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EDITORIAL
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TECHNOLOGY AND DIFFERENCE

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This issue of LEA has come about as a result of my ongoing interest and work in the area of technology and sexual/cultural differences. While considering this particular focus of interest, I realized that the general question of the fundamental relationship between technology and difference has been rarely considered in the field of new media art, cyberculture, science, technology and society studies, and other convergent areas where "modern technologies" are critically engaged. As such, this issue comes from a conviction that any specific study of difference in relation to technology has to be seen within a larger framework that is sensitive to the historic relationship between these two concepts. Moreover, there is an urgent need to systematically and critically think through "technology and difference" together, as a pair.

Whether one frames it as technology and difference or (though not the same, surely) difference and technology, it remains a complex, albeit understudied, connection. While both parts of this expression have been explored in Western literature - philosophical, anthropological, historic, literary, cybernetic, biological and so on - they have rarely been explored together, with a few notable exceptions. Leaving the question of "why" to the historians of ideas, this editorial addresses two main questions: first, what, fundamentally, do the concepts of technology and difference reveal and what role have they played in Western thought and beyond; and second, what is the relationship of art to our understanding of technology and difference. Any analysis that we undertake here would be necessarily limited, not only by the lack of space, but also by (desirable) acknowledgment of the specificity of the language in which it is written and thought through, with all its obvious or unintended consequences. One should also see the following points exactly as questions, openings for a future discussion, rather than theses or theoretical imperatives of the topic at hand.

What is technology? According to Stiegler, technology has come to be "the discourse describing and explaining the evolution of specialized procedures and techniques, arts and trades - either the discourse of certain types of procedures and techniques, or that of the totality of techniques inasmuch as they form a system: technology is in this case the discourse of the evolution of that system" [1]. By its very definition in Western tradition, \*techne\* is tied to its carrier, its maker, most of the time understood as "human" [Ed. note - as the last letter of the word "techne" is Greek, and thus unreadable in this text-only format, it has been rendered here using only standard English characters]. It is a skill, something one acquires, practices and, in that sense, can be a tool or an instrument. When we say that it is tied to a human, the reverse is correct as well: the human (especially "upright" human - see Marx, among many others) is made by its tool, hand tool, in particular. Human and technique form a system. Thus, \*techne\* is an attribute, as well as a defining essence of human.

As such, in Western tradition, \*techne\* sets itself as a differentiator to what the human is - its memory and history (writing, language, database), its soul (mobile, self-creative principle, everything that technical is not, according to Aristotle) and not only to its self, but also, and always, vis-<sup>^</sup>-vis "the rest" of its being in the world (establishing, measuring levels of difference): the human from natural, cultured from barbaric, human from animal and from plant, animate from inanimate, such as automata and machine. However, as Stiegler, following Leroi-Gourhan, argues, far from being an "invention OF human," the technical \*invents\* human, so much so that the entire discipline - anthropology - is foregrounded by a close relation between "the \*ethnic\* and the \*technical\*." And indeed, unlike the conventional view, that through technology humans master nature, here we have an argument that anthropology can be considered as technology - especially in its methodology, in its main focus on "how" people "make" what they are - through language, art, tools, various ways of doing things.

We have seen, so far, that in questioning technology we come close to the whole system of which it is a part: human, nature, machine, society, the question of Creator(s).

If we take into account Stiegler's argument of "technics as inventive as well as invented [2]," the next question for our couple "technology and difference" might be formulated as follows: Can "technology" be subsumed under the concept of difference? Is its "function" to enact, produce and "store" difference? Definitely, it is one of its "realities," especially for modern technologies. Rather than seeing \*techne\* as a means of dealing with nature, machine or other humans, we might suggest here that it is acting as a "spacing", a mediator between various groupings, so that they do not collapse into impossible sameness. This suggestion might not appear obvious in any particular technology, though it comes to the foreground when we consider modern technologies' reliance on differentiation, diversity and non-determinability. The ones that are based on the strongest desire to unify and normalize are the ones that are most obsessed with difference, defined by it and the desire to "domesticate," assimilate or annihilate it.

ART AND \*TECHN(\*

It is not accidental that this topic is raised in a publication that is devoted to art, together with science and technology. Many of the contributors are artists, work with artists or write on art. Frequently in the definitions of technology, its essence and its origin, art becomes "one more" translation of \*techne\*, the "artificial," the "man-made." Otherwise, their difference is traditionally established through the notions of function and purpose: technology is supposed to be "utilitarian," purposeful, while art is anti-utilitarian and use-less. While deconstructing this opposition of art and technology, their difference, as well as their relation needs to be addressed with a new radicality, without collapsing one into another. Heidegger asserts that "Because the essence of technology is nothing technological, essential reflection upon technology and decisive confrontation with it must happen in a realm that is, on the one hand, akin to the essence of technology and, on the other, fundamentally different from it. Such realm is art. But certainly only if reflection on art, for its part, does not shut its eyes to the constellation of truth after which we are \*questioning\* [ 3]."

Such questioning demands a simultaneous address of two imperatives. On the one hand, we need to question the above mentioned definition of technology as "the discourse describing and explaining the evolution of specialized procedures and techniques, arts and trades," as far as art is concerned. On the other hand, we need to ask what kind of art works might engender such questioning, in its own turn. The difference between art and technology, its understanding, is probably what lies at the heart of our specific formulation of the question: technology and (its?) difference. It is also a question on what "other" human might be, or has been, invented by art.

Finally, by introducing "difference" back into "technology," we seek to revive feminist, deconstructivist, genealogical and post-colonial gestures of ethical questioning, a fundamental return to "ethics," before, simultaneously and after technocentric, anthropological, aesthetic, scientific or metaphysical explorations. It is essential to raise this question of interdependence of difference and technology, especially in the light of a new optimism that problematically propagates modern technology as a de-differentiating force: it supposedly builds bridges, unites, globalizes (for better or for worse), brings us closer to become the same, based on the "code" or some other "common ground."

