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Planetary Technoetics: Art, Technology and Consciousness

Roy Ascott

Our best destiny, as planetary cohabitants, is the development of what has been called "species consciousness"—something over and above nationalisms, blocs, religions, ethnicities. During this week of incredible misery, I have been trying to apply such a consciousness and such a sensibility. Thinking of the victims, of the perpetrators, and of the near future, I felt species grief, then species shame, then species fear.

—Martin Amis [1]

Martin Amis called for a planetary perspective to be taken on the dreadful events of September 11th and the way that subsequently justice might be served. In this paper I would like to look at the question of planetary consciousness to see how that relates to our practices as artists and designers, to review the new media that is emerging, to consider the strategies of bottom-up design that it entails, and to anticipate some near-future scenarios while at the same time contributing in some good sense to this troubled present. Before I do this, I think it may be useful to outline briefly the perspective from which I am viewing these issues by setting out the principal features of my field of practice and the markers by which it is distinguished from the past. Interactive art is conceptually led and technologically assisted. It employs telematic media and computational systems and works towards the convergence of technology and biology into what I foresee as the 21st-century substrate for art—moistmedia—the integration of silicon-dry computer systems and wet, living biology. Below I shall describe more fully the extent and implications for art of moistmedia. But first let me outline the five-fold path that, as I see it, can lead to a fully differentiated interactive art practice.

This five-fold path involves:

- connectivity
- immersion
- interaction
- transformation
- emergence.

The cultural shift that this new approach to art entails, and that to some minds constitutes a rupture from past practice, can be summarized in Table 1.

Before examining developments in interactive art more deeply, let me return briefly to the events of 9-11. In order to

address the issue, I would like first, out of respect for the many thousands of Americans who have suffered unbearable sorrow and grief, to make a sober reference to what might be called counter-interactivity, for that surely is at the center, and is in large part the cause, of the massacre of Tuesday September 11th. Terror as the medium of a design-built strategy of planetary dimensions; a top-down design, a blueprint sanctioned, in the minds of pathologically deranged zealots, by the great architect in the sky, or what they see as the architect's authorized agent on earth. In fact what we see is the conflict of two world designs fundamentally opposed to interaction between each other—two separate realities, unable to fuse, resistant to dialogue. There has been, in different measure, violence and cruelty perpetrated over many decades on both sides. Unless wisdom prevails, it will lead to even more horrific events. How conceivably could the work of artists as artists—i.e. not pamphleteers, aestheticized social workers or political pundits—be remotely expected to contribute to the process of reconciliation, mutual respect and understanding that these mixed realities must attain?

What is being designed by terror? Or more to the point, how is the world being re-designed by terror? Simply put, it is in the way that design always operates—by the creation and ma-

ABSTRACT

As the planet becomes telematically unified, the self becomes dispersed. The convergence of dry silicon pixels and biologically wet particles is creating a moistmedia substrate for art where digital systems, telematics, genetic engineering and nanotechnology meet. A technoetic aesthetic not only will embrace new media, technology, consciousness research and non-classical science but also will gain new insights from older cultural traditions previously banished from materialist discourse. In the present post-9/11 crisis, collaborative transdisciplinary research is needed if a truly planetary culture is to emerge that is techno-ethical as well as technoetic.

Table 1. Paradigm Shift. Transformation from classical to post-biological culture.

From	To
reception	negotiation
representation	construction
hermeneutics	heuristics
tunnel vision	bird's-eye view
content	context
object	process
perspective	immersion
figure-ground	pattern
iconicity	bionicity
nature	artificial life
certainty	contingency
resolution	emergence
top-down	bottom-up
observed reality	constructed reality
paranoia	telenoia
autonomous brain	distributed mind
behavior of forms	forms of behavior

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nipulation (or erasure) of symbols, of powerful metaphors. In the case of the Twin Towers, the symbol was created by the West. Its erasure was the object of the terror. The response, I believe, must be a matter of fighting metaphor with metaphor. What was attacked on Tuesday, September 11th, was what the terrorists and their supporters saw as an overpoweringly massive metaphor of strength and domination. This is not to ignore the chilling reality of their grotesque slaughter of the innocent, but the symbolic significance to the terrorists of the destruction of these prominent metaphors is all too evident.

