

Realms of Learning at the Intersections of Art, Science, Technology and Culture: From Awesome Immersion to Holistic Integration

Epilogue from book *Educating Artists for the Future: Learning at the Intersections of Art, Science, Technology and Culture*, ed. Mel Alexenberg, Bristol and Chicago: Intellect Books/University of Chicago Press, 2008.

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This concluding section identifies realms of learning that weave together the complex issues of theory and practice in a post-digital Conceptual Age presented in my introduction and developed in the multifaceted chapters of this book.

The post-digital Conceptual Age is an age of creators and empathizers who activate the right hemisphere of their brains to compliment the left-hemispheric dominance of the Information Age of knowledge workers and the Industrial Age of factory workers. In the Conceptual Age, well-developed high-tech abilities are no longer enough. They must be integrated with high concept and high touch abilities.

High concept involves the ability to create artistic and emotional beauty, to detect patterns and opportunities, to craft a satisfying narrative, and to combine seemingly unrelated ideas into a novel invention. High touch involves the ability to empathize, to understand the subtleties of human interaction, to find joy in one's self and to elicit it in others, and to stretch beyond the quotidian, in pursuit of purpose and meaning. (Pink 2006: 51-52)

In keeping with the high concept and high touch character of the Conceptual Age, I identify realms of learning through an autoethnographic method of inquiry that creates a narrative highlighting episodes in my life that have particular significance for the education of artists at the intersections of art, science, technology, and culture. My autoethnographic inquiry begins in my childhood summers in the Catskill Mountains of upstate New York and leads six decades later to the creation of a new school of art and multimedia design in Israel. It explores the dynamics of integrating multiple roles – artist/researcher/teacher/writer, multiple fields – art/science/technology/culture, and multiple identities – a Jew, an Israeli, a third-generation American, and an artist working

internationally in an era of globalization. It identifies interweaving realms that create a colorful fabric of lifelong learning: awesome immersion, playful exploration, aesthetic creativity, morphological analysis, interdisciplinary imagination, morphodynamic beauty, semiotic communication, cybersomatic interactivity, global connectivity, polycultural collaboration, ecological perspective, responsive compassion, spiritual emergence, moral courage, and holistic integration.

Learning through Awesome Immersion

My integration of art and science had its origins in the summers of my childhood when I was set free among the sowbugs, salamanders, and swallows of the Catskill Mountains. My days were filled studying the behavior of the creatures of the forests and ponds and making drawings and paintings of them interacting in their natural habitats as well as in imaginary worlds of my creation. My intellectual curiosity and zealous observation coupled with my creative encounters and intimate friendships with these creatures made boundaries between science and art diaphanous. I had no clue that science and art were not one integrated human endeavor.

As I lifted a log beside a pond deep in the forest, I saw salamanders and centipedes scramble as sowbugs stopped in their tracks to roll up into compact balls. A barn swallow swooped down over the pond with lightening speed skimming the water's surface to snag a fly on wing. With a swift maneuver of its slate grey wings my avian friend flashed the splendor of his orange breast feathers as he soared up across the pond and lighted on my shoulder.

I first saw this magnificent bird as a limp, featherless, bleeding swallow chick that had fallen from its nest in the eaves of my neighbor Ben's barn. I gently lifted it, cradled it in my palm, and took it home to live in a shoebox in my bedroom. As I painted mercurochrome on its cut that matched its red skin, it opened its flat yellow beak chirping for food. My sister Fran named it Peeper. We read in the encyclopedia that swallows ate

bugs rather than seeds like our canary. We spent our days catching flies, small moths, and crickets and digging for worms to feed the insatiable appetite of our small friend as his wound healed.

My drawings of Peeper documented his down growing to cover his nakedness and the splendid sprouting of his feathers. As flying lessons, I would hold him high above my bed and drop him. Days of plopping down onto my bed unaware of the function of his wings inspired me to make imaginary paintings of him flying free. He learned quickly once he discovered what wings were for. What an awesome sight to see him fly through the house at lightning speeds making ninety degree turns around corners. This sleek swallow soon learned to exit from my bedroom window, soar up to towards the clouds and swoop down to the pond behind our house where Fran and I swam with the newts, frogs, and minnows. Our utter amazement at seeing the graceful flight of our wounded swallow was transformed into joy each night when he would fly back to roost on the edge of the shoebox by my bed.

Although I enjoyed making drawings and paintings, I sensed that my artwork of greater significance was the actual act of nurturing a swallow chick on the verge of death and participating in its transformation into a beautiful bird of swift undulating flight. In his book on the blurring of art and life, Allan Kaprow (1993) contrasts art-like art to life-like art. My life-like art was living with a swallow. My art-like art was documenting my life with a swallow as well as imagining how it could be. My life-like art seemed to reach a higher spiritual plane than my art-like art. Perhaps the biblical injunction against making graven images is a warning to avoid freezing the wondrous and mysterious flow of living life into a static still life, *nature morte*, dead life.

Albert Einstein proposes that the miraculous encounter with the mysteries of our physical world is the fairest thing we can experience.

It is the fundamental emotion which stands at the cradle of true art and true science. He who knows it not and can no longer feel amazement is a good as dead, a snuffed-out candle.... But the Jewish tradition also contains something

else, something which finds splendid expression in many of the Psalms – namely, a sort of intoxicated joy and amazement at the beauty and grandeur of this world, of which man can form just a faint notion. It is the feeling from which true scientific research draws its spiritual sustenance, but which also seems to find expression in the song of birds. (Einstein 1949: 5, 91)

Daily joy and amazement formed the core of my integral summer learning that was lost in my winter learning in the dreary grayness of Queens. What my winter school in the city forced into distinctly different disciplines had been integrally one in my summer learning in the Catskill Mountains. Thinking the world apart rather than experiencing it holistically broke my soul apart.

The joy of my holistic summer learning that honored my combination of spatial, naturalist, and spiritual intelligences was crushed by the fragmented learning of winter school that only valued those students endowed with linguistic and logical-mathematical intelligences. Although I was left with no choice but to develop linguistic and logical-mathematical intelligences, two of ten intelligences identified by Harvard psychologist Howard Gardner (1999), it is my innate spatial, naturalist, and spiritual intelligences that I had developed through my soul-soaring summers immersed in art-science learning that I needed most in my adult work as biologist and artist.

This experience of awesome immersion in the creative process is powerfully expressed by Rabbi Abraham Isaac Kook (1978):

Whoever is endowed with the soul of a creator must create works of imagination and thought, for the flame of the soul rises by itself and one cannot impede it on its course.... The creative individual brings vital, new light from the higher source where originality emanates to the place where it has not previously been manifest, from the place that “no bird of prey knows, nor has the falcon’s eye seen.” (*Job* 28:7), “that no man has passed, nor has any person dwelt” (*Jeremiah* 2:6).

My childhood curiosity about what went on under logs and rocks in the forest followed me to college where I studied biology and wrote my thesis on the ecology of terrestrial isopods. Terrestrial isopods were my old summer friends – sowbugs – land-adapted crustaceans breathing with gills, surviving in the damp habitat under decaying logs. I found that they even lived under discarded cabinet doors on an empty lot in Queens. My

scientific studies on the interrelationships between sowbugs and other organisms in their shared environment refined my systems thinking and ecological perspective that permeates my work as an artist.

Learning through Playful Exploration

After earning degrees in biology and science education, I began doctoral studies in cognitive psychology at Yeshiva University, which I soon left to study painting at the Art Students League. I returned to my doctoral studies at New York University where art department chairman Howard Conant, had the daring to facilitate my earning an interdisciplinary degree in art, science, and psychology, rare four decades ago. My 1969 doctoral dissertation, *A Unitary Model of Aesthetic Experience in Art and Science*, was based on the analysis of my interviews of scientists (Nobel laureates and members of the National Academy of Sciences) and prominent artists who described their creative processes to me.

When the first computer plotter became available in 1965, I began creating vector drawings at NYU's Courant Institute of Mathematical Sciences that I transformed into sensuous encaustic paintings. One of these early high tech/high touch artworks exploring the physics of noise control was reproduced as the cover of *International Science and Technology* (April 1966). Working with nuclear physicists at Brookhaven National Laboratories, I created a series of paintings exploring the paths of subatomic particles moving in a bubble chamber. My representation of motion of subatomic particles developed into presentations of motion in real space-time through my kinetic participatory "Multiform" artworks. Spectators became active collaborators in creating the artwork by manipulating knobs to reveal different colored surfaces of multifaceted prisms. In 1967, I had a solo exhibition, *Multiform of 531,441 Paintings*, at the Art Gallery of Adelphi Suffolk College on Long Island.

During the ten years between my master's degree and doctorate, I earned my living as a science educator while studying painting at the Art Students League and NYU. I worked on Long Island as science teacher at Louis Pasteur Junior High School in Little Neck,

science supervisor of the Manhasset Public Schools, and assistant professor of science education at Adelphi University. I directed one of ten test centers for American Association for the Advancement of Science curriculum project, *Science: A Process Approach*, funded by the National Science Foundation. My papers on scientific inquiry were published in *School Science and Mathematics* (1962) and in *Biosciences: Journal of the American Institute of Biological Sciences* (1969). My paper, “The Binary System and Computers,” appeared in the National Science Teachers Association journal, *Science and Children* (1964). I developed educational materials for the American Iron and Steel Institute, American Chemical Society, and the Leukemia Society of America. At the 1967 American Film Festival, I won the award for art direction for my film on leukemia.