This is the first of two issues exploring these themes. This issue starts with two essays, followed by two project reports and a "featured artists" section. In the First, Gunalan Nadarajan explores the history and implications of our conceptions of "plant difference" with reference to his work-in-progress, \*Moving Garden\*. In the second essay, Faith Wilding critically discusses new reproductive technologies, with specific emphasis on stem cell research in relation to sexual difference. Robert Bodle presents a project report on the on-line activist media collectives in Los Angeles, followed by Diana McCarty's critical consideration of two Berlin-based initiatives in open source software. The "Featured Artists" section offers selected works by interdisciplinary artists Mendi + Keith Obadike: \*The Interaction of Coloreds\*, \*Keeping Up Appearances\* and \*Blackness for Sale\*. The second of these two issues will include essays by Eugene Thacker and Raqs Media Collective and project reports by Radhika Gajjala and Seda

Gÿrses.

One can find both parts, along with illustrations, at the LEA web-site: <http://lea.mit.edu>. In conclusion, I would like to thank all the contributors and express my gratitude to the LEA editors for their patience and editorial assistance.

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AUTHOR BIOGRAPHY

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PHYTODYNAMICS AND PLANT DIFFERENCE

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"Common suddenly felt the firm tug of gravity. He felt glued to the spot, as if attached there. He was attached. Looking down, he was dismayed to find his feet lodged firmly in the ground - and himself a plant! Transformed into something soft and thin, greenish brown, neither tree nor grass." - Kobo Abe [ 1]

WHAT IS A PLANT?

A plant is generally regarded as a biological entity that is rooted to a particular location - an interesting coincidence of etymology and existential condition. Tugged by gravity from below and sunlight from above, being fixed to a particular place and environmental conditions that it is unable to choose or change by way of subsequent physical relocation, the plant seems like an excellent exemplar of adaptation - it has to learn to adapt to and/or manage the conditions as they are rather than exercise the relatively simpler option of migration, available to the more mobile animals. Its immobility is very often conceived to be the reason for its incapacity and, as some such as Aristotle argue, lack of necessity, to develop a complicated response system, given the relative paucity of surprise and novelty in its immediate environment. However, these notions of immobility and a supposed lack of sensitivity that have come to

be attributed as natural to and constitutive characteristics of plants have been culturally constructed. This means that what one assumes to be essential and necessary qualities differentiating the plant from other biological and non-organic matter alike are merely qualities that plants have come to be associated with \*thus far\* and which, therefore, do not form exhaustive descriptions of what constitutes the plant. This also suggests that plants could be described, and therefore encountered, differently.

In 1878, the Russian botanist Kliment Timiryazev presented one of the most radical critiques of the distinctions between plants and animals in his lecture, "The Plant and the Animal" [ 2] . In the lecture, he highlights the fact that the "absence of motion and outward activity is looked upon as the essential point of difference between plants and animals," in most conventional accounts of plants, both scientific and lay [ 3] . However, he argues that it is problematic to define plants by their lack of movement, as many plants display a wide range of movements. He suggests that the surprise and amazement elicited by first-time encounters with the movements of plants such as the mimosa (*Mimosa pudica*) are indicative of a deeper cultural bias that imputes \*non-mobility\* as a fundamental characteristic of plants.

Timiryazev argues that biologists and botanists have historically circumvented the need to adequately conceptualize the movements of plants when they encountered them. He notes that they desperately sought to safeguard the integrity and validity of their time-honored categories of "plant" and "animal" by referring to them as anomalies, or aberrant variants; they sometimes even called such plants that display movement as \*zoospores\* (from zoos, "animal"). Pointing to the fact that many of these movements seem to have "no apparent stimulus," Timiryazev asks if one is justified in wondering whether some of these movements are voluntary. He examines what other distinctions, if any, can be instantiated between plants and animals if movement itself is an inadequate distinguishing characteristic. After deliberating on the nutritional and respiratory habits of plants and animals, he shows that these also form inadequate bases for differentiation.

Timiryazev follows with the question of whether plants have feelings and, by logical extension, consciousness and claims, "If we allow the response to stimulus, i.e., irritability, stimulation, to be a sign of feeling, we are bound to recognize this faculty in the plant [ 4] ." He states that insofar as there are plants that show sensitivity to and sometimes even discriminate between different stimuli, it is difficult to completely deny them the capacity to feel. In an extension of this argument about feeling, Timiryazev asks, somewhat rhetorically, "Is the plant endowed with consciousness? ...Are all animals endowed with it? If we do not deny it in the case of the lower animals, why should we deny it in the case of the plant [ 5] ?" However, in a strategic turn, instead of deliberating further on whether plants have consciousness, Timiryazev chooses to draw his conclusion in terms of upsetting the very distinctions between plant and animal. He states, in what must surely rank as one of the most radical gestures in the history of systematic biology, "the difference between plants and animals is not qualitative, but only quantitative [ 6] ." According to him, "As a matter of fact, there are no plants or animals as such, but a single undivided world. Plants and

animals are only averages, typical conceptions that we form for ourselves, abstracting from certain characters of the organism, attributing special significance to some properties, and neglecting, almost ignoring the rest [ 7 ]."

It is interesting that while Timiryazev identifies non-mobility and lack of sensitivity as primary characteristics imputed to plants, he does not attempt, in this essay or subsequently, to systematically elaborate on the fact that this was historically enunciated and maintained in contradistinction to movement and sensitivity that are conceptualized to be fundamental characteristics of what constitutes the "animal." It is useful to state here that just as the concept of the animal seems to have evolved in contradistinction to the "human," the concept of the plant has been discursively elaborated in contradistinction to the "animal." And in articulating this contradistinction between plant and animal, the notion of movement has been central. How did movement become such a primary marker of animal status and the lack of movement basis for assignment to plant status? And what if plants could move in ways that are not easily explained within the oft-cited, biological imperatives of nutrition, growth, procreation and survival imputed to them?

