Educating Artists for the Future:
Learning at the Intersections of Art, Science, Technology, and Culture

Introduction 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.

Mel Alexenberg

The genesis of this book was an invitation by the renowned mathematicians Tzvi Arad and Bernard Pinchik to create a new School of Art and Multimedia Design at Netanya College in Israel. I began to develop a proposal for a school in which students redefine art in creative ways at the interdisciplinary interface where scientific inquiry and new technologies shape aesthetic and cultural values – both local and global. Although I have had years of experience in both science and art education, I knew that I needed to explore fresh directions for educating artists for the future in a rapidly changing world where the boundaries between art, science, technology, and culture are becoming diaphanous. What better way to discern these new directions, I thought, than to invite some of the world's most innovative thinkers in higher education in the arts to advise me. This book is their advice. It not only offers invaluable advice for creating new schools, but it provides alternative paths for upgrading and refreshing existing art schools and university art departments worldwide for a post-digital future.

As I studied the diverse chapters exploring alternative futures for educating artists that I received from artists/researchers/teachers working in Brazil, Canada, China, Czech Republic, Finland, Germany, India, Israel, South Korea, Switzerland, Turkey, United Kingdom, and United States, I began to search for a conceptual framework for organizing this book. My search was interrupted by a meeting in Holland with Charles Esche, Director of the Van Abbemuseum in Eindhoven, and Richard Flood, Chief Curator of the New Museum of Contemporary Art in New York. We were charged with awarding an artist the coveted Wolf Prize, the equivalent in the arts of the Nobel Prize, from among numerous nominations received from throughout the world. The three of us unanimous agreed to award Michaelangelo Pistoletto the prize because of his inventive career as an artist, educator, and activist, whose restless intelligence has created prescient forms of art that address the major technological and cultural changes of our era. In his hometown, Biella, Italy, he established Cittadellarte as a center to inspire artists to produce responsible change in society through transdisciplinary ideas and creative projects. Pistoletto asserts, "Artists have a unique and totally free way of understanding and analyzing society, and consequently of

being engaged with it. Cittadellarte firmly believes that art can interact among all the diverse spheres of human activity that form society, and is thereby a generator for responsible transformation of society."

At Schiphol Airport, waiting for my flight home to Tel Aviv, I was struck by four books sharing the main display rack in the airport bookshop: *A Whole New Mind*, *Intelligence Reframed*, *The Lexus and the Olive Tree*, and *Machine Beauty*. They explore some of the same concepts that I had discussed with Esche and Flood in Eindhoven. Browsing through them gave me further food for thought about how to group the chapters in the book and write the introduction for it. It is significant that none of these books were art books. Glancing at the back covers, I saw that they were classified as books in the areas of business, psychology, current affairs, and computer science. It is apparent that new ways for educating artists for the future will be found in a global fabric woven with colorful threads from all fields of human endeavor. Significant threads are revealed in subtitles of the four books.

The subtitles of *A Whole New Mind* by business consultant Daniel Pink (2006) are "Why Right-brainers will Rule the Future" and "Moving from the Information Age to the Conceptual Age." Pink proposes that we are witnessing a paradigm shift beyond the digital culture of the Information Age to a Conceptual Age in which people in all walks of life will succeed when they behave like artists who integrate left-brain with right-brain thinking. Industrial Age factory workers and Information Age knowledge workers are being superseded by Conceptual Age creators and empathizers who integrate high tech abilities with high touch and high concept abilities. When the president of General Motors states that he is in the art business selling mobile sculpture that incidentally provides transportation, the MFA degree has become more valuable to corporate recruiters than the MBA.

"Multiple Intelligences for the 21st Century" is the subtitle of Harvard psychology professor Howard Gardner's book, *Intelligence Reframed* (1999) that describes how artists have always needed to develop their spatial intelligence. Artists of the future, however, will realize that this pattern-recognition mode of thinking is not enough. Spatial intelligence will have to be combined in multiple configurations with bodily-kinesthetic, logical-mathematical, linguistic, musical, naturalist, intrapersonal, interpersonal, spiritual, and existential intelligences.

The Lexus and the Olive Tree by Pulitzer Prize-winning author Thomas Friedman (2000) is subtitled "Understanding Globalization." He dramatizes the conflict between manufacturing the luxury car Lexus and attachment to deeply-rooted olive trees – the tension between the globalization system and the ancient forces of culture, geography, tradition, and community. His analysis of our global future makes us understand that artists faced with the challenge of finding a healthy balance between preserving a sense of identity and community in an era of globalization will need to learn to create artworks that combine pride in roots with an overview of the world as shared by others.