We as artists are metaphor makers before we are anything else. I am talking here of course about metaphor in its most potent senses: structural metaphor, behavioral metaphor, spiritual metaphor. We create metaphor, we critique metaphor, we are always on our guard, as Richard Rorty has wisely reminded us, against those metaphors that have outlived their shelf life and are in danger of ossifying as truths. His pragmatic treatise *Contingency, Irony, and Solidarity* [2] remains a valuable instruction for the media artist, just as it continues to show how relativistic postmodernism can be constructively rerouted from the negativity and pessimism that dimmed the creativity of so many of its adherents.

As Rorty points out, it was Nietzsche who first explicitly suggested that we drop the whole idea of “knowing the truth.” His definition of truth as a “mobile army of metaphors” amounted to saying, as Rorty emphasizes, that the whole idea of “representing reality” by means of language, and thus the idea of finding a single context for all human lives, should be abandoned. Such thoughts help describe the context in which the more significant (i.e. non-ornamental) digital art can be produced. There are many takes on reality, many ways of finding their expression. But where hitherto art has been the servant of such expression, it is now more engaged in the process of creating reality, of constructing worlds, and in a sense legitimizing all our own alternative realities. In this way art is an agency of Becoming—a constructive, more than expressive or decorative, process. The artist is ready to call upon any system, organic or technological, that enables that process to develop. For the same reason, the artist must be prepared to look anywhere, into any discipline, scientific or spiritual, any view of the world, however banal or arcane, any culture, immediate or distant, in order to find those processes that engender this becoming. In my own

work, for example, cybernetics and shamanism can happily co-exist in this multidimensional domain of knowledge and its associative structures. This calls for a general disposition of optimism, what I describe as “telenoia” (the celebration of connectivity and open-ended collaboration) to replace the “paranoia,” the anxiety, alienation and loneliness of the old industrial and materialist age.

Such ambition redefines the work of the artist and also gives it relevance in the political context. It replaces the historical sense of the artist’s role as an “honorable calling” with the idea of such work as a “transformative vocation”—a concept that is central to the theory of society of Roberto Unger, the Brazilian thinker and Harvard law professor. His program for social reconstruction constitutes a radical alternative to Marxism on the one hand and “social democracy” on the other. He shows how, against the idea of work as purely instrumental or as an honorable calling, a third idea of work has appeared in the world. “It connects self-fulfillment and transformation: the change of any aspect of the practical or imaginative settings of the individual’s life. To be fully a person, in this conception, you must engage in a struggle against the defects of the limits of existing society or available knowledge” [3].

Let us consider then the value of the idea of planetary consciousness. Questions of consciousness have an important place in the agenda of art and technology and in the formation of the post-biological culture to which we are contributing. There is no time to trace the history of its course through the art of the last century; it is enough perhaps to point to the work of Kandinsky, Boccioni and Duchamp, for whom issues of consciousness, mind and spirit were predominant. Consciousness is the great mysterium that entices artists and scientists alike to enter its domain. It is the ultimate frontier of research in many fields, and probably only a truly transdisciplinary approach will allow us to close the explanatory gap, or, in our terms as artists, to navigate its many levels, to reframe our perceptions and experience. It is within consciousness that our imagination is at work, and it is in imagination that we first mix the realities of the actual and the virtual.

Where consciousness evolves at the planetary level, a new sensibility arises, a new way of valuing ourselves, our attitudes and actions. It has begun to arise from our understanding of the dynamics of living processes, the flux and flow of nature, the transformative continuum of energies at both quantum and cosmic lev-

els, which condition both our material states and our sense of being. Computer-assisted technologies have allowed us to look deeper into matter and out into space, to recognize meaningful patterns, rhythms, cycles, correspondences, interrelationships and dependencies at all levels. Computational systems have led us to a better understanding of how design might be an emergent process, replacing the old top-down approach with a bottom-up methodology. Telematic systems have enabled us to distribute ourselves over multiple locations, to multiply our identity, to extend our reach over formidable distances with formidable speed. We have learned that everything is connected and we are busy in the technological process of connecting everything. But we forget all too frequently that connectivity must be truly ubiquitous and comprehensive if it is to be consistent and humane, and that to maintain its ubiquity it must be cared for and protected, a rule that applies of course not simply to telematic networks and communication systems but must be extended generously to our fellow human beings. Our decision collectively to forget or ignore so many people and cultures in the world, in many cases actively to impede their communication, to silence their voices, often through sheer indifference as much as greed or malice, plays a large part in the situation we find ourselves in today.