#### ROOTING PLANTS

In the historical development of botany, the philosophical biases and methods of botanical speculation inherited from Aristotle had a discursive stranglehold in determining the way plants were conceptualized until the beginning of the last century. The contemporary notion of a plant as a biological entity that is fixed to a particular place and lacking in sensitivity has been inherited from Aristotelian botany. One of the foundational concepts in Aristotle's notion of the living thing is the concept of "anima," conventionally translated as "soul", though most accurately conceptualized in relation to the notion of movement - "that which moves". According to him, the living was distinct from the non-living by way of its capacity for movement, either by some innate capacity for self-movement or enabled to move by some peculiar vital principle.

In Book II, chapter 3 of his \*De Partibus Animalium,\* Aristotle provides a fascinating example of the analogical reasoning that he used to make sense of plant and animal functions. In a discussion of the natural heat required for the nourishment needs of organisms, plants and animals alike, he first outlines the role of the mouth and stomach as part of a continuous system that concocts natural heat and nutrients for animals. Following this same logic of animal nutrition, he speculates on that of plants thus: "For plants get their food from the earth by means of their roots; and this food is already elaborated when taken in; which is the reason that plants produce no excrement, the earth and its heat serving them in the stead of a stomach. But animals, with scarcely no exception and notably all such animals as are capable of locomotion, are provided with a stomachal sac, which is, as it were, an internal substitute for the earth [ 8 ]." Thus, for Aristotle, the earth and stomach become analogous organs of digestion - one serving the fixed plant, the other, the mobile animal. He continues this counterposing of movement of the animal with the fixity of the plant further in his description of the sponge. He claims that a sponge "completely resembles a plant" since "throughout its life it is attached to a rock and that when separated from this it dies [ 9 ]." The fixity of the sponge is marked out as its primary characteristic and thus constitutive of its status as plant. He notes, however,

that there are some problems in such classifications, insofar as there are several exceptions to the principle of plant fixity. For example, he notes that the Holothuriae and Sealungs that are "free and unattached" still display plant-like qualities of "being without feelings" and concludes that their life is simply that of a plant, "separated from the ground." In a seeming acknowledgement of the difficulties of categorically differentiating animals and plants, Aristotle states in this section that "(S)ometimes it is a matter of doubt whether a given organism should be classed with plants or with animals [ 10]."

Julian Sachs, in his excellent account of the histories of botany, suggests that the influence of Greek authors such as Aristotle and Theophrastus was particularly strong in the botanical literature, insofar as every succeeding author felt obliged to refer to and build their own arguments from them. However, Sachs notes that the influence of these "philosophical botanists" has "led to no important result" and argues that these authors had seriously hampered the progress of the systematic and scientific enquiry into plants [ 11]. Sachs claims that these authors "built their views on the philosophy of botany on very weak foundations; scarcely a plant was known to them exactly in all its parts; they derived much of their knowledge from the accounts of others, often from dealers in herbs [ 12]."

Andrea Cesalpino (1519-1603) wrote his botanical classic, *\*De plantis libri XVI\** in 1583. Sachs considers this an important contribution to botanical history, if not for its adherence to classical Aristotelian notions. Sachs claims that "the whole account is controlled by a teleology, the influence of which is the more pernicious because the purposes assumed are supposed to be acknowledged and self-evident, plants and vegetation being conceived of as in every respect "\*an imperfect imitation of the animal kingdom\*" (emphases mine) [ 13]. Cesalpino's conception of the plant is no different from that of Aristotle, despite the fact that the former had the advantage of several decades of scientific observation. In a manner that echoes Aristotle from *\*De Anima\**, Cesalpino begins his book thus: "As the nature of plants possesses only that kind of soul by which they are nourished, grow and produce their like and they are therefore without sensation and motion in which the nature of animals consists, plants have accordingly need of a much smaller apparatus of organs than animals" [ 14].

Joachim Jung, a German botanist who was a contemporary of Kepler, Galileo, Vesalius, Bacon, Descartes and Gassendi, represented a key development in the botanical conception of the plant. His most important text, *\*Isagoge Phytoscopica\**, (1678) provides a fascinating thesis that both continues the Aristotelian logic of conceiving plants as existentially secondary to animals even as it breaks free from the Aristotelian notion of soul in making such a distinction. Sachs formulates Jung's basic arguments on the plant-animal distinction thus: "A plant is ... a living but not a sentient body; or it is a body attached to a fixed spot or a fixed substratum, from which it can obtain immediate nourishment, grow and propagate itself" [ 15]. The primary notion of Jung here, "Plantae est corpus vivens non sentiens" is worthy of some deliberation insofar as this consolidated the Aristotelian thesis of the plant's inability to sense, based on his other thesis about its immobility. Jung's argument was that the immobile plant did not have a biological necessity for a



complicated sensory apparatus, given the fact that it was unlikely to encounter and respond in the wide range of stimuli that a mobile biological entity like an animal would. According to Jung, the plant was thought to live in a world where there were relatively little surprises, insofar as its immediate surroundings were relatively unchanging compared to those of an animal.

It is no surprise, then, that even the first botanist to systematically address the movements of plants, John Ray, in his *\*Historia Plantarum\** (1693), explains away those movements as mechanical and physical phenomena, without according them any significance to the physiological constitution and life of the plant. For example, he explains the movements of the mimosa by referring to them not as sensory responses but as a mechanical process triggered by the pressure applied by the touch of an animate creature or natural phenomena such as wind and rain. The history of botany seems to have systematically circumvented dealing with plant movement and its related issue of its sensitivity to external stimuli. Varro, the Greek philosopher, is the first to have noticed the heliotropic movement of certain flowers; Pliny notes the clove leaves closing in bad weather in his *\*Natural History\**; Albertus Magnus (thirteenth century) and Garcia del Huerto (sixteenth century) recorded the leave movements of the Leguminosae; Cesalpino notes with some surprise the climbing movements of some plants; Borelli notes the irritability of the Centuræ's stamens; and even Robert Hooke has a short excursus on the movements of the mimosa in his famous *\*Micrographia\** in 1667 [16].