Yale University computer science professor David Gelernter (1998) subtitled his book, *Machine Beauty*, "Elegance and the Heart of Technology." Artists educated for the future will need to enter into the heart of the technology they are using to locate its inner beauty as a powerful source for their artistic creativity. Gelernter emphasizes that the scientific and engineering geniuses in the computer field are the people with the keenest aesthetic senses, the ones who are capable of creating beauty at every level, in the most important interfaces and programming languages and the winning algorithms.

Beyond the Digital

Stephen Wilson's chapter, "Beyond the Digital: Preparing Artists to Work at the Frontiers of Technoculture" sets the tone for first section of this book and gives it its title. He proposes that although the impact of digital technology is significant, it forms part of something much more momentous that is intertwined with the aesthetic, ethical, cultural, and social-economic. Scientific research and technological development are radically transforming basic philosophical ideas about the nature of the physical world, time and space, the nature of life and intelligence, and the limits in our abilities to transform the world and humanity. Art redefined by a digital revolution linked to revolutions brewing in the realms of biology, neurophysiology, materials science, and cosmology require new methods for educating artists at the intersections of art, science, technology, and culture.

Roy Ascott in his chapter "Pixels and Particles: The Path to Syncretism" also proposes that the digital moment has passed in the sense that interfaces are migrating from a cabled, box-bound environment to wireless multi-sensory, multi-modal, mobile, wearable forms, and eventually with biochips implanted in our bodies. He coins the word "moistmedia" as the symbiosis between dry

pixels and wet biomolecules. Our artistic inquiry and design skills will be devoted to creating moistmedia artworks from which new metaphors, new language, and new methodologies will arise. The dynamic interplay between digital, biological, and cultural systems calls for a syncretic approach to arts education realized through connectivity, immersion, interaction, transformation, and emergence. Ascott explains that young artists face the challenge of creating a syncretic art that explores telematics (planetary connectivity), nanotechnology (bottom up construction), quantum computing (augmented cyberception), cognitive science and pharmacology (field consciousness), and esoterica (psychic instrumentality).

In "Sustaining Creativity and Losing the Wild," Carol Gigliotti, who teaches media courses as well as environmental ethics for art, design and media students, discusses metaphoric approaches in new media art and design education that envisions natural and human creativity as integrated components in a universal creative process, both of which need to be sustained. She argues that new media art students cannot ignore, for instance, how the mining of coltan in Africa needed in the manufacture of laptop computers wrecks havoc on the environment and creates political conflict and violence. Her chapter explores the deep connections between the suppression and destruction of creativity in natural systems and the corrosive effects of that destruction on sustained human creativity. Gigliotti argues that embedding this kind of information in a digital art curriculum is the key for placing the medium in a critical cultural context, one in which the social and political implications of the digital medium are made transparent. What this means for educating artists for the future is that we learn to avoid contributing to the destruction of our own creativity by our failure to see the connection of that creativity to the natural world.

Mark Amerika in his chapter, "Making Space for the Artist," refers not to the ecological space of the biosphere, but to the space of mind that *digital-artists-to-be* shape into artistic personas through their own unique creative paths. He tells his students that there is no proper straight-forward path for constructing the "right" set of digital personas or sure-fire way for creating their own one-person "art-making machine." Amerika characterizes his own path as being full of aimless drifting, a multi-linear narrative of freeform nomadic excursions. This technomadic journey of writing, performing, hacking, and directing "takes place" in a networked "space of flows" littered with the remains of his collective failures and – much to his total surprise – a few successes. He teaches through example how to enter a space of mind where the *artist-as-medium* improvisationally composes on and in the open playing fields of potential artistic development, while pointing to the radical, intersubjective experiences we are always filtering, tracing,

remixing, and otherwise conjuring into multiple and hybridized works of art when tapping into our unconscious potential. His students learn what it takes to participate in a highly technologized, social process of self-motivated personal discovery, social networking, and artistic invention, so that they can step into the fold and "play themselves" – even if that means having to reinvent their artistic personas over and over again.