Perhaps the most significant events at this time were my marrying my wonderful Miriam, experiencing the birth our first three children, and participating in their early childhood explorations. We realized that opportunities for them to experience the awesome immersion that I had enjoyed in my childhood would come through their playful explorations. I set up opportunities for them to play with everyday things around our house that became equipment and materials for simple scientific experiments. Seeing their enthusiasm and joy engaged in these playful explorations prompted me to share them with parents of other young children. I wrote them up as my monthly “Science Fun” feature in *Humpty Dumpty Magazine for Little Children* that appeared for several years and led to the publication of my best-selling children’s books of hands-on science experiments for exploring the senses, *Sound Science* (1969) and *Light and Sight* (1970). I created an androgynous outer-space-looking creature who invites children on a playful romp to discover how their senses of sight and hearing reveal the secrets of light and sound. My daughter Iyrit named the creature a “Gloop.” The jacket flap copy for *Light and Sight* reads: “If you would like to work and learn as a scientist does, then follow the Gloop through *Light and Sight*. Have you ever wondered why you look so funny when you see yourself in the fender of a car? Or, why some shadows are large and some are small? You can find out about the world of light and sight from mirrors, water, light bulbs, or even your mother’s cookie sheet.”

The intrinsic reward from being immersed in the open-ended process of playful exploration was beautifully expressed by philosophy of science professor David Hawkins in his talk “Messing About in Science” at a meeting I attended at AAAS headquarters in Washington for directors of *Science: A Process Approach* test centers. He quoted from the Water Rat in the classic children’s book, *The Wind in the Willows*.

“Nice? It’s the only thing,” said the Water Rat solemnly, as he leaned forward for his stroke. “Believe me, my young friend, there is nothing – absolutely nothing – half so much worth doing as simply messing about in boats. Simply messing,” he went on dreamily, “messing – about – in – messing – about in boats – or with boats.... In or out of ‘em it doesn’t matter. Nothing seems really to matter, that’s the charm of it. Whether you get away, or whether you don’t; whether you arrive at your destination or whether you reach somewhere else, or whether you never get anywhere at all, you’re always busy and never do anything in particular; and when you’ve done it there’s always something else to do.” (Grahame 2003, first published in 1908)

As editor of *The American Biology Teacher* issue on educating young children, I quoted the Water Rat’s words in my paper, “Biology Education in the Elementary School: The First Task and Central Purpose” (Alexenberg, 1967). My decade of work in awakening in children the sense of joy and excitement in the scientist’s ways of asking questions and seeking answers to them has colored my subsequent work as an art educator. In teaching artists, I continue to emphasize the Water Rat’s philosophy of playful exploration as a vital route to meaningful learning and creative expression. Scientist Jacob Bronowski in his book, *Science and Human Values*, compares the creative activities of artists and scientists to the play of children and young animals.

In science and in the arts the sense of freedom which the creative man feels in his work derives from what I call the poetic element: the uninhibited activity of exploring the medium for its own sake, and discovering as if in play what can be done with it. The word play is in place here, for the play of young animals is of this kind – an undirected adventure in which they nose into and fill out their own abilities, free from the later compulsions of need and environment. Man plays and learns for a long time (he has a longer childhood) and he goes on playing into adult life: in this sense of free discovery, pure science is (like art) a form of play. (Bronowski, 1965: 76)

Learning through Aesthetic Creativity

To understand creativity in science and art at its highest level, I interviewed twenty scientists identified as the most creative by their peers – Nobel laureates and members of the National Academy of Sciences – and artists in *Who's Who in American Art* having their artworks in the collections of major museums. Through content analysis of my interview transcriptions, I found that the creative process in both art and science share a common aesthetic core. Although it is obvious that art and aesthetics go together, my study revealed the significance of aesthetic joy in the research process in the physical and biological sciences. For my 1981 book, *Aesthetic Experience in Creative Process*, I sent the transcripts of my interviews to the artists and scientists I had interviewed and asked them to edit the transcripts for inclusion in my book. Below are excerpts from two of the interviews, those of sculptor Richard Lippold and geophysicist Maurice Ewing. I interviewed sculptor Richard Lippold in his studio on Long Island and geophysicist Maurice Ewing at Columbia University's Lamont Geological Observatory of which he was director.

Richard Lippold is best known for his wire sculpture, *The Sun*, in the collection of the Metropolitan Museum of Art and his monumental *Orpheus and Apollo* hovering over the entire entry lobby of Lincoln Center's Philharmonic Hall. He dismisses things that are static and emphasizes how the constantly changing universe affects our lives and the artistic process. "If I sit down to make a sketch one day, surely it will be different from one I make another day. I feel different. We never feel the same from moment to moment; we are changing every moment. We are reshaping ourselves." He wrote in an article for the book *Structure in Art and Science* (Kepes 1965) that "chance is an accident of order and order is an accident of chance." He described to me his making, *New Moonlight*, his first wire sculpture that became the ancestor of *The Sun* at the Met:

The process involves the materials, the concepts, the feelings, and the physical making of the thing. Then anything can happen. It's charged with possibilities, with excitement, and with involvement. It's a little like making love. All the excitement is going on while it's going on. There is something comparable to an orgasm. It doesn't have quite this physical manifestation. But there is a sudden moment when I know it has come. I didn't mean to say it that way; it's the same word! Actually, this is what it is. You know that then everything has come together.... The first time I made a work in which this happened, it happened quite mysteriously because I wasn't conscious of it. When the finished work arrived, appeared, the material and the technique came together in what struck me as an exquisite balance. The feeling didn't dominate; the concept didn't overwhelm; the form wasn't a technical exercise. Everything contributed to the meaning. It was a total balance which transcended all its parts that together seemed a spiritual totality – an ecstatic event. It impressed me so that I couldn't sleep for a couple of days. I thought, "What have I wrought? I didn't determine all this. It happened through me; I was the medium for it. I was surprised. I was astonished, surprised and delighted. (Alexenberg 1981: 109-110)

Maurice Ewing was America's foremost geophysicist, the first recipient of the Vetlesen Prize that honors leaders in the earth sciences the way scientists in other fields are honored with Nobel Prizes. While he was talking to me, he moved through a labyrinth of paper pillars composed of stacks of charts, heaps of data records, and piles of scientific papers. When not pulling graphs for me to see from these pillars and checking ticker-tape communication from his research ships, he sat at a desk cluttered with mementos of his far-flung journeys while his aging dog sat at his feet.

Ewing had been studying relationships between ocean waves and the waves in the ground under the ocean by making explosions in the water and measuring the results with seismographs. He dreamed about exploring these relationships at the global level rather than at the local level. Ewing had no idea how to do it since there was no way he could make explosions great enough to shake the whole planet. The solution popped into his consciousness from his childhood memories. He recalled a story he had read in his fourth-grade reader about the great eruption of the volcano Krakatoa and suddenly realized that such an enormous explosion had actually occurred naturally. The eruption of a volcanic island between Sumatra and Java in 1883 made sea waves fifty feet high and killed nearly forty thousand Javanese. If he could have been there then and known in

advance that such a massive explosion would occur, he thought, he would have placed tide gauges, seismographs, and barometers strategically around our planet. He could then have measured the waves in the ocean, waves in the ground under the water, and waves in the air above and established mathematical relationships between them on a global scale.

On a shelf in his laboratory, he had an old book, *The Eruption of Krakatoa and Subsequent Phenomena*, published in 1888 by the Royal Society of Great Britain. When he looked in this book, he realized that all the information he needed was there. It was fortuitous that the eruption occurred when Venus was eclipsed by the moon. Scientists throughout the world had placed tide-gauges to measure the effect of the transit of Venus on the oceans. They knew that the alignment of the moon and Venus would cause extra-high tides. Ewing enthusiastically explained the beauty and simplicity of integrating information recorded by different people seventy years earlier into a unified theory of resonant coupling. “It was possible in that one night to move into the study of surface waves, to understand it fully, to write the classic paper on it, to type it up, to put it in the mail. All in one night! Well my friend, that is living. I don’t know any thrill that anybody can have that will compare with that. Do you?” (Alexenberg 1981, p. 158)

Learning through Morphological Analysis

In 1969, I submitted my research on the psychology of aesthetic experience in art and science to my interdisciplinary doctoral committee at NYU: Prabha Sahasrabudhe, art education professor, Janice Gorn, psychology professor, and Morris Shamos, physics professor and president of the National Academy of Sciences. A week after having earned my doctorate, I was on an El Al plane to Israel with my wife and our three children to accept a teaching and research position at Tel Aviv University. Except for a week in Holland two years earlier, this was my first trip abroad.

We rented a cottage set in an orange grove in a small town north of Tel Aviv. Our new neighbor’s young daughter, Zahava, came to our door welcoming us with two large pita-

like breads, one in each hand. They were still warm and surrounded by the welcoming aroma of fresh-baked bread. Our neighbors were Yemenite Jews who had ascended to Israel from the tip of the Arabian Peninsula a decade earlier. Having returned to their biblical homeland, they continued to bake flat round bread in a wood-burning, underground oven dug in their back yard as they had done in Yemen. Jews had lived in Yemen for nearly two thousand years in a style of life that changed little from biblical times.