Following Ray, several botanists seemed to gain confidence in studying plant movements, a field which came to be categorized as *\*phytodynamics\** by the late seventeenth century (although the term itself, interestingly enough, has fallen into disuse). Even within such studies of plant movements, there was greater emphasis on growth movements that were generally explained in terms of physical necessities as movement to sources of nourishment like light, water and nutrients. The serious study of the less regular, non-growth related plant movements, was relatively rare. Linnaeus studied the periodical movements of flowers in 1751 and of leaves in 1755, but was satisfied to have categorized them as "sleep movements," not entirely dissimilar to those found in animals. This tendency to draw similarities to and differences from the movements of animals is also found in Du Hamel's *\*Physique des arbres\** (1758), where he has a chapter entitled "Movements of plants, which approximate to some extent the voluntary movements of animals." In this chapter, Du Hamel ventures a mechanical explanation for these movements based on the "direction of the vapours" inside the plants. This tendency to seek mechanical explanations was also coherent with a larger cultural climate in late eighteenth-century Europe, where a mechanized world-view was gaining currency. Sachs notes, however, that "the mechanical processes in plants were described much in the way in which a person with very indefinite ideas as to the nature of steam and the construction of the inside of the steam engine might speak of its movements" [17]. These mechanical explanations ranged from Tournefort's speculation that the movements of plants were due to them possessing "muscles" that acted similarly to those found in animals to those postulating that there was a vital force that was gradually *\*unwinding\** itself from within the plant as expressed movements.

The nineteenth century witnessed more systematic efforts to

explain plant movements by careful experimentation. Andrew Knight experimentally showed in 1806 that the vertical growth of the stem and primary roots are due to gravitation while Dutrochet showed in 1822 that the movements of the mimosa were due to the alternating expansion of its pulvini. By the middle of the century, the field of phytodynamics had settled on differentiating between two kinds of movements - one that is related to growth and the other, non-growth related movements of parts of the plant that had already ceased to grow [ 18] . While the growth movements were usually explained by reference to nutrition-relevant stimuli, there was still some dispute as to the non-growth movements. For example, De Candolle speculates that the movements of mimosa constitute evidence for the "excitability" of plants. The tendency to impute some mystical, primary sensitivity to plants was still current in these investigations. It was not until Brucke's 1848 study provided an experimentally founded explanation of the mimosa's movements in terms of alternating turgidity and relaxation of its pulvini that the mysticism that surrounded explanations of plant movements started to fade.

The extensive experimental work of Darwin on plant movements in his "The Power of Movement in Plants" in 1880 consolidated this transition from mystical explanations to scientific ones. Darwin concludes this study by noting that one cannot ignore the striking resemblances between plant movements and those of animals. He states "the most striking resemblance is the localization of their sensitiveness and the transmission of an influence from the excited part to another which consequently moves" but quickly clarifies that "plants do not \*of course\* possess nerves or a central nervous system; and we may infer that with animals such structures serve only for the perfect transmission of impressions, and for more complete intercommunication of the several parts" (emphasis mine) [ 19] . Despite citing the different ways in which the sensitivity and movements of plants and animals are similar, Darwin's conclusion that the plant's sensitivity and corresponding movements do not issue from their having some nervous system similar to animals indicates that he follows the historical precedence of understanding the plant's capacities as "reduced versions" of those found among animals.

A noteworthy development in research during this period was the discovery of electrical activity corresponding to plant movement and sensitivity. Becquerel discovered electrical activity in injured plants (1851) while Buff studied the direction of such activity in 1854. Burdon-Sanderson observed and recorded the electrical changes in a Venus' flytrap and in a \*Dinoaea\* plant in 1873, 1877, 1882 and 1888, concluding that such electrical activity was similar to those issuing from stimulation of animal muscles - a phenomenon that was being actively studied as bio-electricity. Kunkel was able to measure significant electrical activity from the stimulation of mimosa in 1878. Sachs (1887), Waller (1900), Ewart (1903), Pfeffer (1905) and Jost (1907) showed that such electrical activity is widely distributed in most plant physiology and that it usually corresponds to chemical reactions and changes in the plant [ 20] . The work of Indian botanist Jagadis Chander Bose during the early part of the twentieth century in the area of plant electricity is remarkable for its extensive recording of such electric activity under experimental conditions and using highly sensitive equipment that he designed. He established the existence of distinct action potentials of electric activity that could be measured with reasonable accuracy, reliability and expression of

the most subtle variations. His work, primarily focused on the \*Mimosa\* and the \*Biophytum sensitivum\*, showed that plant excitability shares many similarities to features of animal nerves: "The plant becomes fatigued if exercised too frequently; stimuli too weak to cause movement on their own can build up into a sufficiently strong signal that eventually triggers movement; each movement has a waiting (latent) period before a response is apparent" [21]. It is noteworthy here that while botanists made comparisons between plant and animal electricity, there is a surprising lack of interest in aligning or understanding the relationship between plants and machines through electricity. While there had been several interesting investigations on the implications of animal electricity with reference to mechanics and machines, notably in the works of Benjamin Franklin, Felix Fontana, Luigi Galvani and A. von Haller, there was practically no attempt to think through how plant electricity and its corresponding movements and sensitivity related to machines.

The attempts to understand plant movements and sensitivity vis a vis parallel phenomena found in animals has been extremely unfruitful, insofar as it has led to the generation of and reliance on somewhat clumsy and mystical concepts like "soul of the plant," "plant muscles" and "plant nerves." The possibility of such sensitivity and movements constituting \*phenomena peculiar to plants\* has seldom been articulated because of the discursive habits that define plants in contradistinction to animals. It seems that for a proper understanding of the difference of plant movement and sensitivity, one needs to excise it from its relation to the animal.