Where in recent history did the notion of planetary consciousness and species consciousness come from? Certainly Marx used it in *Private Property and Communism* back in 1844 [4], and more recently its currency has been renewed by New Age writers of varying complexion, from the so-called info-mystics to more orthodox scientists such as the Pittsburgh physicist Oliver Reiser, with his *Cosmic Humanism* of 1966 [5]. Peter Russell in *The Awakening Earth* (1982) [6] made the case for its emergence out of our telecommunications complexity. We have seen other terms appear in this context. Pierre Lévy in 1994 published *L’Intelligence collective* [7], and Derrick de Kerckhove, a tireless advocate of McLuhan’s global village, published *Connected Intelligence* in 1997 [8]. Aldous Huxley talked of “Mind at large” in *The Doors of Perception* (1954) [9], as did Gregory Bateson, in *Steps to an Ecology of Mind* (1972) [10]. In *The Phenomenon of Man* [11], Pierre Teilhard de Chardin proposed the emergence of the noosphere as analogous on a planetary level to the evolution of the cerebral cortex, an expanding field of consciousness. These ideas were important to me in for-

mulating ideas of the hypercortex, which was first introduced at *Art Futura* in Madrid (1991), and at FAUST in Toulouse the same year. Later, I defined it in the *Leonardo Electronic Almanac* [12] as “a post-biological neural nexus of collective cognition! Superthought is a community affair. Neural networks are merging with planetary networks in a new space of consciousness,” and I discussed it fully in Diana Domingues’s *A Arte no Século XXI* (1997) [13].

When I proposed a Cybernetic Art Matrix in *Behaviourist Art and the Cybernetic Vision* in 1964 [14] I saw in worldwide communication a necessary conduit for art as it became increasingly process-based, fluid and transformational. At the end of the 1970s, the National Endowment for the Arts in Washington, D.C., awarded funding, astonishingly, to stage the first international telematic art project, *Terminal Art*, linking artists on two continents. At the same time, Kit Galloway and Sherrie Rabinowitz created their historic *Hole in Space*, a real-time communication satellite hookup between people on the street in New York and in Los Angeles. The planetary implications were clear. *La Plissure du Texte: A Planetary Fairy Tale* was the title of the project I created for Frank Popper’s comprehensive exhibition *Electra* at the Musée d’art moderne in Paris 1983. In this work, artists at 14 nodes around the world took on the identity of fairy-tale personae, and across the networks created a non-linear narrative. The planetary perspective was also celebrated in *Planetary Network: Laboratory UBIQUA*, at the Venice Biennale in 1984, which I organized as an international commissioner along with Don Foresta, Tom Sherman and Robert Adrian. Later *Aspects of Gaia: Digital Pathways across the Whole Earth* (Linz, 1989), an extensive interactive installation on two levels, enabled expressions of planetary awareness by hundreds of on-line participants.

Enough of history, albeit important to show that planetary consciousness as an ideal, as a dream, has been with us for a long time. But now I believe we must work towards its real emergence as a matter of necessity. Networking supports and promotes intimacy and, as the technology of empathy, can provide the conditions for love and compassion. In this context, I find it interesting that my text of 1991, “Is There Love in the Telematic Embrace?” [15] is consulted quite widely both on American campuses and farther afield. In my view, to bring together telematic media with mixed-reality technology is an important next step, as much for the power-

ful metaphor it will present as for the content that users might generate through the contexts that artists will provide.