I was struck by the contrast between the whole, two-dimensional, circular breads that Zahava brought us, and the supermarket bread that I had been used to buying on Long Island. Supermarket bread is a three-dimensional, rectilinear, cold, white loaf fragmented into slices and kept at a distance from the consumer by a sealed plastic wrapper that cuts off olfactory and tactile contact. This quick lesson in the morphological analysis of visual culture became the core of my research, curriculum development, and teaching at Tel Aviv University. I realized that the morphology of pre-industrial mythological cultures is shaped by two-dimensional, undifferentiated, circular space, and cyclical time as symbolized by pita-like breads. On the other hand, three-dimensional rectilinear space and linear time sliced into discrete units is symbolized by the supermarket bread of industrial logical culture.

I asked myself, “How will my children, fourth-generation American Jews of European background, and Zahava’s siblings build a common future?” In studying the Israeli educational system and visiting schools throughout the country, I learned of the significant gap in achievement between children from European backgrounds and those from Islamic lands. The school system was created by educators from industrial Europe to develop a logical structure of consciousness which was alien to children from pre-industrial lands with a mythological structure of consciousness. It was easy to understand the failure of those children in an unfamiliar, foreign learning environment. It was made ever easier to understand this problem when I passed by my neighbor’s house coming home from my day at the university. Zahava’s father was sitting on his porch reading a newspaper that he was holding upside-down. “Shmuel,” I asked, “why are you reading

upside-down?” “It’s more comfortable for me that way,” answered Shmuel who went on to explain how he had learned to read sitting on carpets with other children around a hand-written scroll. His regular place was sitting at the top of the scroll. Therefore, he learned to read upside-down. When I joined him in his synagogue on the Sabbath, some men sat around the room against the four walls while others sat around the reader’s platform with their backs to him as he chanted words that he read from a scroll. In sharp contrast, the typical American synagogue that I knew had seating in rows all facing in the same direction like the classrooms in Israeli schools.

In Shmuel’s world of mythological perspective, people experience an auditory world listening to the retelling of the oral tradition – their communal mythology as handed down to them by word of mouth. They sit as a community surrounded by a sphere of sound. The auditory experience of space is encircling, involving, and soft-edged. Time is felt as cyclical and pulsating. The nature of the auditory experience is derived from the physics of sound. Sound generated in air produces spherical waves that surround the point of origin and engulf anyone within its sphere. A cross-section of a sound-sphere would appear like the concentric circles that surround a pebble when it is tossed in a pond. When people sit within a sound-sphere of pulsating air, they cannot help hearing the message. They feel that sound surrounds them and involves them. They can neither turn away from it nor close their ears to it. Ears have no anatomical analogues to eyelids. Unlike the visual world where light sources can be accurately pinpointed, the auditory world is soft and fuzzy at both its core and edges. In the logical world of European culture shaped by the single-point Hellenistic perspective revived in the Renaissance, one gets to know the world visually, from rays of light traveling to one’s eyes in straight lines from definite points in Euclidean space. Ecological perspective derives from a kinesthetic integration of auditory and visual senses in experiencing dynamic interrelationships between parts of a whole that are more than the sum of its parts. Space and time are unified in a four-dimensional world of events experienced through movement and interaction expressed in art through lively narratives.

I realized that the attempts to acculturate the mythological Jews in schools whose aim was to develop a logical structure of consciousness was foolhardy at a time when the logical structure of the industrial age had no future. I proposed that both the auditory mythological and visual logical minds can meet in a new shared multi-sense ecological structure evolving in a post-industrial electronic era. My research revealed that not only did both the mythological and logical Jews need to develop an ecological perspective to succeed in the electronic future together, but they also shared a past with a common deep structure of Jewish consciousness which is an ecological structure that creates an integral worldview. The ecological structure of Jewish consciousness remained embedded as a deep structure during the Jews' centuries in Islamic lands when a mythological perspective was plastered on. European Jews, too, had their ecological structure of consciousness and integral worldview distorted by the overpowering logical perspective of a Western culture shaped by Hellenism.

My research on the morphologies of mythological, logical, and ecological structures of consciousness that are revealed through space-time structures of visual culture formed the theoretical basis for my curriculum project, "From Science to Art" (Alexenberg 1974, 2006b). Beyond the theoretic underpinnings of the project, morphological analysis of natural and cultural systems became the subject matter of the curriculum aimed at bridging the gap between mythological and logical youth by stimulating their interdisciplinary imagination and developing their ecological perspective. The "From Science to Art" curriculum project had parallel explicit and implicit morphological aims.

Although I began this curriculum project in 1969, it is even more vital today in our era of globalization and intercultural conflict to educate artists in morphological analysis of visual culture. After all, artists have always shaped worldview by their perspective inventions. Renaissance artists renewed the Greek logical perspective by visually representing three-dimensional space from a single point of view and time as a cross-section of a one-way linear path. Most people in the industrialized world continue to see the world through the eyes of these Renaissance artists. Most third world people, however, continue to see their world through a mythological perspective of two-

dimensional space and cyclical time. Artists today are once again reshaping humanity's worldview by inventing art of ecological perspective and integral consciousness in a multi-dimensional space-time continuum.

Learning through Interdisciplinary Imagination

“From Science to Art” encouraged junior high school students to develop their interdisciplinary imagination, ecological perspective, and integral consciousness through morphological analysis of periodicity and rhythmic structures, threshold phenomenon, bilateral and rotational symmetries, spiral and branching systems, and stochastic processes and asymmetries.

In the unit of study on periodicity and rhythmic patterns in nature and culture, students rolled out ink on a glass plate, pressed their fingers on it, and printed their fingerprints on uninflated white balloons and on tracing paper. They enlarged their fingerprints by blowing up the balloons and by placing the tracing paper in 35 mm slide holders and projecting them. They compared their fingerprints to each other to appreciate the uniqueness of each person. They saw that no two people have the same fingerprint pattern. Students compared their own fingerprints to fingerprints of chimpanzees. They learned that although there was a wide range of variation in human fingerprints, fingerprints from another species were outside that range. After students created classification systems for their classmates' fingerprints, a police officer was invited to the classroom to explain the international system of fingerprint taxonomy. Students taped paper to the wall and projected their fingerprints on it while they drew the lines. They made paintings from their drawings. They enlarged fingerprints on a copy machine and printed them out on acetate sheets that they placed on top of one another to create moiré patterns. They discussed optical illusions and the psychology of human perception.

Students looked at reproductions of the “op art” of Bridget Riley and of Henry Pearson whose artwork was inspired by his drawing topographical maps in the army. Students studied topographic maps of the Israeli landscape. They observed the generation of

rhythmic wave patterns in a ripple tank used in physics classes. What were the connections between ripples in water, geologically formed topographies, and their own fingerprints?

They watched a National Geographic film on zebras that showed how a pregnant zebra removed herself from the herd so that the newborn would only see her pattern of stripes. The baby zebra would memorize its mother's unique pattern of stripes so that it could recognize her in the herd. A zebra that could not find its mother for nursing would perish. Does the supermarket laser recognize the bar code stripes on cans and cartons like a baby zebra recognizing its mother? Bar codes are the secret language of the digital age. We are all illiterate before the stripes that supermarket lasers can read.

Students examined the variety of stripe patterns on the *talit* prayer shawls worn by Jews in synagogue. They looked at Marc Chagall's paintings of men wearing a *talit*. The unsymmetrical sequencing of the parallel stripes on each *talit* looks like a bar code. They studied the biblical verses about Joseph's striped coat (*Genesis 37: 3-4*) and read commentaries on the symbolism of the striped coat. Some watched the video of Andrew Lloyd Webber's musical *Joseph and his Amazing Technicolor Dreamcoat*.

Students went out onto the school playground on a sunny day, unrolled paper on the ground, cut it into long pieces one for each student, and taped them down. Working in pairs, students drew around their classmate's two feet and shadows. They returned to their drawings and placed their feet in the same places every hour for the duration of the day having their shadow drawn each time. The set of shadow drawings one on top of the other were visually linked to topographic maps and fingerprints. They painted overlapping serial self-portraits on their shadow drawings that had documented Planet Earth's rotation. "Conceptualizing the changing relationship of sun and earth, relating that dynamics to the form of one's personal shadow, and communicating these relationships in a serial painting – his squat noontime body form to a late afternoon elongated body form – moves the students toward an integral structure of consciousness

by unifying time-space, subject-object, man-environment, and science-art” (Alexenberg, 1974: 151).

Interdisciplinary imagination sees fresh relationships between disparate realms of experience. In linear logical thinking, phenomena are trapped within narrowly defined boundaries. “From Science to Art” invited questioning that leads to experiencing a diaphanous world in which boundaries lose their opacity. How does one connect one’s own fingerprints with op art, topographical maps, ripple tanks, zebra stripes, supermarket bar codes, prayer shawls, Joseph’s technicolor dreamcoat, one’s shadows and the rotation of Planet Earth? Interdisciplinary imagination couples the cognitive act of matching, of creating relationships/connections/congruencies, with a concomitant affective response of joy/amazement/elation so that “the energy of all one’s discordant impulses creates a single image connecting varieties of experience” (Bruner, 1963: 70).