Realms of Learning

The second section of the book explores realms of learning for educating artists in a post-digital world. In the first chapter of this section, "Realms of Learning: From Awesome Immersion to Holistic Integration," I identify realms of learning by reflecting on episodes in my self-education as an artist/researcher/teacher in the complex playing field where art, science, technology, education, culture, and consciousness intersect and interact. This autoethnographic method of qualitative research is expanded in the Reflective Inquiry section of this book. Through reflective inquiry, I discern realms of learning in episodes emerging from my learning path that spans more than a half-century from my childhood summers in the Catskill Mountains of upstate New York, when I had no clue that art and science were different fields of human endeavor, to my current work creating a new school of art and multimedia design in Israel. These pedagogically relevant episodes include: immersion in the life of a barn swallow, designing hands-on science experiments for children to learn about their senses, researching the psychology of aesthetic experience in the creative work of scientists and artists, developing an integrated art-science curriculum for Israeli youth from diverse cultural backgrounds, constructing a semiotic taxonomy of contemporary art forms, creating a biofeedback digital imaging system generating mind-body self-portraits, producing an art exhibition to explore the spiritual dimensions of the electronic age, sending cyberangels on a circumglobal flight using communications satellites, collaborating with elders of different ethnic communities in creating monumental works of environmental public art, working with students in the Everglades on creating ecological artworks, creating a responsive digital artwork for blind people to "see" images through their fingers, creating a website inviting people to photograph God revealed in their everyday lives, creating an Internet artwork that expresses moral outrage in the tradition of *Guernica*, and building a new school for learning at the intersections of art, science, technology, and culture.

Realms of learning for educating artists that I identify from these episodes in my journey are: awesome immersion, playful exploration, aesthetic creativity, morphological analysis,

interdisciplinary imagination, semiotic communication, cybersomatic interactivity, global connectivity, polycultural collaboration, ecological perspective, responsive compassion, spiritual emergence, moral courage, and holistic integration.

In his chapter, "Art/Science and Education," Stefan Sonvilla-Weiss focuses on how cultural, intellectual, and spiritual fields are prerequisite to evolutions in art, science, and technology. He identifies the main question for educating artists in a digital network culture as how the increased recognition of interconnections in differing fields of knowledge, systems and ecology theories is perceived in light of learning tasks. Chaos theory and self-organization and social network theories suggest that we acquire learning competences from forming connections between disparate ideas and fields in which links between them represent survival in an interconnected world. Amplification of learning, knowledge, and understanding through the extension of a personal network into a global network is the epitome of a new learning culture. The task of tomorrow's artist is that of an intermediary, a catalyst between diverse fields of knowledge, ways of thinking, social models, and solution strategies based upon cooperation, communication, and interaction. Digital network culture not only changes modes of media production and distribution, but it transforms art from object making to art as processes of creating "immaterial" rhizome-like structures of remotely connected individuals in online communities. "Print and radio tell; stage and film show; cyberspace embodies."

Sonvilla-Weiss suggests that pedagogical strategies to encourage more student-centered, self-regulated, participative and active learning include learning modules that are more responsive to change than full courses, projects that emphasize explorative learning and research-based design, and internships in diverse scientific, economic, artistic, public, and administrative fields. In addition, he develops a curricular topography addressing three realms of learning: 1) sensual, mental, and reflexive media perception and usage, 2) spatio-temporal perception and contextualization in creative processes, and 3) contextualization of forms of knowledge and design.

Ron Burnett argues in his chapter, "Learning, Education and the Arts in a Digital World," that digital networks of communication and the speed with which artists and designers have made use of these networks has led to a broadening of all fields that make it necessary for art and design schools and departments to radically alter not only their practices, but also their disciplinary structures. The institutional infrastructure upon which so much education in art and design has

depended — discipline-specific departments, specialized educational models, classroom lectures, studios as sites of teaching and practice, learning as training and vice-versa, no longer operate with the same authority for students who do schoolwork and create music on computers, chat, surf, and post their videos on the Internet, use iPods, take photos with a cell phones, and create their own blogs. Art students need to be challenged to understand the impact of these activities on themselves and on society and analyze whether they open up critical discourses or shut down serious thinking. There is no question that the depth of involvement and commitment of students to these media has changed them and their views of the world. It is, however, essential that learning about these phenomena is framed by a self-reflexive understanding of their structure, function, and role as tools of communication and interaction. Digital technologies can be change agents when they encourage new kinds of interdisciplinary learning that provide students with tools to evaluate alternative ideas, practices, and vantage points and create revolutionary ways of seeing beyond works of art to seeing the world that surrounds and enframes them.

Robert W. Sweeny's chapter, "Unthinkable Complexity: Art Education in Networked Times," explores the challenges and possibilities for educating artists in a network society, looking to connections between multidisciplinary complexity theory, art theory fusing physical and virtual space, and educational theory that was put into practice in open classrooms a half-century ago. Sweeny proposes a form of networked pedagogy that is informed by and responsive to complex networks of unthinkable complexity. Teaching in the network society, through hybrid networks consisting of traditional physical spaces and cyberspaces, offers art educators opportunities to address the potential for complex networks in the service of developing new forms of pedagogy and art. Based upon complexity theory, characteristics of both networked art and learning are: differentiation, interaction, self-organization, and emergence. As differentiated networks and artworks interact, self-organize, and emerge, educators have the opportunity to think the unthinkable, working the 'net through educational practices that are creative, critical, and complex. The structure of the Internet, composed of research tools, interactive social space, communication channel, and art gallery, parallels the structure of open classrooms in which students gained access to a variety of forms of information and took part in social exchanges. The open classroom in networked times offers an educational model for educating artists in a hybrid environment of real and virtual spaces.