#### PLANT MOVES

In a series of unconventional experiments, Cleve Backster, an American lie-detector examiner, beginning in 1966, discovered that when attached to a galvanometer, \*Dracaena massangeana\* plants displayed a rich array of electrical activity that was related to different kinds of stimuli, ranging from real threats to their lives to the life-threatening situations of other plants and animals (See Tompkins and Bird, 1972: pp. 17-26). Backster's experiments had interestingly enough caused a greater stir in the parapsychology community than in the regular scientific communities, which remained relatively skeptical of his findings. The scientific community considered his experimental conditions to be flawed and problematic and, most damagingly, argued that these experiments were never repeated successfully under stricter experimental conditions (for a critical review of these experiments, see Simons, 1992: pp. 202-203 and Galston and Slayman, 1979).

In a radio interview in 1972, Backster said cheekily, "But if you really want to make a psychologist sit up and take notice, you could instrument a plant to activate a small electric train, getting it to move back and forth on no other command than that of human emotion" [22]. According to Backster, the abilities of the plant to sense and respond in synchrony to human emotions could conceivably make it function as a sort of relay station for issuing signals to control non-animate machines and processes. Tompkins and Bird give an account of how Pierre Paul Sauvin, an electronics enthusiast keen on testing the feasibility of Backster's instrumentation, actually developed an experimental situation wherein he trained a plant to transmit his emotions to trigger and control a toy train. They also highlight the work of Ken Hashimoto, another researcher affected

by Backster's experiments, who was able to transcode the electrical signals from a cactus into musical notes and simple graphical messages [23]. While the authenticity of Backster's, Sauvin's and Hashimoto's experiments and developments have been rightfully challenged, the notion of aligning plant and machinic processes brims with aesthetic and critical possibilities. The machine, in being neither animal nor plant but historically defined in relation to both, represents a useful point of reference for articulating phytic difference as it has in defining animal difference.

Canguilhem argues that "a machine can be defined as a man-made artificial construction that essentially functions by virtue of mechanical operations." Identifying movement as a central aspect of the mechanism as such, he stresses that "in every machine ... movement is a function, first, of the way the parts interact, and second, of the mechanical operations of the overall unit" [24].

Drawing on movement as a central trope of the machinic and the phytic, where both are defined with reference to their differential capacities for movement, I have conceptualized a series of artworks over the last few years, which I am currently developing in partnership with various technical collaborators. In this concluding section, I offer a brief description of one such work, \*Moving Garden\*.

\*Moving Garden\* is an \*anthorobotic\* (Greek, anthos, "flower") installation for an outdoor location. The work is part of a series of \*phytorobots\* (Greek, phytos, "plant") being developed, where plants would control mobile robots through their natural tropisms and propensities for movement. This work has a group of mobile robots being controlled by the natural "suntracking motion" of sunflowers that are connected to them. A combination of mechanical (gauge sensors) and electrophysiological (Galvanic Skin Response) sensors will be used to detect electrophysiological changes resulting from and accompanying the subtle movements of the flowers. A group of ten anthorobots would be deployed in an outdoor area where the sun's movements would trigger the sunflower's movements which, in turn, would trigger the solar-powered robots to also move. The sun thus becomes the choreographer of the complex dance movements of these anthorobots. This \*solar choreography\* thus binds the plant and robot in an intimate symbiotic relationship, where their mutual nourishment is made possible by their ability to function as a single entity. In addition to this work, several other phytorobots drawing on various movements and electro-sensitive activities of plants are being developed, including a mimosa-controlled robot that develops a rich contact-avoidance repertoire.

#### UPROOTING PLANTS

In a fascinating short story, \*Dendrocacalia\*, Kobo Abe tells of how a man, named Common, suddenly finds himself being transformed into a plant. The transformations, which happen without any warning, are characterized by short intense spells where Common feels the strong tug of gravity that root his feet to the ground and where his body becomes stiff and unwieldy. Understandably, Common resists the transformations but finally decides to give in to it on the advice of a messenger who has guided other humans who have also been stricken by this imperative of becoming-plant. The story presents an interesting occasion to speculate on what constitutes the human in

contradistinction to the horror of the vegetal state. The anxiety with which Common meets his transformation into a plant are indicative of a larger cultural conception where the plant and the vegetal are conceived to be states of inertia, insensitivity and immobility. Phytorobotics as an aesthetic strategy provides the possibility of technologically "uprooting" the plant and the ways in which it is conceived, so as to enable different encounters with it.

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#### BIOTECH BODIES/DIFFERENCE/RESISTANCE

by Faith Wilding, School of the Art Institute of Chicago, 280  
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Human bodies have always been culturally constructed and  
physically modified through technologies including tool-making,

agriculture, cooking, medicine and language. Today, radically new biological bodies are being created through genetic engineering, cloning, stem cell cultivation and transgenics. Many knowledge/power systems and technologies intersect and collide on this biotech frontier: visualization and computing, corporate science, religion, philosophy, ethics, feminist and post-colonial theory and genetics. But there is a lack of public debate and critical analysis engaging crucial issues of difference that the new biosciences raise. Genetic engineering has ushered in an age of \*matrixial technologies\* that produces irrevocable changes in reproduction and body processes. Women's body parts - eggs, uteri, placentas, cord-blood and embryos - often provide the raw materials for these processes; yet there is no acknowledgement of how these technologies replay historical colonization of female bodies, creativity and productive labor. This essay takes a critical look at cultural meanings of reproductive and recombinant biotechnologies, in which (female) bodies, transgressing boundaries, are becoming distributed, patented, migrational bodies - part of a global flow and exchange of property and value.

#### MATRIXIAL TECHNOLOGIES

"Matrix: mother, maternal, material, womb, pregnant animal. Recent meanings: The movie, cyberspace, that from which everything comes into being, endless self-generation" [ 1 ] .

\*Totipotent\* human embryonic stem (hES) cells - cells capable of being programmed to produce any bodily tissues including germ cells - were first isolated and grown in the lab in 1998. They are a highly desired commodity because they are undifferentiated, programmable biological entities that can be isolated, controlled, grown and replicated virtually without limit under laboratory conditions. Potential bio-medical uses of hES cells include fertility procedures, organ and tissue regeneration, "rejuvenation" therapies, therapeutic and reproductive cloning and drug manufacture. Since hES cells are derived from human "early" embryos, the technologies developed from them are literally \*matrixial technologies\* - maternal or generative technologies, where the matrix is a culturing environment or simulated uterus. hES cells can function as external embryos from which cell lines can be cultured. In these culturing processes, the matrix is \*real\*, not a metaphor; it is simultaneously the cytoplasm of egg cells, the culturing medium and the pre-embryo that gives rise to the new organism.

