If the purpose of a keynote lecture is metaphorically to open a doorway to the future, be it on to the new province of the museum, the education of a broader public, the emergence of new art practice or indeed the transformation of a whole cultural domain, the metaphor could not be more apt than when it is applied to the field of interactive art. In the course of this paper I hope to show how art has moved from its preoccupation with being a window on to the world towards becoming a doorway into another reality, an opening through which the viewer can pass to engage in a new kind of relationship with the artist in the creative process. This new kind of relationship involves interactivity and transformation: interactivity between people and computational systems, and the consequent transformation of images, structures and ideas within those systems and within the viewer’s consciousness.

I describe the approach to interactivity in art as constituting a five-fold path of connectivity, immersion, interaction, transformation, and emergence. It involves the creation of new worlds, in whose construction the viewer can become actively involved. It is the world of cyberspace, telematic networks, of telepresence, virtual reality and the technology of artificial life. It is life at the edge of the Net, in a space of connectivity that has no centre. At the edge of the Net we are in a particularly unresolved, ambiguous zone, partly virtual, partly material. It is the interspace between these two conditions that engages the imagination of many artists today, and particularly exercises architects and engineers faced with accommodating the Internet society within a post-biological environment. And it is with the coming together of the silicon dry world of interactive media with the wet biology of living systems, that the emergence of a new substrate and vehicle for art can be detected, which I identify as ‘moistmedia’, and which may lead to the evolution of a moist art. Moistmedia involves bits, atoms, neurons and genes (the big B.A.N.G.) co-existing in new configurations of form and meaning.

I would be trespassing far from my area of expertise if I tried to argue philosophically for these ideas, but I think it appropriate at the start of my presentation to recognize the relevance to cyberculture of radical constructivism in formulating the aesthetic of interactive art. The thrust of the movement’s ideas was expressed by the cyberneticist and bio-mathematician Heinz von Foerster in his classic 1973 lecture ‘On Constructing a Reality’, which showed how the environment, as we perceive it, is our invention, describing the neuro-physiological mechanisms of these perceptions and the ethical and aesthetic implications of these constructs. Artists working now in cyberspace and eventually with moistmedia contribute to this perspective by creating worlds in whose construction and definition the viewer can be actively involved, and in which perception can be restructured and amplified. The point I wish to make also, in this context, is that many artists in the field I am discussing value the philosophical aspect of their work, and
its appeal to the mind, rather more than its visual or aesthetic qualities alone.

The roots of interactive art date back to at least 1957, when Marcel Duchamp, in a University of Texas lecture, described the artist as medium, and talked about the viewer interacting with the artwork to bring about meaning. The 1960s saw innumerable events, happenings and actions involving some degree of interaction, described, for example, in Frank Popper’s *Art: Action and Participation* or Lucy Lippard’s *Six Years: The Dematerialization of the Art Object*. The interest in art and technology, cybernetics and systems theory of the time led to experiments with computers and communications, and eventually to digital and telematic art. The term ‘interactive art’ was coined, or at least given public currency, in 1989, the year in which the journal *Kunstforum* and the Festival Ars Electronica introduced it definitively into the canon of Western art.

For my part, I proposed a cybernetic art matrix in 1964 in ‘Behaviourist Art and the Cybernetic Vision’, which 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 funded me to stage the first international telematic art project, *Terminal Art*, linking artists in two continents. At the same time Kit Galloway and Sherrie Rabinowitz created their historic *Hole in Space*, a real-time communication satellite hook-up between people on the street in New York and in LA. *La Plissure du Texte: A Planetary Fairy Tale* was the title of a project involving dispersed authorship that I created for Frank Popper’s *Electra* at the Musée d’Art Moderne de la Ville de Paris in 1983. Here 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 celebrated in *Planetary Network: Laboratory Ubiqua*, which I organized as an international commissioner for the 1986 Venice Biennale, along with Don Foresta and Tom Sherman. I put a more mixed reality technology at work in *Aspects of Gaia: Digital Pathways across the Whole Earth* for the 1989 festival of Ars Electronica.