Polycultural Perspectives

The first two sections of the book primarily explored educating artists in networked times of global reach and transnational interconnectivity. Art, however, has always been an expression of a particular community's cultural values. Thomas Freidman symbolizes globalization and technological progress by the luxurious Lexus sedans that he saw being built entirely by robots in Toyota City and local cultural values by centuries-old olive trees rooted in the Land of Israel.

> Olive trees are important. They represent everything that roots us, anchors us, identifies us and locates us in this world – whether it be belonging to a family, a community, a tribe, a nation, a religion or, most of all, a place called home. Olive trees are what give us the warmth of family, the joy of individuality, the intimacy of personal rituals, the depths of private relationships, and well as the confidence and security to reach out and encounter others…. So what does the Lexus represent? It represents an equally fundamental, age-old human drive – the drive for sustenance, improvement, prosperity, modernization – as it is played out in today's globalization system. (Friedman 2000: 31-33)

Although the emphasis of the chapters in this section is on the olive tree, the authors create a lively dialogue between the forces of globalization represented by digital media art and cultural values – ancient and contemporary – of India, China, and Turkey. The concluding chapter in this section is a transcultural dialogue between a professor of interactive arts and technology in Canada who grew up in a remote part of the U.S. raised by her grandfather, a folk healer in the tradition of the Carpathian Mountains of Poland, and her South Korean doctoral student whose background of Buddhism and Eastern philosophy related to mind-body interconnectivity shaped her interactive immersive artworks.

The first chapter in the Polycultural Perspectives section, "Expressing with Grey Cells: Indian Perspectives on New Media Art" begins with Vinod Vidwans' erudite overview of a tradition of creativity in the arts that spans millennia on the Indian subcontinent. This overview forms the theoretical foundation for his description of the multifaceted confluence between traditional Indian perspectives and directions in art and education shaped by new media technologies. Art in both ancient India and the post-digital age share profound computational and mathematical foundations, convergence and interdependence between fields, and an aesthetics of virtual reality. The Sanskrit word for art is *kala*, etymologically derived from the root that means counting, calculating or computation, indicates a deep level of correlation between artistic quantification and the quality of aesthetic experience. Art, science, and technology in India were integrated activities shaped by awe, curiosity, primordial quest, magic, and mystery. The contemporary orchestration of art, science, and technology in a symphony of new media art mirrors the

interdependent flow that guided art students in ancient India from learning sculpture, image-making, painting, architecture, to theatrical arts, dance, instrumental music, vocal music, composing songs, prose and poetry, literature, languages, grammar, logic, and mathematics. Mathematical aesthetics coupled with the interdependence of various fields of human endeavor and the consequent educational necessity of learning them together indicate a living pedagogy of arts in the civilization of India that resonates powerfully in the education of artists for a post-digital future in which the formal logic of algorithms offers infinite creative possibilities, ineffable corollaries of timelessness, and unfolding of hidden metaphors in the unfathomable depths of structures of space and time.

Wengao Huang's chapter "New Media Art as Embodiment of the Tao," reinforces through Chinese philosophy the contemporary significance of Asian traditions at the intersections art, science, and technology that Vinod Vidwans presents through his Indian perspective. When I first encountered a paper that Wengao Huang wrote on the resonance between ancient Chinese philosophy and new media art, I was intrigued by the parallels between his explorations of art as the embodiment of Tao and my work on the confluence between ancient Jewish philosophy and new media art as expressed through kabbalah, a down-to-earth mystical tradition of Western civilization (Alexenberg 2006b). Although we live and work at opposite ends of Asia, China and Israel, I had the opportunity to meet Wengao Huang at the 2006 Consciousness Reframed conference in England and discuss his chapter for this book and our common background of being scientists turned artists exploring spiritual dimensions of the post-digital age derived from two very different cultures. We were both amazed that ancient spiritual traditions arising simultaneously on the east and west coasts of Asia millennia ago addressed creativity and the arts with a common language perhaps encoded in the shared consciousness of all humanity. Our dialogue prompted me to write "Ancient Schema and Technoetic Creativity" in the journal *Technoetic Arts* (Alexenberg 2006a), in which I explore how schematic systems originating in Chinese and Jewish traditions offer fresh insights into the structure of human consciousness and its creative expression in technoetic art.