Both human and animal embryonic stem (ES) cell research are being advanced as fast as possible by consortia of private, academic and government entities, entrepreneurs and researchers. The rhetoric surrounding hES cell research is promissory and mythical - hysterical in its desire to dazzle scientists, academics, government officials and the public alike with possible medical miracles of tissue regeneration, rejuvenation and saving lives. Research and deployment of these biotechnologies are being pushed ahead rapidly, while public fear and opposition is quelled by extolling the miraculous benefits of transgenic and cloning sciences through hyperbolic rhetoric.

Fears and objections to Assisted Reproductive Technologies (ART) were successfully silenced in public discourse through strategic marketing campaigns that celebrated consumer choice and control over offspring quality, and naturalized the eugenic tendencies of these technologies. Initially, cloning and

embryonic stem cell research has been met with similar objections to those raised against ART. The ideological/cultural battle currently raging about human cloning and hES cell technologies is not the focus of this paper. Suffice it to say that the often ridiculously contradictory, legal and ethical debates over hES cell research in the U.S. Congress testify to deeply seated non-rational fears and motivations awakened by this science of biological control. Ethicists have jumped into the fray, pointing to the threat cloning poses to beliefs in the sacredness of human nature and the value of individual human lives [ 2 ] .

However, not many of them seem very concerned about the problems of potential loss of species difference, the corporate control over Life Science and the privatization and patenting of the world's genetic heritage. Meanwhile, corporately funded scientists and entrepreneurs are betting that people will soon forget their fears of the monstrous in return for medical miracles that stave off death, disease and senescence.

#### WHY ARE WOMEN LIKE CHICKENS?

Scientists apply many of the genetic engineering techniques learned from animal research to the production of human embryos and hES cell lines. They argue that the sequencing of the human genome has clearly shown that humans are not very different genetically from animals after all, so that crossing species boundaries in genetic engineering is really no different in effect than traditional animal breeding. Animal genetic manipulation is "unlocking the secrets of life," thus giving humans more control over the production and reproduction of the living world.

Much of the controversy surrounding hES cell technology concerns the use of human eggs and embryos as experimental material. A human egg cell is needed to make a "transformed" pre-embryo through nuclear transfer (NT) [ 3 ] . Totipotent cells with similar potential can be isolated from "the gonadal ridge of the aborted fetus" [ 4 ] . ART depends on the forced ripening and harvesting of multiple human eggs, a time-consuming, painful, risky and expensive procedure that requires the woman "donor" to take massive doses of fertility hormones so she will super-ovulate - sometimes producing up to 30 eggs per cycle [ 5 ] .

Genetic engineering produces hybrids and so-called chimeric embryos. Hybrids are the result of crossing two different species or varieties within a species; every body cell of a hybrid contains copies of the genomes of both parents. Hybridization can now be done very efficiently by molecular DNA transfer. Chimeras are genetic mosaics made by mixing body cells, or parts from two individuals, by actually combining cells with different DNA, or sprinkling DNA over cells in a lab dish. Advanced Cell Technologies (ACT) has reportedly been attempting to create "hybrid embryos" using cow eggs and the nuclei from human cells.

Much of the controversy surrounding such creations focuses on language: "What do you call such a thing?" - which reflects the fear that hybridity is actually a kind of pollution, or criminal miscegenation [ 6 ] . The rationale for using an enucleated cow egg is that human eggs are so much harder to come by and the cow's egg simply furnishes a "way station", a kind of universal, de-contextualized matrix, for human nuclear DNA to be cultured into hES cells. It is already relatively commonplace and accepted



practice in transgenic science to transfer genes from one species into another (human genes into goats and pigs) to produce insulin or compatible transplant organs. Why, then, object to temporarily housing an entire human genome (nucleus) in the cytoplasm of a cow egg, or vice versa?

In today's life-sciences, there is a head-on collision between deep-seated cultural mythologies and taboos and latest style capitalist science, which is erasing the particularities of genetic species differences. That these differences are vitally important is shown by the fact that the actual danger in creating transgenic hybrids lies in mixing the mitochondrial DNA (found in the cytoplasm) from one species with the nuclear DNA of another species. Only a few monkey species, for example, are close enough in their mitochondrial DNA to mix with human nuclear DNA and have even one of the basic cell functions occur. Thus species differentiation is still a major stumbling block of genetic engineering; but this is not stopping corporate science.

Consider the intersecting fates of women and chickens in corporate biology. Both produce eggs so necessary to genetic engineering and cloning. Women's eggs (and other reproductive tissues) are the matrix for hES cell line production. Chicken eggs are important drug factories: "The chicken egg, as nature's bioreactor, offers a far more preferable drug manufacturing vehicle as compared to present equipment or other transgenic production methods, such as mammals" [ 7]. Chickens have long been the factory-farmed animals of choice. Continuous feeding with medicated meal and hormones, crowded confinement inhibiting movement and controlled lighting enables genetically "improved" chickens to be raised to market-ready size in 49 days. Conditions for workers in U.S. chicken growing and processing factories (many of them women and undocumented migrants) are similar to those of chickens: long hours, low pay, unspeakable, dangerous working conditions, crowded housing and no job security or benefits are their lot. These conditions have only gotten worse as the efficiency technologies of genetic engineering and rationalized food production are becoming ubiquitous.

It seems likely that the genetic engineering of chickens for transgenic pharmaceutical production will provide scientific knowledge that will be applied to women. Already, patented, live cell-lines derived from women's eggs are being circulated all over the world for medical experiments, without compensation of the donors or disclosure of the source of this valuable material, the conditions under which it was obtained and who is - or is not - benefiting from it.