Planetary consciousness needs more than the expansive drive of telematic networks, however. A sensibility to cultures that lie outside the Western paradigm is essential, and here, despite the obvious reference to Islamic cultures (and I use the plural with grave emphasis), which we in the West clearly need to approach and understand more intimately, I refer to the “exotic” and largely ignored indigenous cultures of South America and Australia. Here is knowledge of a kind we too often ignore or despise with a kind of techno-aristocratic sneer (containing perhaps as much fear as hubris). And here too a Mixed Reality prevails, where “ordinary” perceptions, ordinary reality, ordinary states of being are crossed by, converge with, are entwined within non-ordinary states of awareness and non-local states of consciousness. As in the West, a technology is instrumental here in producing the condition of Mixed Reality; but it is plant technology rather than digital technology at work. And make no mistake, the technological skills, methodologies and instrumentality of the shaman—healer, mystic and man of knowledge (or woman of knowledge, as it is in Korea today and always was largely throughout the Northern Hemisphere)—constituting what we would classify as pharmacology, botany, biology and psychology, amount to a knowledge base certainly as extensive and complex as what is prized in Western science. As is the case with the advanced tools of the West, the shaman’s two realities mix on the plane of imagination, their convergence offering the potential of new ways of being, perceiving and behaving. My feeling is that we can learn from these cultures in ways that will bring mixed-reality technology into our lives as environment rather than merely a tool, however efficacious or profitable that tool might be in surgery, engineering, architecture or entertainment. Indeed we have much to learn from these cultures in the widest and deepest sense, not least in how we shall manage the condition of double consciousness, multiple identity and Mixed Reality. The tools are different of course—in one case taken from nature, in the other brought to our post-biological world, a condition in which technology has assimilated and, in some cases replaced, natural process.

Tuesday, September 11th, 2001: a day of the utmost horror and barbarism. While it is clear that life will never be the same again for any of us and may be far

shorter than we might have expected, we need as artists and as citizens to reflect carefully on the dynamics of the situation we are facing, and to seek wisdom in the guidance of our response and future actions. In the light of omnipresent terror, meaning can quickly escape from people’s lives. Our job as artists is not to provide meaning but to offer creative contexts in which new meaning can be built and from which new meaning might emerge.

My feeling is that the canon of digital art—our aesthetic values and aspirations—may offer a useful model to civil society as it is confronted with terrorism from within and without its boundaries. Ours is an art that is dialogical. I have alluded to the canon of Connectivity, Immersion, Interaction, Transformation and Emergence. Meaning is created out of interaction, and dialogue can transform attitudes and behaviors. It is as if media art must more clearly highlight its aesthetic uniqueness and must fully communicate its values more widely to the world. For these principles, wisely applied, could enable a more integrated and coherent world politic to emerge. Make no mistake. I am not arguing that art can effect these changes directly. Art of whatever complexion always works, and is allowed by society to work, on the symbolic level, through its construction of powerful models and metaphors. It can enable us to navigate new reaches of consciousness. In interaction with the viewer, the artist enables new meaning and new experience to emerge, creating paradigms of perception or construction that may then affect events or aspirations in the social, political or industrial world. But the relationship is indirect. It is this indirectness that protects artists and permits our dreams and visions to have currency and survive.

Mixed Reality will constitute the hub around which I would like to frame this discussion of a technoetic awareness and my description of the steps that might be taken, in the frame of art and research, to cultivate the hypercortex, enabling a planetary consciousness, a species consciousness, to fruitfully emerge.

The emergence of mixed-reality technology marks a further step in our quest to control our own evolution, to redefine what it is to be human and to become actively responsible for the construction of our own realities. It is this quest that distinguishes us from past generations imprisoned in superstition or in thrall to scientific determinism.

Mixed Reality, whose technology affords the integration of events in actual and virtual space, parallels the conver-

gence in the material world of nano-engineering and living systems. It provides a metaphor for the convergence of cultures, which we do desperately need. We need to be able to live in mixed realities, mixed ethnicities, mixed cultures, with the ability seamlessly to shift focus, while comprehensively grasping the planetary whole. In its strictly technological form, Mixed Reality is in many ways a rehearsal for the truly enormous changes that lie ahead as the dry digital technologies converge with the biologically wet, producing what I call moistmedia.