In his chapter, "New Media Art as Embodiment of the Tao," Wengao Huang presents evidence of how the natural sciences are creating a new paradigm that demonstrate what the ancient Chinese perceived as the Tao – dynamic monism in which matter is not concrete and the self not centered and unified. New media arts are embracing this holistic paradigm derived from complexity science that finds parallels in the traditional Chinese spirit's emphasis on connections,

transformations, and emergence. Generative and interactive art utilizing emerging technologies have great potential to vividly demonstrate the transforming spirit of the Tao and give new meanings to the saying within the traditional Chinese art world: "Art is the embodiment of the Tao." He describes his artwork on interactive morphogenesis that derives from his research in biotechnology, computer graphics, and ancient Chinese philosophy. The virtual creatures that he creates in artificial evolutionary developmental systems are based upon a biologically plausible developmental model guided by interactions between genes and a morphogenetic field of protein gradients. Artistic expression in new media does not fit within boundaries of areas of conventional specialization. Traditional Chinese education has aimed to produce generalists. Various artistic talents, from painting, calligraphy, music, literature, to chess playing, have been considered necessary for an intellectual to cultivate himself toward the Tao. Underlying various art forms there is a unifying aesthetics based on *Ch'i*, which links the arts, humanity, and the universe in a great whole that promotes artistic creativity. New media art education also calls for generalists rather than specialists. Wengao Huang emphasizes that new media art is the alchemy of our time, bringing technology, consciousness, and culture into a global crucible that leads to the only reality – the Tao, transforming diversity within coherence.

Ismail Ozgur Soganci discusses in his chapter, "Between Hyper-Images and Aniconism: New Perspectives on Islamic Art in the Education of Artists," the curricular negligence in Turkish art schooling of the aniconic tradition in traditional Ottoman visual culture. This negligence stems from the wholesale adoption of Eurocentric models for educating artists that emphasized figurative art and modernist movements as part of the revolution to Westernize Turkey in the first quarter of the 20th century. Today, the blind adherence to these adopted aesthetic values make new media art forms unwelcome in most Turkish art schools and university art departments where the rich aniconic past almost always remains unmentioned. Soganci presents a highly original thesis that the aniconic tradition of Islamic art with its emphasis on mathematical beauty, geometric design, and abstract ornamentation can counterbalance the excessive hyper-image bombardment of contemporary media. Aniconism has untouched potentials for enlightening prospective artists about the negative, unwanted, and alienating consequences of the constant barrage of hyper-images and the exhibitionist urges so common among the current generation. He invites not only Turkish art educators, but educators in new media art worldwide, to evaluate the consensus reached by Abrahamic/Byzantine/Islamic visual traditions as possible cures for today's societies of spectacle by quieting the media blitz with the meditative patterns of an art of non-

figurative mathematical geometries conceptually linked to the algorithmic power of digital media.

"Touching Light: PostTraditional Immersion in Interactive Artistic Environments" is a transcultural dialogue between Diane Gromala, a Polish-American professor of interactive arts and technology at a Canadian university, and her Korean doctoral student, Jinsil Seo, who explores the artistic significance of immersion in responsive and interactive spaces. This chapter presents examples of Seo's art-research work in which her cultural background colors her explorations of ambient immersive space, body interaction with environment, ephemeral and transient states of consciousness, and *Ch'i* as the flow of energy, in creating artworks in which bodily movements trigger interaction and immersion. Seo describes how her research and artmaking is influenced by growing up in South Korea where she developed a deep level of understanding of the conceptual connectivity between consciousness and immersion related to space and time derived from Buddhist thought. In counterpoint to Seo's description, Gromala comments on the interplay between her cultural background, her experience as an artist exploring interactive technologies, and her educational philosophy. Gromala relates how her pedagogical orientation is shaped by being raised in a remote part of the United States by her folk-healer grandfather from the Carpathian Mountains, early Montessori training, a ruinous stint in a Catholic school, and outsider suspicions evoked by her Ivy League education. She attempts to create enough space for her students to work independently, to advise them on how to hunt for what they need, how to build intellectual frameworks and connections with their work, how academia works, and how to creatively navigate around the limitations that new forms of technology and new ways of knowing provoke.