After four years in Israel, I returned to the States to accept a position as Associate Professor of Art and Education at Columbia University where I introduced an interdisciplinary graduate course “Morphodynamics: Design of Natural Systems” that I had first taught at the Bezalel Academy of Arts and Design in Jerusalem. I coined the word “morphodynamics” to describe the processes that give rise to form rather than “morphology” which has a more static tone. In these courses, my students further expanded the units in the “From Science to Art” curriculum project to develop their interdisciplinary imagination through exploring evolving patterns in nature (Alexenberg 2005a).

I extended this pattern thinking into the realm of culture in the research methods course at Columbia that I team-taught with anthropologist Margaret Mead, in my subsequent research and teaching at Bar-Ilan University in Israel, in “Morphological Perspectives: Space-Time Structures of Visual Culture,” the second chapter of my book *The Future of Art in a Digital Age: From Hellenistic to Hebraic Consciousness* (Alexenberg 2006b), and in my paper, “Biblical Fringes: Biomorphous Consciousness through Ancient Ritual,” presented at the 2006 Consciousness Reframed conference at the University of Plymouth.

Learning through Morphodynamic Beauty

Parallel with my teaching at Columbia University, I explored morphodynamics in the cellular growth of plants in the laboratory of the New York Botanical Gardens and in my studio in Teaneck, New Jersey. I found hidden within leaves a vital inner beauty that rivals the beauty of the outer forms of plants and their flowers. I sought to reveal this hidden beauty through encaustic paintings on photomicrographs of leaf cross-sections.

I prepared microscope slides of leaf cross-sections, photographed their elegant cellular patterns through a microscope, enlarged them 600 times, mounted them on shaped panels, and painted on the photographs with vibrant pigments suspended in molten waxes. The shapes of the panels are the outer shapes of the leaves, shapes emerging from the dynamic interplay between the cells within. Nothing is more important to us than what happens inside leaves. Without the vital process of photosynthesis occurring within leaves, we would not exist and there would be no life on our planet. Leaf cells, using sunlight and chlorophyll, take water flowing up into leaves from roots in the earth and carbon dioxide blowing into leaves from the surrounding air and transform them into food and oxygen.

My focus on the inner beauty of the photosynthetic process and the cellular organization within leaves rather than the outer beauty of the plant is not only inspired by my background in biology and art, but by my Jewish consciousness. Unlike the Hellenistic art revived in the Renaissance that sees beauty in the imitation of external form, Judaism honors the inner dynamics of living systems. The growth process by which the outer form of a leaf is created by the organization of the cells within reveals an inner beauty known as *tiferet* in Judaism. *Tiferet* is the innermost node interconnected with nine others in the “Tree of Life” metaphor for the spiraling of divine light into our everyday world of space and time. This metaphorical way of seeing beauty as the dynamic harmony between multiple forces is called *hokhmat hanistar* (hidden wisdom), another name for *kabbalah*, Judaism’s esoteric tradition.

This aesthetic enthusiasm for revealing the elegant cellular growth patterns hidden within leaves began with large oil paintings that I made when I was a 22 year old science teacher at Louis Pasteur Junior High School on Long Island and tactile collages that I made as a student at the Art Students League of New York when I was science supervisor for the Manhasset Public School. This enthusiasm was renewed as the central focus of my artwork during my four years as art professor at Columbia when I equipped a studio for encaustic painting. I installed ventilation hoods to remove the fumes generated when I made paints by suspending powdered pigments in a combination of molten beeswax, microcrystalline wax, and dammar resin. I designed and built special equipment combining soldering irons and funnels with touch valves for painting on photomicrographs that I mounted on shaped panels. Light waves reflected from within the depths of the translucent encaustic paints rendered the cells vibrancy unattainable with oil or acrylic paints.

At the laboratory of the New York Botanical Gardens, I replaced the water in plant cells with alcohol and then xylol and liquid paraffin so that they would be firm enough when refrigerated to be cleanly cut with a microtome into cross-sections one-cell thick. I prepared microscope slides through which I photographed the cellular patterns creating the outer form of the leaf. In the darkroom at Columbia, I printed these photographs in black and white to mount on the shaped panels that I prepared in my Teaneck studio.

Three decades later, I am taking a break from writing this book to mount an exhibition at the Jerusalem Botanical Gardens of these shaped encaustic paintings of cellular patterns within leaves alongside the actual living plants that invite visitors to the exhibition to embark on an aesthetic journey from the whole plant into the beautiful world hidden within it.

Learning through Semiotic Communication

In response to my students at Columbia University being confused by the multiple directions that art was taking in the 1970's, I attempted to make sense out of this confusion using semiotics, the study of how signs communicate significance. As a starting point, I turned to the pioneering work on semiotics of American logician and mathematician Charles Peirce (1960). He identified three classes of signs: icon, symbol, and index. These categories can describe how significance is created in representational art of premodernism and modernism. They were insufficient, however, to describe postmodern presentational forms of art that my students were encountering.

Representational art forms show after-the-fact signs of what was. Presentational art locates art in the present and future in contrast to *representational* art that locates art in the past. Presentational art forms invited me to propose an expanded semiotic taxonomy (Alexenberg 1976). I identified three classes of presentation: identic, prioric, and dialogic. Identic art gains meaning by presenting what is. Prioric art presents what can be. And dialogic art gains meaning through dialogue, collaboration, and interaction in dynamic responsive processes.

My semiotic taxonomy provides a theoretical framework and pedagogical tool for educating artists in understanding how contemporary artforms and those that will evolve in the future create significance. I expanded the paper I had written when I was teaching at Columbia three decades ago by applying my semiotic taxonomy to new media art in my chapter, "Semiotic Redefinition of Art in a Digital Age," in the book *Semiotics and Visual Culture: Sights, Signs, and Significance* (Alexenberg 2004).

Iconic art, the first category of representational, represents the surface appearance of things. It gains meaning by looking like something that we see in the real world. Computer users know the word "icon" as the blank sheet of paper with its corner folded down, the floppy disc, the file folder, the printer, and the scissors icons on the toolbar of computer screens. These computer icons, Redon's painting of a vase of flowers, Michelangelo's Adam reaching out to touch the hand of God, Picasso's *Three Musicians*, and a road map are all icons with different levels of iconicity.

Symbolic art represents things or ideas through signs that are assigned meaning maintained by convention, by the agreement of community. Unlike an icon that bears a likeness to what it signifies, a symbol bears no direct or necessary connection to what it signifies. A red traffic light, for example, signifies a command to stop, while a green light signifies go. These are assigned meanings agreed upon by community consensus. Had the opposite assignment been made, green would signify stop. I have shown a slide of Larry River's painting, *Last Civil War Veteran*, when I lectured in Israel, Holland, and Japan. No one could identify the subject of the painting that shows the Confederate and Union flags behind a person in a bed. They all recognized the Union flag as the flag of USA, but none could recognize the flag of the Confederate states. On the other hand, when I showed this same slide in the USA, everyone could identify the subject of the painting.

The third class of representational art is indexical. If a painting that looks like a man walking on the beach is iconic art, and words MAN WALKING ON BEACH painted on a canvas are symbolic art, then the actual footprints in the sand indicating that a man had walked on the beach can be perceived as indexical art. Indexical art represents occurrences by presenting direct physical evidence that they occurred. The word "index" is used as in its original derivation from Latin *indicare*, meaning to indicate, to point out as an index finger does. Although indexical signs are felt strongly in Van Gogh's paintings as his impasto brushstrokes, he continued to maintain iconicity in them. The full abandonment of the icon in painting and its replacement with pure index occurred most powerfully in action painting. A Jackson Pollack painting is indexical art that displays symptoms of the artist's having dripped paint, as well as a documentary map and after-the-act choreographic score of the movement of his body over a canvas floor. There is a direct physical connection between the artist dripping paint and the dripped paint on the canvas. Indexical art represents by correspondence, directly connecting what was to what is.

During the years I taught at Columbia, I created a series of encaustic paintings on shaped panels of leaf cross-sections enlarged 600 times. At the laboratory at the New York Botanical Gardens, I made microscope slides of leaf cross-sections, photographed them, mounted them on panels, and painted the revealed cellular structures with vibrant paints that I made by suspending pigments in molten beeswax. Staying faithful to the photomicrographs while painting, my artworks are indexic – documentation of cellular structure and organization in leaves. Photographs, at first impression, would seem to be the epitome of iconic art, the zenith of iconicity, since they represent the most accurate visual likeness of an object or event. On closer scrutiny, however, it becomes clear that the very high iconicity results from the photographic image being produced by point-to-point correspondence between light rays coming from what is being represented and a chemically or electronically sensitized plane. From this point of view, photographs are indexic art forms, documentary records produced by direct physical connection between what was and what is. Indexic pictures that render the invisible visible play a vital role in contemporary science. The work of many scientists involves reading symptoms of natural occurrences from X-rays, MRIs, electrocardiograms, spectrograms, scintigrams, seismograms, voiceprints, and numerous other technologically generated indexic pictures.