Moistmedia arises from the convergence of bits, atoms, neurons and genes: the “Big B.A.N.G.” of our post-biological universe. As examples, think of Osaka’s micro-bull, the product of nano-photon technology (just 10 micrometers long and 7 micrometers high—about the size of a red blood cell) [16]; Roslin Institute’s lamb called Dolly [17]; Kac’s Alba the GFP Bunny [18]; ATR and Genobyte’s Cellular Automata Machine CAM-Brain project [19]; or Steve Grand’s robot baby orangutan, Lucy [20]. Relevant here too is the work of Oron Catts and Ionat Zurr of the Tissue Culture in Art Project in Perth, Australia [21]. These are the harbingers of the re-materialization of a culture that earlier we thought would be totally immaterial and virtual. It is a matter of “bye-bye Baudrillard.”

The aesthetic, as well as pragmatic, value of mixed-reality technology should not, however, disguise the fact that what is commonly regarded as “unmediated” or “directly apprehended” reality is as much a construction as the virtual reality with which it becomes technologically fused.

If we see the tools of mixed-reality technology as an extension of our own organic systems of perception and cognition (together constituting an emergent faculty of cyberception) we can more readily understand the whole flow of events in this domain as primarily technoetic.

Overall, we can foresee the development of a quite radical Mixed Reality that will be made up of three essential parts, which can be called the Three VRs:

- *validated reality*, involving reactive, mechanical technology in a prosaic, Newtonian world
- *virtual reality*, involving interactive, digital technology in a telematic, immersive world
- *vegetal reality*, involving psychoactive plant technology in an entheogenic [22], spiritual world.

Vegetal Reality?! The question will be asked: What meaningful relationship can

there possibly be between spiritual practices in the rain forest and the materialism of Silicon Valley or the labs of molecular biology? The link may lie in the area of DNA research. Jeremy Narby, in his book *Cosmic Serpent: DNA and the Origins of Knowledge* [23], suggests that the shaman’s visions come from the shaman’s communication with his/her own DNA. We have to remember that we do not know why most of our DNA is there. A mere 3% accounts for the whole diversity of life. Narby thinks the shaman’s information comes from the mysterious junk DNA, the 97% we cannot account for. DNA in one cell exchanges signals with the DNA in other cells. Narby suggests that once someone taps into his/her own DNA, it can then communicate across organisms, across species—even across the boundary between animal and plant—and that the totality of all the DNA in the world forms a kind of matrix. This is another way of approaching planetary consciousness. This transmission of signals between DNA in separate cells is effected by the emission of photons; the signals are in the form of light, and at a wavelength visible to humans.

Narby’s working hypothesis is that shamans can take their consciousness down to the molecular level and gain access to information related to DNA, which in their terms are “animate essences” or “spirits.” He writes:

Here they see double helixes, twisted ladders, and chromosome shapes. In this way shamanic cultures have known for millennia that the vital principle is the same for all living beings and is shaped like two entwined serpents (or a vine, a rope, a ladder . . .). DNA is the source of their botanical and medicinal knowledge, which can be attained only in defocalized and “nonrational” states of consciousness, though its results are empirically verifiable. The myths of these cultures are filled with biological imagery. And the shamans’ metaphoric explanations correspond quite precisely to the descriptions that biologists are starting to provide [24].

Before we dismiss critically these ideas as “merely metaphorical,” i.e. not real genetic or biological science, we should perhaps remember that the war of interpretation in quantum physics was won with metaphor by Neils Bohr and his Copenhagen School, as Mara Beller of the Hebrew University of Jerusalem has shown in her recent book *Quantum Dialogue: The Making of a Revolution* [25]. Just as she argues for dialogical discourse rather than paradigmatic dogma within science, so I think we should attempt to

build a dialogical discourse between Western science and other bodies of knowledge.