In one sense we recognize that all art is interactive now, whether the work consists in the static field of a painting or a dynamic system in cyberspace. In every case artistic experience and meaning are the product of a negotiation between the viewer and the viewed, rather than the one-way transmission of content. In the case of computer-mediated interactive art some would argue that silicon-based, computer-mediated interactivity has reached its peak, if not actual maturity. Others talk of its decline, arguing that the impact on art practice of technology, especially digital and communications technology, has been to reduce art in many cases to a form of craft in which polished technique or skilful programming, leading to dazzling special effects, have come to replace the creation of meaning and values. A resonance with the nineteenth-century Arts and Crafts movement of William Morris is invoked. There was then the same process of dumbing down from art to craft, in which the authoring of technique took primacy over the authoring of ideas, with a pandering to a luxury market, partially obscured by a veneer of social conscience. That view is refuted in my experience by a great deal of the conceptually based, open-ended and evolutional work I see in juries of the annual Ars Electronica Festival, the Interactive Media Festival in Los Angeles and the Intercommunication Centre Biennale in Tokyo. Here interactivity stretches far beyond the screen to complex intelligent environments and robotic structures. It is refuted by collaborations of artists in the Net, which will also, I suspect, lead to further artistic
development as wireless applications bring the telematic interface into the very clothes that we wear, into our bodies, and eventually to the chip in the brain, which only a few decades ago was considered to be pure science fiction.

But we should not forget the initial shock of interactivity. The liberation and elation felt by the viewer’s ability to influence, if not totally to control, the evolution of a work of art, a narrative fiction, a line of thought, through the magic of interactive media, online and off, in cyberspace and bionic space, with all the accoutrements of hyperlinks and cybernetic loops, simply at the touch of a button or a wave of the hand. But the shock is wearing off. There is interactivity on every desktop now, and soon it will come, if not to your own kitchen and living-room, then to a home near you. Interactivity has turned the corner and is becoming a part of your life, your house, your entertainment centre, your car and, not least, your job. Computing is ubiquitous, and intelligence is seeping out of the human brain into every man-made object, tool and environment. But for the fact that the Net is all edge (as I have said, there is no centre), we could anticipate art effectively being driven out of cyberspace by the colonizing thrust of an aggressive e-commerce. Instead many artists are being absorbed within web-based corporations and much artistic creativity is being expended on the capitalist machine. This should not surprise us since internet start-up companies, particularly in Silicon Valley, seem to be becoming the primary vehicle for creative imagination, if not for artistic thought. Though of course, as in art, historically, relatively few start-ups survive.

Attention is now turning towards nano-technology and the convergence of digital media and molecular technology, which I call ‘moistmedia’ (dry silicon with wet molecules, or pixels and particles). While the desire to enter these realms is quite strong in many artists, access to the necessary laboratories is difficult and funding virtually non-existent. It was the same 30 years ago, when artists could see the potential of digital media but could not get their hands on the machines; slowly they infiltrated into computer laboratories and into corporate systems. Much of our work at that time was due to the subvention of the commercial network I.P.Sharp in Toronto and the support of Jacques Vallee’s Infomedia Corporation in San Bruno, CA. Similarly now, those artists who see the potential for their art in moistmedia must cross the difficult barrier of gaining access to laboratories and biotechnology research centres. One exponent of moistmedia is Eduardo Kac, whose genetically engineered fluorescent rabbit Alba has captured many headlines worldwide. Tissue culture art researches the use of tissue culture and tissue engineering as a medium of artistic construction. Tissue engineering can be seen as the way to produce bio-artificial organs for the body, and, if applied to the production of semi-living objects (a combination of living tissue and artificial support) can be used to create living sculpture. In 1999 Kac produced *Genesis*, a transgenic artwork whose key element is an ‘artist’s gene’, i.e., a synthetic gene that does not exist in nature, invented by the artist. The *Genesis* gene was incorporated into bacteria, which were shown in the gallery. Participants on the Web could turn on an ultraviolet light in the gallery, causing real biological mutations in the bacteria. This work, although less dramatic than the creation of his living fluorescent rabbit, heralds the new interest in molecular process that in my mind will increasingly preoccupy artists over the coming years.