Categories of representational art signify what *was* by illustration, symbolization, and documentation. Presentational art forms signify what is, what can be, and what is becoming. The first category of presentational art, identic art does not look like something else, nor does it symbolize or indicate something other than itself. It is form and color presented as form and color; it is a real thing presented as itself, it is a real time electronic transmission of an event, and it can be an everyday event that is presented as life being lived.

Prioric art is the presentation of a proposal or plan for a potential event, an *a priori* statement of what can be. It often employs iconic and symbolic modes of signification for presenting itself. The prioric form is more common in art forms other than the visual

arts. It can take the form of scores in music and dance, scripts in theater and film, or architectural plans. Like these forms, visual artists can propose artworks that they do not make themselves. Musicians perform music created by composers, dancers move to choreographers' notations, actors enact a script written by playwrights, and building contractors convert architectural drawings into buildings. Visual artists act more like composers, choreographers, playwrights, and architects in creating prioric art. New media artists in a networked world have the unprecedented power to create prioric artworks to disseminate their proposals globally. My Internet artwork described below in the section "Learning through Moral Courage," www.futureholocaustmemorials.org, is a prioric artwork that makes outlandish proposals as a call to action to confront bigotry, hatred, terrorism, genocide, and cults of death and destruction with moral outrage.

Dialogic art comes into being through dialogue. It exists as the interrelationship between people. The difference between identic and dialogic forms of art can be described by philosopher Martin Buber's two primary words: I-It and I-Thou. I-It is the experience of something; it describes identic art. I-Thou, however, is not the experience *of* something, but rather an interrelationship that has its own existence. I-Thou comes into being through dialogue, the interactive shared sphere between people, a sphere of spiritual intensity. "The participation of both partners is in principle indispensable to this sphere.... The unfolding of this sphere Buber calls 'the dialogical.' The meaning of this dialogue is found in neither one nor the other of the partners, nor in both taken together, but in their interchange." (Freidman 1960: 85, 241)

Learning through Cybersomatic Interactivity

After four years at Columbia, I returned to Israel as founding president of a regional college in the Negev Desert and as Associate Professor at Bar-Ilan University. I established an art school at the college in which the students joined me in creating conceptual and environmental artworks in the desert environment that addressed

ecological, spiritual, and cultural issues. In 1984, after seven years of desert life, I returned to the States as Research Fellow at MIT's Center for Advanced Visual Studies. I taught the graduate seminar "Art, Technology and Culture" and developed a workshop for artists, scientists, and engineers, "Mindleaping: Developing Creativity for the Electronic Age." In collaboration with MIT's Center for Advanced Visual Studies director Otto Piene and our MIT colleagues, I created a major exhibition, *LightsOROT: Spiritual Dimensions of the Electronic Age*, for Yeshiva University Museum in New York. Harvard University psychologist Rudolf Arnheim wrote the catalog introduction. The *ARTnews* critic wrote: "Rarely is an exhibition as visually engaging and intellectually challenging."

We created 25 artworks using laser animation, holography, fiber optics, biofeedback-generated imagery, computer graphics, interactive electronic media, spectral projections, and digital music. My cybersomatic interactive system was born in my realization that the Hebrew words for face *panim* and for inside *p'nim* are written with the same four letters *PNIM*. I knew that I needed to create portraits which create a dialogue between the outside face and inside feelings.

As an MIT artist with access to electronic technologies, I designed a system for creating digital self-generated portraits in which internal mind/body processes and one's facial countenance engage in dialogue. I constructed a console in which a participant seated in front of a monitor places her finger in a plethysmograph, which measures internal body states by monitoring blood flow, while under the gaze of a video camera. Digitized information about her internal mind/body processes triggers changes in the image of herself that she sees on the monitor. She sees her face changing color, stretching, elongating, extending, rotating, or replicating in response to her feelings about seeing herself changing. My artwork, *Inside/Outside:P'nim/Panim*, created a flowing digital feedback loop in which *p'nim* effects changes in *panim* and *panim*, in turn, effects changes in *p'nim* (Alexenberg and Piene, 1988).

Educating artists in a digital age should provide opportunities for learning to create artworks that are systems of cybersomatic interactivity that forge a vital dialogue between mind and body and between human consciousness and digital imagery. Significant developments in future art will occur at the interface between cyberspace and real space where virtual worlds interact with our bodies moving in our physical environments to shape consciousness. New directions in aesthetic creativity are being realized through elegant cybersomatic feedback loops that flow between dry pixels and wet biomolecules, between silicon-based cybersystems and carbon-based biosystems to create what Roy Ascott (2000) calls “moist media artworks.”

Learning through Global Connectivity

While creating the *LightsOROT* exhibition at MIT, I accepted the position as Professor and Chairman of Fine Arts at Pratt Institute and became a frequent flyer on the Boston-New York shuttle. At Pratt, I introduced and taught the first computer graphics course there, “Fine Arts with Computers,” and began my digitized homage of Rembrandt series exhibited in my solo show, *Computer Angels*, at the Art Gallery of the State University of New York at Stony Brook. More than forty museums worldwide added my serigraphs, lithographs, and etchings exploring digital technologies and global systems to their collections. I was Art Editor of *The Visual Computer: International Journal of Computer Graphics* that published my paper, “Art with Computers: The Human Spirit and the Electronic Revolution” (Alexenberg 1988).

A powerful force shaping the digital age is globalization, free trade and the free flow of information, and the range of human reactions to them. Thomas Freidman (2000) argues in *The Lexus and the Olive Tree: Understanding Globalization*, that the challenge in this era of globalization is to find a healthy balance between preserving a sense of identity, home and community and doing what it takes to survive within the globalization system. Digital-age art has the power to negotiate connections between global and local, between high tech and high touch, between Lexus and olive tree.

My global telecommunications artwork had its origins in a very local setting. It began in a small Hasidic synagogue in Brooklyn while I was listening to the chanting of the weekly biblical portion from the handwritten *Torah* scroll. I listened to the ancient Hebrew words, translating them into English in my mind. They told of the prototypic artist Betzalel being filled with divine spirit, wisdom, understanding, and knowledge, and talent for all types of craftsmanship to make all manner of *MeLekHet MakHSheVeT* (*Exodus* 35:33). Usually translated as “artistic work,” it literally means “thoughtful craft.” In a sudden flash of insight, it dawned on me that the biblical term for “art,” *MeLekHeT MakHSheVeT*, is feminine and that its masculine form, *MaLakH MakHSheV*, literally means “computer angel.” Art is a computer angel when biblical Hebrew meets modern Hebrew in a digital age. As soon as the synagogue service came to an end, I ran to my wife and explained to her that as a male artist my role in life is to make computer angels.

I went to the print room of Metropolitan Museum of Art where I selected angel images from Rembrandt’s drawings and etchings to digitize. I wanted to applaud Rembrandt by having his winged angels wing their way around the world. I phoned AT&T and asked if I could use their telecommunications satellites to send a cyberangel on a circumglobal flight. “You have *what* to send around the globe?” was the usual response as I was transferred from office to office. Incredulity was turned to interest when I reached the public relations people who liked the idea. AT&T agreed to sponsor my memorial faxart event.

I flew to Amsterdam to meet with Eva Orenstein-van Slooten, Curator of Museum het Rembrandthuis, the artist’s home and studio. With trepidation, I proposed having a fax machine placed on Rembrandt’s 350-year-old etching press to receive the angel that would fly there from New York. She thought it was a wonderful idea. It would make her museum, a quiet place, come alive as a virtual Rembrandt angel rematerialized in the place he had originally created it.

On the morning of October 4th, the angel ascended from the Chippendale top of the AT&T building in New York. It flew to Amsterdam to Jerusalem to Tokyo to Los Angeles, returning to the former New Amsterdam on the same afternoon. It took an hour in each city to receive 28 pages of angel fragments and fax them on to the next city. After a five-hour flight around the planet, the deconstructed angel was reconstructed for the fifth time at its starting point. When it passed through Tokyo, it was already the morning of October 5th. The cyberangel returned to New York on the afternoon of October 4th, five hours after it had left. It had entered tomorrow before flying forward into yesterday.

The cyberangel was received at Rembrandt's house seconds after it left New York. Ms. van Slooten fed the 28 sheets back into the fax machine on Rembrandt's etching press and dialed the fax number of the Israel Museum in Jerusalem. She then assembled all the fragments into a whole 4 x 6 foot angel.

Jerusalem was the appropriate next stop since it is an angel from a biblical scene. It was evening when the cyberangel arrived. Amalyah Zipkin, Curator of European Art at the Israel Museum, sent me a description of the angel coming and going. She wrote:

There is something appropriate in the illogic of the event: here we were in Jerusalem, the Holy City of 4000 years of turbulent history, huddled next to a fax machine in the mail room of the Israel Museum. It was a few days before Yom Kippur. Somewhere out there in technological space, a disembodied angel – computerized, digitized, enlarged, quartered, and faxed – was winging its way towards us from Amsterdam. This angel had been drawn in the 17th century by a Dutch artist with the instantly-recognizable mass-media name of Rembrandt van Rijn, and had undergone its electronic dematerialization 320 years after the artist's death at the hands of a New York artist and technology freak who had the audacity to make the connections: Rembrandt, the Bible, *gematria*, the electronic age, global communications, the art world, and the fax machine. Like magic, at the appointed hour the fax machine zapped to life and bits of angel began to materialize in Jerusalem. Photographs and the attendant PR requirements of contemporary life were seen to, and the pages were carefully fed back into the machine. We punched in the Tokyo phone number and the angel took technological flight once more.