Reflective Inquiry

There is a growing literature in art education and curriculum theory that employs the qualitative research methodology autoethnography. Rita Irwin calls this autoethnographic methodology in the life of an *A*rtist/*R*esearcher/*T*eacher "a/r/tography," a hybrid form of action research creating its rigor through continuous reflexivity, discourse analysis, and hermeneutic inquiry" (Irwin 2006, p. 78). Artists-researchers-teachers inhabit and explore the borderlands between art, science, and education, integrating knowing, doing, making through aesthetic experiences that elegantly flow between intellect, feeling, and practice to create and convey meaning. A/r/tographers search for new ways to understand realms of learning at the interface between their art making, research, and teaching through attention to memory, identity, reflection,

meditation, storytelling, interpretation, and representation. (Irwin and de Cosson 2004). In the "Reflective Inquiry" section of this book, the autobiographical discourses of a diverse group of artists/researchers/teachers highlight episodes in their lives that offer lessons of significance for the education of artists for the future.

Michael Bielicky's autoethnographic narrative, "Media Golem: Between Prague and ZKM," forms a transition between the Polycultural Perspectives and Reflective Inquiry sections of this book. His polycultural perspective had its origins in his overnight transition from a young Communist Pioneer to a Western hippie when his Jewish family ran from the advance of Russian tanks into Czechoslovakia to live in Germany. Three decades later, after having studied medicine and art in Dusseldorf, he was encouraged by his mentor, video art pioneer Nam June Paik, to return to Prague and create a new media department in the art academy there. During his 16 years teaching in Prague, Bielicky was also instrumental in creating centers for new media arts throughout the former Communist world from Bucharest, Odessa, and Moscow, to Alma-Ata in Kazakhstan. He discovered that the new found freedom in Eastern Europe produced a level of energy and creative potential that was stronger than what was happening in Western Europe. Currently back in Germany as professor of new media art at the Hochschule fur Gestaltung linked to the ZKM Center for Art and Media in Karlsruhe, Bielicky reflects on how living at the intersections of Czech and German cultures triggers high levels of creative thought and action.

Bielicky sees the challenge in educating future generations in the new media arts in dealing with the rapidly changing conditions that make today's media theory stale tomorrow. The most significant change is the democratization of technologies that makes everyone a potential artist when powerful media tools that are cheap enough and compact enough for anyone to create serious digital artworks at home. Although primarily conceptual in orientation, his department in Prague was a laboratory for his students to experiment freely. They became more his partners than his students. Bielicky's experience taught him that project-centered study motivates students more and is generally a more efficient educational methodology than more formal methods. He believes that students should be encouraged to break out of institutionalized frameworks and ask if the so-called art system (art school, gallery, museum, art critic, curator, art magazine, art fair, etc.) is meaningful for a new media artist at in a post-digital era.

He describes how his own most recent artwork in collaboration with his wife operates completely outside of the art system. Equipped with a car, a laptop, a compact powerful projector, and a

small power generator, they are able to create an instant presence in the urban landscape. They transform city architecture into dynamic and living organisms. Without any on-site preparation and without any permits, they create guerrilla-theater style projections. Within less than ten minutes, they can illuminate giant buildings with their computer animated urban screening project reaching huge audiences that would probably never walk into a gallery or museum.

In his narrative, "Learning through the Re-embodiment of the Digital Self," Yacov Sharir develops his educational philosophy and practice by tracing his artistic journey from learning music, ceramics, sculpture, and dance in Israel to teaching dance, improvisation, choreography, multi-disciplinary art/technology, and virtual reality/cyberspace at the University of Texas. Sharir's artistic quest that led to the immersion of his wired body in virtual environments had its origins in his childhood studies with a violin teacher whose way of playing made him feel as if his teacher was wearing the music, as if the music had become his second skin. He taught young Yacov that technological success playing the right notes was not enough without learning to embody the overall mood, the atmosphere, the colors, and the appreciation of meaning. "Tell me your story through your music," his violin teacher insisted. This early learning experience deeply influenced his artistic development and his ways of working and teaching.

After studying art and dance in Jerusalem, he lived two professional lives simultaneously – shaping raw earth into works of clay art while transforming his body into art material as a dancer with the renowned Bat Sheva Dance Company. His trans-disciplinary life also became a trans-cultural life as he moved to Texas to found the American Deaf Dance Company which pioneered in including deaf artists in professional dance and the Sharir Dance Company for which he choreographed and created original technologically mediated compositions using wearable computers, technologically charged interactive systems, virtual reality, interactive video art, and computer animated cyber human performers. He teaches his students how to build content and meaning through collaborative creation of interactive art that explores how the disembodied digital self is re-embodied in cyber-bodies occupying increasingly immersive cyber-worlds.