Not only does interactive art use new technologies, but it must also use a new language. It is a matter of the hybridization of everyday language in order to try to reach an understanding of the hybridization of art. For not only does the art vocabulary of Clement Greenberg have little relevance to the art of today, but that of contemporary pundits such
as Hal Foster or Rosalind Kraus is also increasingly marginalized. This is because science has entered the discourse of art, almost to the point of colonization. By ‘science’ I mean the models and metaphors of science made available to the lay reader by such exponents as Francesco Varela, Christopher Langton, David Chalmers or Roger Penrose today, as well as Werner Heisenberg, D’Arcy Wentworth Thompson or Norbert Wiener in an earlier era. Contemporary artists are much more likely to invoke contemporary thinking about consciousness, quantum physics, biotechnology and genetic engineering than they are to refer to formal aesthetics or art theory as such. And this is not confined to the digital arts community. Painters and sculptors are just as likely to find useful models in the discoveries and speculations of new science. Indeed it is the nature of reality rather than the reality of nature that causes the shift in the focus of art, whether analogue or digital, from a concern with representation or expression of (given) reality towards the construction of new worlds and parallel realities.

To exemplify the range of practices involved in interactive art, I can do no more than point in the direction of those who in my estimation are creating generic strands in this emergent field and whose work is most intimately known to me by virtue of their presence in my research group CAiiA-STAR: Victoria Vesna, Jill Scott, Eduardo Kac, Char Davies, Bill Seaman, Miroslaw Rogala, Thekla Schiphorst, Joseph Nechvatal, Donna Cox, Gretchen Schiller.

It is through the new language that interactive art produces that we can begin to evaluate it. This language will include a range of semiotic structures, signs, texts, forms of behaviour. For the artist simply to reiterate and maintain established language uncritically is to renounce the idea that we can rethink ourselves and our world, and to accede to the notion that in matters of reality our minds are made up for us. As Richard Rorty says in Contingency, Irony and Solidarity: ‘To create one’s mind is to create one’s own language, rather than to let the length of one’s mind be set by language other human beings have left behind.’ Rorty is a pragmatist who sees that artistic vision and fecundity of metaphor are central to the creation of reality, by denying the passive acceptance of canonical descriptions of the world. It is the artist’s role to exhume those dead metaphors which we have internalized, and whose ghosts may have ascended to the illusory realm of truth, and finally lay them to rest. The sanctity of representation in Western art was assured by its fidelity to a consensus reality, a consensus institutionally retained and reinforced over centuries. Rorty points out that it was Nietzsche who first explicitly suggested we drop the whole idea of ‘knowing the truth’. His definition of truth as a mobile army of metaphors amounted to saying 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.

In the Postmodern context the interactive artist is ready to call on any system, organic or technological, that empowers the construction of reality. He/she is 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 which engender creativity. There is no metalanguage or metasystem that places one discipline above all others. This liberated trans-disciplinarity informs artistic research at all levels. It calls for a general disposition of openness and optimism towards knowledge and towards the world at large, the condition in telematic culture which I describe as ‘telenoia’ – the celebration of connectivity and open-ended collaboration – to replace the paranoia, the
anxiety, the alienation, the compartmentalization of knowledge, and the social segregation and loneliness of the old industrial age.

One of the grand metaphors so long in use that it has effectively acquired the status of truth is that of ‘Nature’. Time prohibits a proper examination of the term, which is more fully explored in my text ‘Back to Nature II’, first published as. ‘Zurück zur (künstlichen) Natur’, in *Kultur und Technik im 21.Jahrhundert* in 1993. My thesis is that Nature, which can be shown to be our dialectical invention in any case, is no longer relevant to our evolution. Honoured since the late Middle Ages by artists who invested enormous imaginative skill in its depiction, the metaphor has reached the end of its shelf-life and is no longer useful in the post-biological culture that we are creating. The velocity of technological change makes Nature far too slow, and epigenetic human development much more attractive, a perspective that informs a number of contemporary artists, most visibly perhaps Stelarc, whose work with the prosthesis of body parts and telepresence in the Net is exemplary. This may be why artists using new media are more interested in the constructive process than in purely expressive activity. They wish to build realities rather than reflect ‘given’ or authorized reality. In this respect they are perhaps not far from the shaman who uses an entirely different but equally efficacious technology, that of the plant. As Western artists themselves become more interested in entheogens, we may see an interesting juxtaposition arise of what I refer to as the three VRs:

- **Validated Reality**, which uses reactive mechanical technology, and is prosaic and Newtonian
- **Virtual Reality**, which uses interactive digital technology, and is telematic and immersive
- **Vegetal Reality**, which uses psychoactive plant technology and is entheogenic and spiritual.

Ideas of telerobotics, telepresence, of being both here and there at the same time, the self multiplied and dispersed – a kind of creative schizophrenia – are fundamental to life in the Net. The further extension of this phenomenological development lies in the realm of quantum teleportation. On 11 December 1997 it was reported in *Nature* that quantum teleportation has been demonstrated in laboratories at Innsbruck, Rome and Cal Tech. According to Furusawa, reported in the journal *Science* in October 1998, ‘The quantum state of one entity could be teletransported to another entity’.

Many of these ideas, variously developed by artists and technologists alike, prioritize the mind and consciousness as the focus of study, while seeing a new kind of materialism and embodiment in the world. I referred earlier to moistmedia, the convergence of the wired and the wet, the telematic and biological. There are two aspects of this convergence that I would like to examine here. One involves issues governing the relationship of consciousness to technology which I shall refer to as ‘technoetics’ (‘noetic’ from the Greek *nous* meaning mind or intellect); the other concerns the implications of molecular, cellular, structural and computational biology and nano-engineering for art. As art becomes more and more invested in moistmedia, the issue of sentience and consciousness will increasingly come to the fore.

To many it may seem rather perverse to suggest that technology, particularly computer technology, has brought consciousness into particular focus in art today. It may be
difficult to see how technology, apparently cold and alienating, could do anything to advance the subtlety of feeling and vision that art has always demanded. Historians, however, will know that technology, whether in the form of engineering, chemistry, optics or pharmacology, has always mediated the vision and aspirations of artists in all parts of the world and at all times. And observers of contemporary culture will confirm that, despite the seeming paradox, artists today are finding in digital technology and telematic media new ways to make consciousness both the subject and object of their work. Their use of interactive media enables the viewer to participate in a shared space of consciousness and actively to participate in the construction and transformation of artistic meaning. The work of Char Davis uses immersive VR to enable the user to traverse new fields of experience leading to a sense of disembodied consciousness. The interface is of particular interest here, involving, as it does, the viewer breathing in and out to gain a sense of ascent/descent in the virtual environment. Ulrike Gabriel of Frankfurt employs consciousness in quite another way. In Terrain robots randomly moving about an arena are energized by light generated when the mind of the observer is calm (or when two users cooperate to create a calm field of consciousness between them). As the robots become more energized and more animated, the mind of the observer also becomes agitated, thereby restricting the flow of energy to the robot, whereupon further control of consciousness has to be exercised to bring the robots back to life.