It was almost dawn on October 5th when the angel arrived in Tokyo in the Land of the Rising Sun where fax machines are made. Ikuro Choh of Tokyo National University of Arts and Music received the angel and revealed its full image by assembling the 28 sheets on the ground among the ancient pillars in Ueno Park. He then disassembled them and attached all the sheets end-to-end in a long ribbon ascending the stairs and entering into a centuries-old religious shrine built in traditional pagoda style. The old Tokyo site was selected to carry a spiritual message of electronic age homage to tradition. With the sun rising over Japan to begin a new day, the faxart angel rose over the Pacific Ocean to fly into yesterday. It arrived in the City of the Angels at 2:40 p.m. on October 4th. The angel came together once again at the Museum of Contemporary Art in Los Angeles on the day before it had visited Tokyo. Cyberangels can not only fly around the globe, they can fly into tomorrow and back into yesterday. They reshape our concepts of time and space.

Learning through Polycultural Collaboration

In 1990, I was invited to be Dean of Visual Arts of New World School of the Arts in Miami, a new school created by the Florida State Legislature as “A Center for Excellence in the Arts,” a joint venture of University of Florida, Miami-Dade College, and Miami-Dade Public Schools. As part of a BFA program in environmental public art that I created at NWSA, I collaborated with Miriam Benjamin on an intergenerational art project, *Legacy Thrones* (Alexenberg and Benjamin 2004). My wife Miriam is a high touch counterpart to my high tech leanings, with a MFA in ceramic sculpture from Pratt.

Elders from the three largest ethnic communities in Miami worked together with art students under our artistic direction to create three colossal thrones reaching twenty-feet high and weighing more than two tons. We brought together African-American elders from the Greater Bethel AME Church, Hispanic elders from Southwest Social Services Program, and Jewish elders from the Miami Jewish Home for the Aged to work with New World School of the Arts students to create three *Legacy Thrones* facing Biscayne Bay in Miami. Through aesthetic dialogue between these elders and young people, valued traditions of the past were transformed into artistic statements of enduring

significance. Together, young hands and old shaped wet clay into colorful ceramic relief elements collaged onto three monumental thrones, works of public art constructed from steel and concrete.

Elder-student dyads collaborated creatively with Miriam and me one day each week for a full academic year. All sixty participants worked simultaneously in one huge studio space. At their first meeting, each student listened to an elder tell about her life experiences and cultural roots. Life review methodologies facilitated elders looking back and reaching inward to trigger reminiscences of events and images of personal and communal significance. The challenge at the next meetings was to explore ways of transforming reminiscences that reveal cultural values into visual images that can be expressed through clay. The eminent psychologist Erik Erikson (1986) explains: “For the ageing, participation in expressions of artistic form can be a welcome source of vital involvement and exhilaration.... When young people are also involved, the change in the mood of elders can be unmistakably vitalizing.”

Working parallel to each other in one large studio, the three culturally different groups of elders continually engaged in dialogue with each other, an opportunity that rarely exists outside of the studio. African-American, Hispanic, and Jewish old people in their ethnically specific homes for the aged and senior centers seldom encounter one another. Working alongside each other and learning about each other’s cultures, they came to realize how much they shared in experiences and in values. In *Mixed Blessings: New Art in a Multicultural America*, Lucy Lippard (1990) describes our art project’s values: “I am interested in cultural dissimilarities and the light they shed on fundamental human similarities...in art that combines a pride in roots with an explorer’s view of the world as shared by others.”

The elders worked with clay to make relief sculptural statements of images from their personal and collective past. They painted them with colorful glazes creating numerous collage elements that were cemented to the thrones until the sculptural surfaces were entirely clad in ceramics. Our role as the artists was to integrate all the elements into

aesthetically powerful expressions of each ethnic community. Although the elders had no prior experience working with clay, they developed their technical prowess and aesthetic judgment during their year of participation. While the students facilitated the elders' growth artistically, the young people's lives were enriched through creative collaboration with partners blessed with a long life of fertile experiences. By sharing their stories with the students, transforming them into artistic images, and leaving a legacy for future generations, the elders added deeper layers of meaning to their lives.

Learning through Ecological Perspective

In my ten years living in Miami, it became clear to me that polyculturalism and ecological perspective are related. Both promote multiple views of the whole and of dynamic interrelationships in growing ecosystems that embrace nature, society, and media. Twenty-two young artists in the senior class of the NWSA high school worked on an art project, *Miami in Ecological Perspective*, with me and biologists from the Everglades National Park (Alexenberg 1994). These Miamians and their parents were born on five continents, in sixteen countries, and in twelve states. Miami is a lively international city framed by the Mangrove swamps of Biscayne Bay and the wide sawgrass river of the Everglades. Its future is related to how its ethnic communities bring their numerous viewpoints together in a common enterprise and how it protects and honors its natural environment, its primary source of revenue. Thousands leave a shivering winter of snow and ice to sun themselves on the palm-studded beaches, swim in warm blue waters, and marvel at the flight of flocks of great white egrets and the movements of giant alligators in the Everglade's waters.

Under the guidance of the Everglades biologists, the students waded through the Everglades, a shallow river 60 miles wide flowing 300 miles from the Kissimmee River to Florida Bay. It was the time of year that the waters receded leaving fish no choice but to find refuge in waterholes that alligators had dug under the water. When birds came to eat the fish concentrated in the waterholes, the alligators could choose the birds or fish for their breakfast. The students documented the dynamic interrelationships of the numerous species of animals and plants to each other and their environment using observational

drawing, photography, and verbal and statistical notation. These studies became the raw material for artworks. Their scientific study of ecology was coupled with artistic explorations that expressed ecological perspective in relation to their environment and their place in it and with social action cleaning up trash thrown in the water by tourists in the national park.

The ecological perspective begins with the view of the whole, an understanding of how the various parts of nature interact in patterns that tend towards balance and persist over time. But this perspective cannot treat the earth as something separate from human civilization; we are part of the whole too, and looking at it ultimately means looking at ourselves. (Gore 1993)

The students studied how artists shape world view by their perspective inventions. The artists of the Renaissance, for example, created logical perspective by visually representing three-dimensional space from a single point of view and time as a cross-section of a one-way linear path. Most people in the industrialized world continue to see the world through the eyes of these Renaissance artists. Before Renaissance perspective spread from Italy throughout Europe, artists employed a mythological perspective that arises from an auditory experience of space as two-dimensional and of time as cyclical. People from most pre-industrial cultures continue to experience space and time from a mythological perspective. Today, artists have an opportunity and responsibility of once again reshaping humanity's worldview by inventing an art of ecological perspective.

Whereas the aesthetic perspective oriented us to the making of objects, the ecological perspective connects art to its integrative role in the larger whole and the web of relationships in which art exists. A new emphasis falls on community and environment.... The ecological perspective does not replace the aesthetic, but gives a deeper account of what art is doing, reformulating its meaning and purpose beyond the gallery system, in order to redress the lack of concern, within the aesthetic model, for issues of context or social responsibility. (Gablick 1991)

As the students were creating artworks expressing ecological perspective, they studied ecological works of other artists. They were inspired by the work of Helen and Newton Harrison, Mierle Ukeles, Alan Sonfist, and Mel Chin. These artists and others had their work shown in the *Fragile Ecologies* exhibition at the Queens Museum of Art near the

empty lots where I studied sowbugs for my thesis on the ecology of terrestrial isopods four decades earlier. The curator of *Fragile Ecologies* wrote in the exhibition catalog:

Artists are in a unique position to effect environmental changes because they can synthesize new ideas and communicate connections between many disciplines. They are pioneering a holistic approach to problem solving that transcends the narrow limits of specialization. Since art embodies freedom of thought, spirit, and expression, its creative potential is limitless. Art changes the way people look at reality. (Matilsky 1992: 3)

Learning through Responsive Compassion

I returned to Israel in 2000 to accept a professorship at the College of Judea and Samaria in Ariel where I taught the courses, “Space-Time Systems in Nature and Culture,” to architecture students and “Art in Jewish Thought” to students of humanities, sciences, and engineering. I also headed the studio arts programs in fine arts and graphic design at Emunah College of the Arts in Jerusalem and was appointed by the President of Israel to the Council of the Wolf Foundation which grants the prestigious Wolf Prizes in the arts and sciences.

I created a responsive artwork *Cybersight* linking Internet technology with a digital device that provides haptic opportunities for blind people to “see” computer images through their fingers. It attempts to create art that transcends the distanced formality of aesthetics and responds to the cries of the world. It creates art rooted in the responsive heart, rather than the disembodied eye, not as a solitary process it has been since the Renaissance, but as something we do with others (Gablick 1991).

Cybersight responds to these cries by reaching out to human beings lacking the primary sense required to encounter art as defined by Western culture. *Cybersight* offers blind people opportunities to experience imagery through their sense of touch using unique digital technologies developed in Jerusalem. They can gain tactile access to those things they would most like to see. Through the Internet, access is extended globally to the blind as webservers contribute images that generate funds for research to fight blindness.