It could well be, then, that DNA’s highly coherent photon emission accounts for the luminescence of the shaman’s hallucinatory images, as well as their 3D, or holographic, aspect. On the basis of this connection, Narby conceived of a neurological mechanism for his hypothesis. The molecules of nicotine, or di-methyl-tryptamine, contained in ayahuasca, the psychoactive brew of choice of most South American healers, activate their respective receptors, which set off a cascade of electrochemical reactions inside the neurons, leading to the stimulation of DNA and, more particularly, to its emission of visible waves, which shamans perceive as “hallucinations.” There, he concluded, is the source of knowledge: DNA, living in water and emitting photons, like an aquatic dragon spitting fire.

I think it is worth reciting this account of Narby’s work because it amplifies the intuition that there is much to be gained in both biological sciences and the arts from research that seeks correspondences and collaborations between the two technologies of machines and plants, within the natrificial (natural/artificial) space of the Three VRs, virtual, validated and vegetal. Indeed it can be argued that the whole ecological movement could gain if a constructive dialogue with technology would be instituted with the intent to observe the deep correspondences between Western science and archaic knowledge. The problem is not with science but with society’s rejection of science at its leading edge in favor of the old scientific paradigm, that very paradigm that refuses the spiritual implications of quantum physics, for example, or the very intelligence of plants, so to speak, that molecular biology might reveal.

In this talk I have tried to indicate some of the many issues that call for research and reflection, innovative practice and theoretical elucidation if new media art is to mature and take its place in the world. If potent images, environments, systems and structures are to be constructed that can challenge the constraining orthodoxies of thought and behavior, now increasingly supported by violence, whether overtly fundamentalist or covertly repressive of our liberties, and not only from without but increasingly from within civil society, new conditions for creative practice, transdisciplinary research, critical interaction and collaborative effort must be established and

maintained. The orthodoxy of universities and art academies more or less inhibits, if it does not expressly outlaw, this very transdisciplinarity. New instruments and organisms of learning and production are quite urgently needed.

POSTSCRIPT

Three points call for an update.

1. Since October 2001, when this text was written, the shock, fear, horror, and anger of events surrounding the Twin Towers have migrated to Iraq, where reciprocal violence has proved ineffective and burned bridges seem irreparable, metaphorically as much as practically. While much media space is given to global warming, global healing is clearly not on the political agenda, and so planetary consciousness could seem temporarily to be halted in its evolution. However, away from state and military aggression, civic will appears increasingly to seek understanding of cause and effect, to attain more connectivity between peoples and to effect more interaction in the planetary domain. The pursuit of the spiritual and of an understanding of consciousness is perhaps more widespread in the West than at any time since the Enlightenment.

2. Following up on Jeremy Narby's speculative comments, it can be seen that research in DNA-emitted biophotonic activity as a defining feature of living organisms [26], indeed as constituting an information network of light that might participate in a planetary matrix of information between all living phenomena, has accelerated in recent years. The research has been led largely by Fritz Albert Popp, who first used the term "biophotons" in 1976 [27] to describe a permanent light emission from all biological systems in terms of single photons, indicating a biological quantum phenomenon. Quantum coherence is seen as the basis of living organization. I visited Popp's laboratory at the International Institute of Biophysics in Neuss, Germany, in August 2003 to participate in a biophotonic workshop and conference. Building on the ideas of the Russian biologist Alexander Gurwitsch, who introduced the concept of the "morphogenetic field" and "mitogenetic radiation," Popp argues that every change in the biological or physiological state of the living system is reflected by a corresponding change of biophoton emission. This may be indicative, he argues, of a hitherto-overlooked information channel within the living system [28].

Biophoton research is hardly recognized in mainstream science, but a very reasoned case for its acceptance has been argued by R. Van Wijk of the Department of Molecular Cell Biology in the University of Utrecht [29]. From the artist's point of view, the parallelism between the body's internal information network of light and the external environment of telematic communication, and the implication of connecting the natural and artificial networks in a moist confluence of information, within a holistic planetary field, offers considerable room for conceptual creativity.