The provenance of technoetics in art is not hard to find. Throughout the course of this century there has been a tradition in art of valuing concepts in their own right, even to the exclusion of direct visual reference to the external world at its surface level of appearance. Duchamp’s work The Bride Stripped Bare by Her Bachelors, Even is the icon of the whole movement, bringing together in a set of wholly unfamiliar and densely layered metaphors the marriage of metaphysics and the mechanical world. To make the invisible visible is a familiar ambition of artists, an ambition by no means restricted to conceptual art alone. Artists as different as the coolly cerebral Mondrian, the buoyantly dynamic Boccioni and the esoteric Kandinsky sought to express the spiritual in art, or ‘the invisible which moves and lives beneath the gross forms’, as Boccioni put it. In quite different ways artists such as these created works attempting to transcend their materiality and the materialist view of human nature, to express or evoke other planes of experience and awareness. At the same time there is a strand of art practice, emanating from Russia, that eschews representation and self-expression entirely in favour of construction, a strand that winds its way right through the twentieth century. These conceptual and constructive tendencies exert a huge influence on the strategies of artists in the field of interactive art. A third element in the lineage of attitudes and approaches that have led to the technoetic aesthetic is art dealing with identity. The existential and ontological dimensions of twentieth-century art are perhaps too well known for me to detail them here. The expression of self, the identity of self, the presence of self are issues that differentiate twentieth-century art perhaps more than anything else from the art of previous eras. This triad of concerns, concept, construction and consciousness, underwritten by technological innovations in our perception of invisible forces and fields, prepared the ground for the technoetic aesthetic. This perception, developed further by advanced technology, becomes in our era what I call ‘cyberception’ – a bionic faculty in the human repertoire, involving an amplification of conceptual and perceptual processes, in which also the connectivity of telematic networks plays a formative role.
Artists whose practice is invested in networked hypermedia and virtual reality, in their interactions with artificial agents and avatars, know that personal identity can be endlessly transformed. We see the immutability and unity of the self, so dearly prized in the European tradition, giving way to an understanding of how we each can be involved in our own self-creation. In cyberspace the self is open to tele-differentiation, distribution and planetary dissemination. In consequence a kind of non-linear identity is emerging. The telematic adventure in art, currently played out in the Net but swiftly migrating to the ‘smart’ environments and mechatronic structures of ubiquitous computing, has brought questions of distributed mind and shared consciousness to the definition of a new aesthetic. Within this, the question of double consciousness may have some importance. Double consciousness refers to the state of being that gives access to two distinctly different fields of experience, or to two quite separate locations, with two distinctly different identities, at one and the same time. This also describes the shaman in trance, who is both in the everyday world and at the same time navigating the outermost limits of other worlds. Shape-shifting, changes of identity, out-of-body experiences, are all part of the tradition. In post-biological terms, this double consciousness is found in our computer-aided ability, employing ‘mixed-reality technology’ to move effortlessly through the dimensions of cyberspace while at the same time accommodating ourselves within the structures of the material world. Confronted by an array of technological devices that offer us a pathway into virtual worlds, we are invited on the plane of prosthetics to enact the shaman’s journey. Immersion in such noetic simulation may induce real changes of consciousness and eventually real transformations of self.

Historically, we have had little option but to keep the worlds of our double consciousness in separate and distinct categories, such as the real, the imagined, and the spiritual. The advent of the artificial life sciences, in which I include both dry (pixel) and moist (molecular) artificial organisms, and the whole prospectus of nano-technology (still largely theoretical), points to the possibility of eroding the boundaries between states of mind, between conception and construction, between the internalization and the realization of our desires, dreams and needs of our everyday existence. Let me give an example, which can be found in our cyberception of matter at the atomic level. Scanning tunnelling microscopy (STM) enables us not only to view matter at this level but also to image individual, single atoms. However, the real significance of this process does not end there. Not only can we select and focus on individual atoms, but we can also, at the same time, manipulate them one by one, atom by atom, to construct from the bottom up atomic structures of our own choosing. Nano-technology could eventually allow the creation of self-replicating mechanical devices that build products on the nanometric scale (billionth of a metre), or atom by atom, molecule by molecule. Lined up end to end, hundreds of thousands of nano-machines would fit across the width of a 50p coin.

Artificial life technology (Alife) is concerned with investigating ways in which living systems can be generated and evolve, such that not only biological systems but also any series of complex non-linear self-organizing interactions may ultimately arise. It is an ambition mirrored in the artist’s fascination with complexity, with algorithmic process, and bottom-up design. The best definition of Alife may be that provided by Chris Langton, who was responsible for naming the field, and for convening the first Alife
workshop at Santa Fe in 1987: ‘Natural life emerges out of the organized interaction of a great number of non-living molecules, with no global controller responsible for the behaviour of every part. Rather, every part is a behaver itself, and life is the behaviour that emerges from all of the local interactions among individual behavers. It is this bottom-up, distributed, local determination of behaviour that Artificial Life employs in its primary methodological approach to the generation of lifelike behaviours.’