Cybersight is the embodiment of “the next historical and evolutionary stage of consciousness, in which the capacity to be compassionate will be central not only to our ideas of success, but also to the recovery of both a meaningful society and a meaningful art” (Gablik 1991: 182).

Cybersight is responsive art that gives eyes to the blind and systems art that gives hands to art. Art of the past may have expressed social and humanitarian concerns, but it hangs insularly on a museum wall disengaged from the issues that define it. In a sense, that art is handicapped. It possesses no hands to help the cause it is advocating. Responsive systems art plugs art into the real world transforming its audience into active participants. It has hands to reach out and invite people to collaborate in fixing the world. When art has hands for receiving and giving, art gains a soul.

The genesis of *Cybersight* was a discussion with my son, Ari, about extending into the social realm the human-machine interaction in our bioimaging artwork, “*Inside/Outside: P’nim/Panim,*” that we had created at MIT. Our work at MIT led us to see how art of the future will more deeply explore interfaces between real space and cyberspace. We began brainstorming about how actions in cyberspace could effect changes in people’s lives in real space, how the Internet can bring people together to help one another, how digital technologies can be used for fixing the world by filling it with loving kindness, and how web art could actually generate charity. We sought ways to move beyond making art *about* compassion and charity, to creating art in which actually performing acts of compassion and charity provide the aesthetic experience

Ari suggested that he could build a website in which people worldwide would be invited to contribute pictures to the site. Like the funding of walkers in a walkathon, we could get corporate sponsors to donate money to a charity each time an image is contributed. We began by asking people who were born blind or became blind at a young age: “What are four things that you would most like to see if you had vision?” We interviewed blind people in Israel, the Czech Republic, and United States and sent questionnaires worldwide to associations and schools for the blind. We received responses from

countries as disparate as Australia, Ethiopia, Fiji, India, Korea, Lebanon, Lithuania, Niger, Poland, Slovenia, Zambia, and United Kingdom. The similarity of responses from such diverse cultures teaches us about the common vision of humanity. Ari created the website on which we posted the results of our cross-cultural research to invite web surfers to contribute pictures of things that blind people most want to see.

The next stage was to link the Internet to innovative digital technologies that enable blind people to “see” pictures through the sense of touch. A special computer mouse was developed in Jerusalem that gives blind people direct access to pictures on a computer monitor. Beneath fingers placed in indentations in this specially designed mouse, there is a grid of pin-like protrusions that move up and down independently to trace the image on the computer monitor onto the blind person’s fingertips. I drove up to Jerusalem to meet with Dr. Roman Guzman, inventor of this digital system, to discuss how his innovative technology could facilitate developing aesthetic experiences for blind people. With this new technology, blind people worldwide could access pictures from the image bank at our website.

In my years of dialogue on art and technology with the Lubavicher Rebbe, the 20th century’s foremost leader of Hasidic Jewry, I learned that the sweeping technological changes we are experiencing today are described in ancient kabbalistic texts. They relate how the outburst in scientific knowledge and technological advancement would be paralleled by an increase in sublime wisdom and spirituality. Integrating the wisdom of the mind and the wisdom of the soul, which is the role of the artist, can begin to usher true unity into the world.

The divine purpose of the present information revolution, which gives an individual unprecedented power and opportunity, is to allow us to share knowledge – spiritual knowledge – with each other, empowering and unifying individuals everywhere. We need to use today’s interactive technology not just for business or leisure but to interlink as people – to create a welcome environment for the interaction of our souls, our hearts, our visions (Schneerson 1995: 191).

Learning through Spiritual Emergence

Wassily Kandinsky (1977) explored the spiritual nature of the emerging modern art movements at the beginning of the 20th century in his classic book, *Concerning the Spiritual in Art*. He saw modern art as movement away from the representation of the material world to a more spiritually elevated world of abstraction. He symbolized this spiritual ascent by a moving triangle with its apex leading it *forwards and upwards*. Complimenting modernism's movement of art to a higher spiritual realm of pure color and form, 21st century art forms promote the movement of art down into everyday life and out across the planet. This spiritual movement *downward and outward* can be symbolized by a second triangle moving into the future through the wisdom of the past with the apex pointing downwards. The two triangles intertwined symbolize the teaching of the Lubavicher Rebbe that it is not enough to rest content with our own spiritual ascent, the elevation of our souls in closeness to God. "We must also strive to draw spirituality down into the world and into every part of our involvement with it – our work and our social life – until not only do they not distract us from our pursuit of G-d, but they become a full part of it" (Schneerson 1986: 320).

The final project for my students in the colleges in Ariel and Jerusalem was to photograph God. I created a blog, www.photographgod.com, where I posted instructions and some of the most interesting sequences of photographs. The first question the students' asked was, "Where do we find God?" I responded with the teaching of Rabbi Joseph B. Soloveitchik (1983), one of the foremost thinkers of the 20th century, that they should not direct their glance upward but downward, not aspire to a heavenly transcendence nor seek to soar upon the wings of some abstract, mysterious spirituality, but to fix our gaze upon concrete, empirical reality. Look for God in the marketplace, the street, the factory, the house, the mall, and the banquet hall. "For God your Lord walks in the midst of your camp." (*Deuteronomy* 23:15) God permeates into every nook and cranny of life.

In his book, *Seeing God*, Rabbi David Aaron uses kabbalistic insights to illuminate how we can see divine light all around us. He shares my discomfort using the word “God,” a Germanic word conjuring up images of some all-powerful being zapping us if we step out of line. Hebrew speakers call God *Hashem*, literally “The Name” in Hebrew, the name of the nameless One encompassing all of reality and beyond.

Hashem does not exist in reality – Hashem is reality. And we do not exist alongside Hashem, we exist within Hashem, within the reality that is Hashem. Hashem is the place. Indeed, Hashem is the all-embracing context for everything. So there can’t be you and God standing side by side in reality. There is only one reality that is Hashem, and you exist in Hashem.... Everything is in Hashem, Hashem is in everything, but Hashem is beyond everything.... Seeing God is all about getting in touch with reality (Aaron 2001: 14).

In *God is at Eye Level* (2000), photographer Jan Phillips quotes from Rabbi Elimelech:

My eyes find God everywhere, in every living thing, creature, person, in every act of kindness, act of nature, act of grace. Everywhere I look, there God is looking back, looking straight back.... Whoever does not see God in every place does not see God in any place.

In his acclaimed novel, *The City of God* (2001), E. L. Doctorow echoes these thoughts:

If there is a religious agency in our lives, it has to appear in the manner of our times. Not from on high, but a revelation that hides itself in our culture, it will be ground-level, on the street, it’ll be coming down the avenue in the traffic, hard to tell apart from anything else. It will be cryptic, discerned over time, piecemeal, to be communally understood at the end like a law of science. They’ll put it on a silicon chip.

We learn divine attributes from the biblical passage, “You Hashem are compassion, strength, beauty, eternity, splendor, and everything in heaven and on earth” (*Chronicles* 1:29). Like the spectral colors that make up white light, we can see the spectrum of divine light emerging everywhere we look. My students’ charge was to photographically document processes that reveal these six divine attributes, a divine spectrum filtering down into their everyday lives:

Compassion: Largess / Loving All

Strength: Judgment / Setting Limits

Beauty: Aesthetic Balance / Inner Elegance

Eternity: Victory / Success

Splendor: Gracefulness / Magnificence

Integration: Foundation of Everything/ Gateway to Action

I created a blog, www.photographgod.com, for posting my students work and inviting worldwide participation. On the blog, I posted Karen's photographic sequence expressing *compassion* as a process that begins with hungry feral cats, hungry for love and food, surrounding an elderly gentleman who has seen much in his life who chose to respond to their hunger. He pets them in one photograph, satisfying their hunger for love, and in the next photograph portions out food for each of them making sure there is enough for all. Sharon sees *compassion* as the divine loving kindness bestowed upon a bride on her wedding day. Her photographs show a beautiful bride, her eyes closed in contemplation, enveloped in the aura of her new husband's love, as they stand close together under a wedding canopy.

Dalia sees *success* as the *victory* of good over evil and the love of the Jewish people for its Torah for *eternity*. As a participant, she photographed the "March of the Living" to Nazi death camps in Poland in order to never forget the horrible nightmare and unimaginable suffering of millions of Jews brutally murdered there. On her return home to Israel, she photographed *strength* as her brave peers, soldiers defending their country against its current enemies seeking to destroy it. They are wrapped in prayer shawls reading from a Torah scroll in an open field marking the beginning of their dangerous day.

Esti documents avian *strength* in a photographic sequence showing a parrot chick pecking its way out of its egg and avian *splendor* as the metamorphosis of the young parrot, a strange-looking earthbound creature with stubby feathers, into a magnificent bird in flight. Roni's photographic sequence shows the birthing of a calf at a dairy farm on Israel's coastal plain, an awesome event expressing *beauty* as helping bring new life

into the world. It reveals *beauty* as the vital balance between the farmer's *compassion* aiding a cow in labor and the *strength* of his arms pulling the calf through the birth canal.