#### CONTESTATION AND RESISTANCE

"The cultivation of diversity has to be a conscious and creative act, intellectually and in practice. It demands more than mere tolerance of diversity..." - Vandana Shiva, \*Biopiracy: The Plunder of Nature and Knowledge\*, p. 119.

"...the genes, in making possible the development of human consciousness, have surrendered their power both to determine the individual and its environment. They have been replaced by an entirely new level of causation, that of social interaction..." R. C. Lewontin, \*Biology as Ideology: The Doctrine of DNA\*, p. 123.

The crucial role of difference and diversity is increasingly

acknowledged in society, art, ecology and politics: difference experienced as a fundamental principle of life itself. By contrast, genetic engineering erases difference, or instrumentalizes it for specific, controlled ends. Instrumentalized difference negates the liquid transformational possibilities arising from particular interactions of different organisms/bodies with their environments.

Living organisms are in a state of becoming, rather than a genetically fixed or essential state as eugenic thinking proposes. Cyberfeminist and post-colonial discourses of difference contest the authoritarian systems of domination, privatization and specialization that much scientific work in the U.S. is infected with. Worldwide, activists and artists are working on projects that challenge and critique eugenic ideologies of control underlying much of current biotech. Projects range from: farmer-initiated land-race seed exchanges and land reclamation; Shiva's experimental pedagogical Indian farm to expand diversity of food crops; Women on Waves' floating reproductive health clinics; proposals for a "Genetic Commons" protecting the world's genetic heritage; Natalie Jeremijenko's projects showing that cloned plants develop differently in different growing environments; Critical Art Ensemble's contestational science projects that teach genetic-engineering processes to enable people to detect and reverse-engineer genetically modified food crops; subRosa's informational performances, interrogating capitalist and eugenic basis of ART, egg donation and the traffic in human organs and stem cells - to name a few. Effective resistant strategies must start with an analysis of the systems of biopolitical control within which all organic bodies now exist, and must find provocative tactics to disrupt this control.

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2. Leon Kass, "Why Not Immortality?," in *\*The Future is Now: America Confronts the New Genetics\**. William Kristol and Eric Cohen, eds. (Lanham: Rowman and Littlefield Publishers, Inc. 2002)
3. In NT, the nucleus of a donor egg is removed and replaced with a nucleus taken from a stem cell of the person/animal being cloned. The "transformed" egg is then stimulated and the cells begin to divide into a pre-embryo that is a genetic copy (clone) of the stem-cell donor.
4. "Introduction," *\*The Human Embryonic Stem Cell Debate\**, S. Holland, K. Lebacqz and L. Zoloth, eds. (Cambridge, Mass: MIT Press, 2001) p. xvii.
5. Do No Harm, a coalition of ethical scientists and others opposed to embryonic stem-cell research has estimated that "...in order to provide genetically matched embryonic stem cells derived from cloning to treat the potential patient pool, scientists would have to obtain at least 670 million eggs, donated by at least 67 million women. See [www.stemcellresearch.org/info/dothemath.htm](http://www.stemcellresearch.org/info/dothemath.htm).

6. See [ 4 ] , p. 230

7. See [www.viragen.com/avian\\_chickeneggs.htm](http://www.viragen.com/avian_chickeneggs.htm).

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#### AUTHOR BIOGRAPHY

Faith Wilding, new genre artist/writer/scholar, is an associate professor of Performance Art at the School of the Art Institute of Chicago. She is a member of the cyberfeminist art collective subRosa, which initiates public discourse about the economic, social and political implications of bio and genetic technologies. Wilding co-edited (with Maria Fernandez and Michelle Wright) *\*Domain Errors! Cyberfeminist Practices\**, a subRosa anthology (Autonomedia, 2003).

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#### PROJECT REPORTS

##### ONLINE ACTIVIST MEDIA COLLECTIVES IN LOS ANGELES: AN ARGUMENT AGAINST THE DEMATERIALIZATION VIEW OF CYBERSPACE

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Recent studies lament the loss of historical specificity in Los Angeles due to the destruction of landmarks and the removal of ethnic neighborhoods, in addition to distorting representations in the media that divide the city into narratives of celebrity and crime. Selective de-industrialization, de-unionization and the brutal demographic divisions that exist in the spatial organization of LA also provide the preconditions for a loss of regional identity and broad grassroots networking in the city, home to 3.5 million Latino, black, Asian and white citizens that inhabit its 464 square miles. Mike Davis, in his widely read *\*City of Quartz\**, suggests that the loss of public space in LA is a central factor in preventing the mingling of its citizens, preventing their ability to forge networks of solidarity that can result from common experiences among classes, ethnicities and races.

In this essay, I advance cyberspace as a location that can potentially provide a common space to enable Angelinos to overcome class, racial and spatial divisions. Norman Klein argues the dematerialization view of cyberspace, dubbing online regional practice as "the digitization of forgetting," and its ties to localism an impossibility due to the spatial indeterminacy of cyberspace - "a spot un-rooted to any definite spot on the surface of the earth" (Klein, 1999: p. 198). The process of creating an Independent Media Center in Los Angeles (LA IMC), however, establishes an offline/online nexus, creating material conditions for social interaction and community-building; ultimately enriching, rather than erasing, notions of place, regional identity and community.

Presently, language differences, ethnic insularity, the digital divide, and the daily grind of the working poor prevent many ties easily achieved in theory. Yet, the process of building

alternative online media collectives does provide a viable model for overcoming urban processes of erasure and alienation, an experience common to those that inhabit the decentralized sprawl of Los Angeles. People forging links across online and offline spaces, I argue, can engage in new social relations, linking bodies across divisions of race, culture and space, creating local networks of solidarity.

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#### AUTHOR BIOGRAPHY

Robert Bodle is completing a Ph.D. in Critical Studies at the School of Cinema-Television, University of Southern California. His dissertation, "Radical Culture in the Digital Age: A Study of Critical New Media Practice," examines online cultural activism and issues of access and control in informational politics. Bodle is an early participant in the Indymedia Movement.