3. In respect of the "new instruments and organisms of learning and production [that] are quite urgently needed," the research platform CAiiA-STAR, with which I am identified, has since 2003 regrouped as the Planetary Collegium, now based in the University of Plymouth, continuing its advanced inquiry in the transdisciplinary space between the arts, technology and the sciences, with consciousness research an integral component of the work [30]. It sees its influence extending to new forms of creativity and learning in a variety of cultural settings. Far from eschewing the study of esoteric or spiritual disciplines, it seeks to relate ancient, exotic, even archaic knowledge and practices to radically new ideas emerging at the forward edge of scientific research and speculation and thereby to new forms of art and cultural expression.

The Collegium seeks to produce new knowledge for the new millennium; new language, new systems, new structures, new behaviors and new insights into the nature of mind, matter and human identity. It takes a constructive and pro-active approach to the social, technological and spiritual aspirations of the emerging planetary society, while sustaining a critical awareness of the retrograde forces and fields that inhibit social harmony and cultural transformation. While stretching to the full the constructive and expressive potential of electronic, telematic and interactive digital media, the Collegium intends to pursue developments in post-biological research, molecular engineering, neuroscience, and nanotechnology, while identifying artistic and spiritual strategies that optimize human capabilities and seed new visions of a planetary society. In pursuit of its planetary networking, the Collegium, since its inception as the Centre for Advanced Inquiry in the Interactive Arts at the University of Wales College, Newport, in 1994, has met in over 10 countries and

given some 20 public conferences and symposia, including the series of annual Consciousness Reframed conferences [31].

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27. F.A. Popp, *Biophotonen—Ein neuer Weg zur Lösung des Krebsproblems* (Heidelberg, Germany: Verlag für Medizin, 1976).

28. F.A. Popp and L.V. Belousov, eds., *Integrative Biophysics* (Dordrecht, the Netherlands: Kluwer Academic, 2003).

29. R. Van Wijk, "Biophotons and Bio-Communication," *Journal of Scientific Exploration* 15, No. 2, 183–197 (2001).

30. See <www.planetary-collegium.net>.

31. The conferences have been held at Artspace Media Centre, Dublin, Ireland (1997); La Beneficia

Cultural Centre, Valencia, Spain (1998); CYPRES, Marseilles, France (1999); Federal University, Rio de Janeiro, Brazil (1999); University of Arizona, Tucson (2000); Ecole National Supérieure des Beaux-Arts, Paris (2000); Fondazione Fitzcaraldo, Turin, Italy (2001); Universitat Oberta de Catalunya, Barcelona (2001); DARNet, University of California, Santa Cruz and Los Angeles (2001); University of Arizona, Tucson (2002); Curtin University, Perth, Australia (2002); IAMAS, Ogaki, Japan (2002); the Hochschule fuer Gestaltung und Kunst, Zurich,

Switzerland (2003); and Image Technology Center, Universidade Federal do Rio de Janeiro, Fortaleza, Brazil (2003). CAiiA-STAR co-sponsored Invenção in Sao Paulo, Brazil (1999), in collaboration with the ITAU Cultural Centre, the International Society for Electronic Arts (ISEA), and the journal *Leonardo*. Future conferences will be hosted by Ciber@RT, Bilbao, Spain (2004) and the China Center for Electronic Music, Central Conservatory of Music, Beijing (2004).

CALL FOR PAPERS

Leonardo Electronic Almanac

The Leonardo Electronic Almanac is issuing an open call for papers. The LEA Editorial Board seeks proposals for the following:

Theoretical Discussions: original essays documenting research and critical commentary in areas of discussion such as nanotechnology, cyberart, cyberfeminism, hypertext, robotics, bio-art, artificial life and genetics. This list is by no means exhaustive, and proposals need not be limited to these areas.

Artists' Statements and Gallery Commissions: international artists are encouraged to submit statements or proposals for exhibiting new media artwork. Curators are welcome to propose thematic exhibitions.

LEA encourages international artists, academics, researchers and students to submit proposals for consideration. We particularly encourage authors outside North America and Europe to send proposals for articles.

Proposals should include:

- a 150–300 word abstract or synopsis detailing subject matter
- a brief bio (and list of prior works for reference)
- names of collaborators (if suggesting a thematic issue or curated gallery)
- any related URLs
- contact details.

Please send proposals or queries to:

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