The biblical prophet Zechariah envisioned a beautiful future during the depths of despair when Jerusalem was razed by its enemies and the Jewish people exiled. Tzipi sees Zechariah's vision being realized in our day after two millennia of bitter exile. "Thus said God: I will bring My people from the land of the east and from the land where the sun sets to dwell within Jerusalem.... We will see the wondrous vision of elderly men and women once again sitting in the streets of Jerusalem and the streets of the city will be filled with boys and girls playing." (*Zechariah* 8:6-7). Tzipi photographed *beauty* as she and her brother sitting with their great-grandparents, both 91 years old, in their home in Jerusalem. Her grandparents have 7 children, 47 grandchildren, 170 great-grandchildren, and 6 great-great grandchildren – in total 230 offspring!

Learning through Moral Courage

In the kabbalistic schema, beauty is the balance between compassion and strength. This vital balance teaches that it is not enough for artists to rest content with their compassionate responses to the cries of the world through their artworks. They must gain the strength and courage to use art to confront hatred, bigotry, racism, terrorism, genocide, and cults of death and destruction with moral outrage. There are artists in the past who have exhibited the moral courage to confront evil through their paintings, drawings, and prints, from the etchings of Goya recording the horrors of Napoleon's invasion, George Grosz's drawings of the catastrophe of World War I – the disabled, crippled, and mutilated – and his caricatures ridiculing Hitler and his Nazi henchmen, Ben Shahn's *Passion of Sacco and Vanzetti* painting exposing bigotry, to Picasso's *Guernica* crying out against the bombing practice by Hitler's burgeoning war machine killing hundreds in a little Basque village in northern Spain as a prelude to WW II and the Holocaust.

In the tradition of *Guernica*, I created www.futureholocaustmemorials.org, an Internet artwork to warn the world of Iranian president Ahmedinejad's quest for a nuclear bomb to "wipe Israel off the map." Just as the world's acquiescence to Hitler's raining bombs on Guernica gave him the license to proceed with preparing for WW II and exterminating the Jews of Europe on his way to global conquest, the world's indifference to the thousands of rockets launched against Israel by Iran's proxy armies, Hamas and Hizbullah, are empowering Ahmedinejad to incinerate the Jews of Israel as a prelude to his global jihad.

The nations that did little to prevent the murder of six million Jews in Europe or collaborated with the Nazis in their extermination have built memorials to honor those dead Jews. They are once again doing little to prevent a Second Holocaust. As a wake-up call to today's apathetic world, I propose designing in advance Holocaust memorials honoring the six million Jews in Israel incinerated by an Iranian nuclear bomb. I also propose redesigning, embellishing, and enlarging existing Holocaust memorials to pay tribute in a single artwork to all the twelve million murdered Jews. The Holocaust monument in Berlin, for example, is a sprawling field of 2,700 stone slabs for Holocaust One. I propose doubling its size by adding 2,700 more stone slabs as a future memorial for Holocaust Two. 5,400 stone slabs for twelve million Jews murdered by the world's indifference.

The Islamist hatred for the Jews is so intense that they are willing to incinerate millions of Arab men, women, and children living among the Jews in the Land of Israel. I am inviting an Arab artist to collaborate with me in creating a memorial in advance for this collateral damage from Iran's nuclear bomb.

My web proposal for designing "Memorials for a Second Holocaust" is an artist's attempt to make the world see that the dangers that face Israel are dangers faced by the whole free world. The world's indifference to Hitler's murderous attacks on the Jews encouraged him to attack Europe and America. Iran's nuclear ambitions and aggressive intent goes beyond incinerating Israel. It is a program of global conquest in the service of a mad ideology.

Today, the global reach of a networked planet gives artists unprecedented power to express their moral outrage as a worldwide call to action against these evils. The Internet is a powerful art medium that can reach out across our planet screaming, "Never Again!" On seeing www.futureholocaustmemorials.org, Kenneth Treister, artist/architect of the acclaimed Holocaust Memorial in Miami Beach responded: "I do not remember being struck so sharply, like a thunder strike, by a work of art, in any form. It is so powerful. In a simple way, you tell a message that is both urgent and so sad. Reality is staring us in our face and we are blind... I never thought that contemporary art could speak clearly of important things. Your work has changed that perception."

Ahmedinejad maintains a website that invites letters to him. In an effort to change his genocidal ambitions, I sent him a letter with reasons derived from Islamic art and thought for him to recognize Israel as a blessing expressing Allah's will rather than as a alien presence in the center of the Islamic world.

An Open Letter to President Ahmedinejad:

Your aim to wipe Israel off the map defies the values of Islam expressed in the Holy Koran and through Islamic art.

In Islamic art, a uniform geometric pattern is purposely disrupted by the introduction of a counter-pattern to demonstrate that human creation is less than perfect. Based upon the belief that only Allah creates perfection, rug weavers from Islamic lands intentionally weave a small patch of dissimilar pattern to break the symmetry of their rugs. The Islamic artisan does not want to be perceived as competing with the perfection of Allah.

Perhaps you see a continuous pattern like a beautiful Islamic rug running from Morocco on the Atlantic Ocean to the eastern borders of Iran. Shift your perception to see Israel, not as a blemish on the great Islamic rug, but as a small counter-pattern needed to realize Islamic values.

The ingathering of the Jewish People into its historic homeland in the midst of the Islamic world is the fulfillment of Mohammed's prophecy in the Koran (Sura 17:104): "And we said to the Children of Israel, 'scatter and live all over the world...and when the end of the world is near we will gather you again into the Promised Land.'"

Switch your viewpoint to recognize the sovereign right of the Jews over the Land of Israel as the will of Allah as expressed in the Koran (Sura 5:20-21):
“Remember when Moses said to his people: ‘O my people, call in remembrance the favor of God unto you, when he produced prophets among you, made you kings, and gave to you what He had not given to any other among the people. O my people, enter the Holy Land which God has assigned unto you.’”

As a devout Muslim, you should recognize the State of Israel as a blessing expressing Allah’s will.

Learning through Holistic Integration

Holistic education is described in an online encyclopedia of education as learning that nurtures a sense of wonder, of the wholeness of the universe, of intrinsic reverence for life, and of passionate love of learning. Holistic education is based on the premise that each person finds identity, meaning, and purpose in life through connections to community, the natural world, and spiritual values. The art of holistic education lies in its responsiveness to diverse learning styles. (Online Encyclopedia 2006)

In a special issue of *Visual Arts Research* devoted to holistic approaches to art education, its editor, Peter London, writes:

Holism posits that at any moment in time we are the sum total of the prevailing states of our mind, body and spirit. This is the dynamic phenomenon, the being who is actively engaged in creating their life moment by moment, and their art, project by project. It is therefore addressing and ultimately integrating mind, body, and spirit, that holistic art education is after” (London 2006, p. 8).

I have the opportunity to put holistic art education theory into practice by creating a new School of Art and Multimedia Design at Netanya Academic College in Israel in which students redefine art in creative ways at the interdisciplinary interface where new technologies and scientific inquiry shape cultural values of a Jewish state in an era of globalization. The educational model for the new college is derived from my nearly five

decades of experience as artist/researcher/teacher, my research on higher education in America, and ancient kabbalistic wisdom that has special relevance for the future of higher education in Israel (Alexenberg 2006a).

My research study in higher education, presented at the SIGGRAPH 2005 conference on computer graphics and interactive media in Los Angeles, analyzes degree requirements, curricula, and course offerings in theoretical studies and studio practice in BFA and MFA programs in sixty American art colleges and university art departments that have a range of cognate titles: digital art, multimedia design, art and technology, computer art, conceptual information arts, new media, electronic art, interactive media, science technology art, electronic imaging, interdisciplinary computing and the arts, arts computation engineering, interactive telecommunications, and others. (Alexenberg 2005b)

In my book, *The Future of Art in a Digital Age: From Hellenistic to Hebraic Consciousness* (Alexenberg 2006b), I explore the confluence between new directions in art and kabbalah, Judaism's ancient esoteric tradition. Kabbalah provides a symbolic language and conceptual schema that facilitates understanding the dynamics of the creative process in technoetic art – art that arises from the intersections of art, science, technology, and consciousness research. The kabbalistic model of creative process is a metaphorical way of thinking derived from the deep structure of biblical consciousness. It is a choreography of the mind that reveals a progression that draws inspiration down into the material world from a higher source where originality emanates.

Based upon a biblical passage (*Isaiah* 43:7), the kabbalistic schema posits worlds of Emanation, Creation, Formation, and Action, realms of spirit, mind, and body flowing from intentions, thoughts, and feelings to their realization through creating something original. The creative process aims “to liberate those who are blind though they have eyes and deaf though they have ears” (*Isaiah* 43:8). Educating artists for the future requires a liberating curriculum to open the eyes and ears of students to their continually expanding range of learning options in these four worlds.

Emanation is the precognitive realm of consciousness/spirituality/intention.

Creation is the cognitive realm of insight/conceptualization/inquiry.

Formation is the affective realm of emotions/aesthetic experience/artistic expression.

Action is the space-time realm of working with materials/technologies/media and the space-time realm of creating through one's body/local community/global culture.

Holistic integration is the vital flow between these worlds that weaves together realms of learning at the intersections of art, science, technology, and culture: awesome immersion, playful exploration, aesthetic creativity, interdisciplinary imagination, cybersomatic interactivity, global connectivity, polycultural collaboration, ecological perspective, responsive compassion, spiritual emergence, and moral courage.

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