The application to art of the principles Alife and molecular biology, and of nanotechnology as it develops, will lead to a re-materialization of art. The ascendency of the immaterial in art in the last quarter of the twentieth century, theorized by Jean-François Lyotard, and Jean Baudrillard, is perhaps coming to an end, a case hopefully of ‘Bye, bye Baudrillard!’ The importance of telematic networks, however, will certainly not decline; rather, we shall see the progressive embodiment of moistmedia within the Net. The technoetic principle will remain paramount.

This paper’s brief navigation of the emergent world of interactive art is nearly at an end. However, I cannot finish without at least touching briefly on the ways in which architecture is responding to the post-biological condition, if only because it will have an impact – eventually, I think, a considerable impact – on the design and construction of the museum. I shall pass over its achievements with smart buildings, which, along with smart products, present ideas that are popularly quite familiar. The Institut du Monde Arabe in Paris is a particularly charming example of the genre, with iris windows that respond to the density of sunlight falling on its façade. At the edge of the Net and the boundaries of the material world much research is underway in defining, as well as designing, the interspace between the virtual and built environment. Among those architects engaged in this area, are Peter Anders and Marcos Novak. One outstanding work in this area is fresh20 eXPO, a water pavilion and interactive installation for the Ministry of Transport in the Netherlands. Its creators, NOX, aim to create subtle forms that nestle between biological life and the metallic and electronic fauna of technology. These architects have much to tell designers of the future museum.

The change in the focus of architecture is not registered at the level of form so much as at the level of behaviour. To give just one simple example, our exaggerated interest in what a building looks like, its mere appearance, will give way by contrast to the concern with how a building sees us and its world, the quality of its gaze. Instead of the emotions that places and objects exert on us, we might consider how we could affect them; how products and structures might respond emotionally to their social environment. Questions of the form and structure of buildings will be overshadowed by ambitions for their dynamism and intelligence, their ability to interact with each other and with us, to communicate, learn and evolve, essentially to anticipate our needs. Engineering will embrace ontology!

The convergence of an architecture based on molecular technology and nano-engineering, allied to artificial consciousness and the networking of the human hypercortex, can bring us to an architecture that has a life of its own, that thinks for itself, that feeds itself, takes care of itself, repairs itself, plans its future, copes with adversity. It will be an architecture that is as much emotional as instrumental, as intuitive as it is ordered. We shall want to get inside the mind of such architecture and an architecture that can get into our own mind. The building of sentience is the challenge to architecture in the twenty-first century.
By way of conclusion I would like rather briefly to summarize the cultural shift that is
under way in interactive art by contrasting current cultural attitudes and practice with
those of the previous era.

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Taking 1989 as the year of its birth, or at least of its naming, we should note that
interactive art has hardly reached puberty. It is certainly becoming self-conscious and
demanding its place in the adult museum world. However, in seeking the legitimacy of its
place, I believe it will eventually transform that world, and open doorways into aesthetic
and artistic domains that we can hardly imagine at this time.

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Roy Ascott
Roy Ascott is internationally recognised as a pioneer of interactive art, having first introduced cybernetics into his work in 1963, and telematic networking as his medium in 1979. He has exhibited at the Venice Biennale, Museum of Modern Art Paris, Ars Electronica Linz, V2 Holland, Milan Triennale, Biennale do Mercosul, Brazil, European Media Festival, and gr2000az at Graz, Austria. He is the founding editor of the journal Technoetic Arts, and is on the editorial boards of Leonardo, LEA, Convergence, Digital Creativity, and the Chinese language online journal Tom.Com. He has advised new media centres and festivals in North and South America, the UK, Europe, Japan, Korea, and lectures widely around the world. He was a member of the design team for the Ars Electronic Center in Linz, and is on the Board of the new Media Art Center NABI in Seoul, currently under construction. In 1984 he was International Commissioner of Art and Technology for the Venice Biennale. Author of many papers, translated into many languages, his books include Art Technology Consciousness (2000), Reframing Consciousness: (1999) Intellect Books UK; Art & Telematics: toward the Construction of

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