Eduardo Kac's chapter, "Life Transformation – Art Mutation," traces two decades of his work as an artist exploring the boundaries between humans, animals, and robots. In his artworks, he appropriates and subverts contemporary technologies to *enact* critical views rather than making detached comments on social change. He makes present in the physical world new transgenic organisms which seek to open a new space for both emotional and intellectual aesthetic

experience. The implications of this ongoing work have aesthetic, social, and educational ramifications, crossing disciplines and providing material for further reflection and dialogue. His transgenic art using genetic engineering to create unique living beings was a natural development from his biotelematic art in which biology and networking are coupled to produce a hybrid of the living and the telematic, and from his earlier telepresence art in which humans coexist with other humans and non-human animals through telerobotic bodies. Kac appropriates the techniques of biotechnology to critique the language of science and its inherent ideologies, while developing transgenic art as an alternative means for individual expression. As an artist and as an educator heading a department of art and technology, he explores multiple social implications of genetics, from unacceptable abuse to its hopeful promises, from the notion of "code" to the question of translation, from the synthesis of genes to the process of mutation, from the metaphors employed by biotechnology to the fetishization of genes and proteins, from simple reductive narratives to complex views that account for environmental influences.

Aaron Marcus develops guidelines for educating designers and artists for the future by considering past issues and their resolution in his extensive career that evolved from physics at Princeton to art and graphic design at Yale to user-interface/information-visualization design at Aaron Marcus and Associates (AM+A), the leading-edge international design firm that he founded in 1982 and currently heads. His pioneering work using digital technologies in art and design at AT+T Bell Labs in the 1960s and Lawrence Berkeley Laboratory's Computer Science and Mathematics Department in the early 1980s, coupled with his decades of teaching and practice make his recommendations relevant to the education of students for an age of ubiquitous computing, virtual social networks, cross-national cultures, and access from one's current location to almost any text, image, sound, and experience from any time and place. Marcus proposes educating designers for a worldwide sensorium, a world of unimaginable size, density, variety, intensity, and activity, in which much is changing rapidly even while powerful economic and political forces grind slowly, relentlessly onward, challenging all that we have as human, corporeal, mental, cognitive, spiritual, and emotional beings. His creative journey from young cartoonist and photographer to university professor, from conceptual artist and computer graphics artist to graphic designer, from corporate designer to information-designer, from print designer to user-interface designer was a bumpy road with many unexpected twists and turns that taught him lessons significant in preparing students for an unknown future. They should learn to not to be so immersed in tools and techniques that they forget the larger issues of theory and practice, to expect the unexpected, to realize that help may come when most needed from unexpected

sources, to facilitate people make smarter decisions faster, to think about other cultures and times, to conceptualize everything in a system of interrelated parts, to scan the horizon to discern future developments in knowledge-oriented communications, and to cultivate a terminology to quickly, efficiently, and successfully describe their work.

Emerging Praxis

Art historian Edward A. Shanken reflects on teaching about the entwined histories of art, science, and technological media.   In the absence of faculty in art history departments to teach these entwined histories, studio faculty are often entrusted with providing students with a strong grounding in the history and theory of art, science, and technological media in order to become effective practitioners. The traditional use of slides or other still images to teach art history is inadequate given the time-based and interactive nature of much work in this interdisciplinary field. The conceptual and technical richness of the best artworks, exciting and inspiring for scholars, are difficult to teach given the absence of canonical literature and media resources. Shanken has found a media-archaeological approach to be an effective pedagogical tool, as historical attempts to create surrogates, simulations, and immersive environments can be mapped onto more recent artworks involving technologies such as robotics, artificial life, and virtual reality.   Shanken argues further that students who do not develop a firm grasp of the pluralism that characterizes contemporary art practice and similar command over the concepts and histories of information theory, cybernetics, computing, networking, and media, cannot hope to have anything but a superficial understanding and appreciation of the contributions of art-science-technology to discourses on the future of art and visual culture. It is important, moreover, to emphasize the particular contexts in which historical and contemporary works emerge, for it is these conditions that make those works distinctive and significant statements about the epistemological and ontological circumstances of the cultures that produce them.   Shanken teaches his students how to develop strategies for thinking about systems and systemic behavior illustrated with examples from art history that function as visual markers of parallel cultural developments. In this way, he helps his students "learn how to think with their eyes and see with their minds."

Bill Seaman describes a generative emergent approach to graduate education in the Digital+Media department that he created at Rhode Island School of Design. This exemplary educational program fosters a richly focused liberal arts/conceptual/social agenda in relation to a digital practice in counter distinction to a set of common practices that are passed on to students

in a "cookie cutter" manner. His teaching methods articulate a core set of concepts and approaches by providing essential texts and central technological methodologies augmented with a broad range of study related to more individual, eclectic practices and research potentials. The curriculum at the Digital+Media department begins with a "Continuum Studio" where students explore the continuum from the physical to the digital while simultaneously building a space for conceptual exchange, critique, and reflection. Students develop a vocabulary of relevant processes to help them define their own working processes. Along with the Continuum Studio, students participate in a course in the history of digital media focusing on interactivity, in a seminar/tutorial that Seaman teaches, and in lectures by prominent guest artists. Students also choose between a variety of "Node" classes, borrowing a navigational concept from the structure of the Internet. These classes balance the study of technology and art (or design) with inquiry that is conceptual, social, and cultural. They bring core Digital+Media department students together with a broad range of students from other disciplines to facilitate understanding and communicating multiple approaches to contemporary creative technological practice. Central is a multi-perspective approach to knowledge acquisition where students develop a bridging language and articulate relationships that are relevant to their own fields.

Shlomo Lee Abrahmov demonstrates how visual literacy is developed in his students by combining *reading* and *writing* images. He suggests a set of common categories for both activities based on observing and creating three levels of meaning in images: Factual, Interpretive and Conceptual. Abrahmov proposes that an effective strategy for teaching visual literacy is a blended approach where the writing of images is through face-to-face teaching on campus and the reading of images is through e-Learning using a web-based teaching platform. Such an approach creates synergy between theoretical and practical activities in a digital age when images become fluid and are used to convey messages and intentions with ease. E-Learning has been shown to be more effective than traditional methods in teaching the reading of images since it provides opportunities for individual students to engage in interpretation and analysis at their own pace. An open submission model in which students post their assignments on a course website and participate in a group discussion board allows them to learn from peer examples.

In "The Creative Spirit in the Age of Digital Technologies," Lucia Leão proposes seven tactical exercises to enhance the creative potential of her students of technoetic arts and new media in Brazil. She traces parallels between the sacred dimensions of education as the search for meaning, creativity as a path to self-discovery, the search for a personal sacred meaning, and new

technologies as tools to stimulate interconnected consciousness. The seven learning exercises Leao describes follow mythic movements of the labyrinth path that challenge her students to develop aesthetic dimensions of human experience that make the learning process a path to creative liberation. She invites students: 1) to follow an inner trajectory into a spiritual realm as a creative path to self-discovery. 2) to reflect on non-sense aspects of their lives to discover and appreciate dichotomies, complexities, and ambivalences. 3) to visualize complex systems by mapping their multiple affiliations. 4) to get in touch with the collective unconscious and its archetypes while exploring authorship in an information society by using digital systems for collective writing. 5) to experience their own bodies in relation to the collective body of their class, the Gaia body of Planet Earth, and the expansive body of the Universe. 6) to develop the ability to see inspiration everywhere as the basis for exercising the creative spirit. 7) to go back to the world, sharing knowledge, developing the art of listening and the art of tolerance, and becoming an agent for integrative coexistence.

Realms of Learning

The concluding section identifies realms of learning that weave together the complex issues of theory and practice in a post-digital Conceptual Age by reflecting on episodes in my self-education as an artist/researcher/teacher in the complex playing field where art, science, technology, education, culture, and consciousness intersect and interact. Through reflective inquiry, I discern realms of learning emerging from my learning path that spans more than a half-century from my childhood summers in the Catskill Mountains of upstate New York, when I had no clue that art and science were different fields of human endeavor, to my current work creating a new school of art and multimedia design in Israel. These pedagogically relevant episodes include: immersion in the life of a barn swallow, designing hands-on science experiments for children to learn about their senses, researching the psychology of aesthetic experience in the creative work of scientists and artists, developing an integrated art-science curriculum for Israeli youth from diverse cultural backgrounds, revealing beauty hidden in the cellular structure of a blade of grass, constructing a semiotic taxonomy of contemporary art forms, creating a biofeedback digital imaging system generating mind-body self- portraits, producing an art exhibition to explore the spiritual dimensions of the electronic age, sending cyberangels on a circumglobal flight using communications satellites, collaborating with elders of different ethnic communities in creating monumental works of environmental public art, working with students in the Everglades on creating ecological artworks, creating a responsive digital artwork for blind

people to "see" images through their fingers, creating a website inviting people to photograph God revealed in their everyday lives, creating an Internet artwork that expresses moral outrage in the tradition of Guernica, and integrating theory and practice in a new school for learning at the intersections of art, science, technology, and culture.

Realms of learning for educating artists that I identify from these episodes in my journey are: 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.

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