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#### RESONANT CULTURE

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[www.reboot.fm](http://www.reboot.fm); [www.bootlab.org](http://www.bootlab.org); [www.juniradio.net](http://www.juniradio.net)

\*reboot.fm\* and \*Juniradio\* are projects that combine local FM radio transmissions with open-source software. The aims of this work are to create both dialogs and technologies that recode old and new media for non-commercial arenas of cultural production. They also raise numerous issues around subtle forms of inclusion and exclusion in what are understood as open structures. \*Juniradio\* was a three-week experiment with FM radio. As a collaboration between disparate partners, the multiple social orientations exposed many faults within existing open cultures like Free Radio and Open Source; at the same time, it pointed towards an inclusionary social practice, where emergent technological innovation can actually take issues of race, class and gender on board in the technical development and implementation of software and in the programs broadcast on local radios. \*reboot.fm\* is an attempt to unfold such a practice, one that not only allows multiple points of entry for participation, but demands it.

#### COMMUNITY

Communities around Open Source and Free Radio offer alternative uses and forms for the media often taken for granted; non-commercial media that espouse democracy, non-hierarchical structures and emphasize their heterogeneous make-up, liberal values and inclusive qualities. Open source, with its emphasis on non-proprietary software generated by users and objective valuations of new tools that allows anybody to contribute to the shared pool of resources. Free Radio, with its claim of grassroots radio for the people and rejection of editorial hierarchies.

In spite of their myriad forms and multiple localized manifestations, however, these groupings are commonly dominated by middle-class white males with shared values and similar

histories. The norms for communication and participation are dictated through those commonalities. The result is a free-media practice that is open to initiates, those that know, technically, how to enjoy the benefits of such a system. Rooted in technology that includes the studio and releasing new software, specialized knowledge is required to join. That specialized knowledge, shared between initiates, defines and controls access to the media being proclaimed open. It also limits the terms of participation. Program schedules are decided by those in control of the studio, community software is developed by individual geniuses and both are delivered to the multitudes as pre-defined packages, with little room for more meaningful engagement with the structure, planning or implementation. Good intentions translate into a closed circle of insiders enjoying their own freedom, and an aura of benevolence when shared with the less fortunate.

#### TUNING

\*Juniradio\* illustrated very clearly that social inclusion is not an automatic process; open calls to participate in the program were totally dominated by free radio advocates, that is, those who felt they belonged. This problem was compounded by the attendant homogenous social networks; race and gender simply were not an issue with this crowd. To reflect the multi-layered reality of Berlin, another approach was needed. This called for extensive communication and specific invitations to participate. It meant making groups and individuals feel that they belong by creating a context where they actually do. To the extent that the three-week transmission aired programs from a very broad spectrum of social strata of Berlin, the hierarchical editorial strategy was a success. Jungle kids from Marzahn spun their discs and stopped complaining about house music long enough to see the mixer smoke when the Prince was on the decks; latina immigrants lobbied for legalization of informal work, comforted by a latina sound technician; former RAF members talked politics with teenage global resistance. Challenging the established norms of open cultures, the city resonated with the sounds of itself.

#### REBOOT

Taking those challenges further means that \*reboot.fm\* extends that inclusive social practice into the development of open source tools - here, a working environment that comprises individuals that bring lived experience to the table, allowing for different sets of knowledge and logics to inform the process and define the function of a set of software. It means a practice that values human input, voicing difference as part of norm. The potential is for a collaborative process that extends far beyond one project or temporary broadcast, but rather an entirely different form of software development and model for working with open cultures.

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#### AUTHOR BIOGRAPHY

Diana McCarty is a co-founder of bootlab and numerous critical media projects, such as the faces and nettime mailing lists. McCarty has co-organized and participated in media events throughout Europe and the Americas.

## FEATURED ARTISTS

[Works by the following artists, which accompany this issue, can be seen online at <http://lea.mit.edu>.]

Mendi + Keith Obadike, 204 Mill Rock Rd., Hamden, CT 06517,  
U.S.A.

Mendi Obadike e-mail: [mendi@blacknetart.com](mailto:mendi@blacknetart.com)  
[www.blacknetart.com](http://www.blacknetart.com)

Mendi + Keith Obadike are interdisciplinary artists whose music, live art and conceptual Internet artworks have been exhibited internationally. their writing and art projects have been featured in the film *\*Take These Chains\**, in periodicals (including *\*Art Journal\**, *\*Artthrob\**, *\*Indiana Review\**, *\*Black Arts Quarterly\** and *\*Tema Celeste\**), and in the upcoming anthology, *\*Sound Unbound: Writings on Contemporary Multi-Media and Music Culture\** (edited by Paul D. Miller). Their work generated much discussion online and offline when Keith offered his blackness for sale on ebay in 2001. In 2002, Mendi + Keith premiered their Internet opera, *\*The Sour Thunder\**, which was the first new media work commissioned by the Yale Cabaret, and they launched the *\*Interaction of Coloreds\** (commissioned by the Whitney Museum of American Art). In 2003, *\*The Sour Thunder\** was broadcast internationally from 104.1 in Berlin. Most recently, Mendi's manuscript *\*Armor and Flesh\** (forthcoming on Lotus Press) won the Namoi Long Madgett award.

## THE INTERACTION OF COLOREDS

Mendi + Keith Obadike

<http://artport.whitney.org/gatepages/august02.shtml>  
[www.blacknetart.com/IOccs.html](http://www.blacknetart.com/IOccs.html)

This work is part of Whitney Museum's net-art portal, "Artport." It was commissioned as a gate project and was featured during the month of August 2002. It is an on-line skin color verification system, part of the current pool of products in image recognition and manipulation, that was developed "after years of detailed Diasporic research." As its producers claim, it is just necessary to "follow our strict jpeg guidelines and answer a few detailed questions about family history", and this color verification system will identify your true color.

## KEEPING UP APPEARANCES

Mendi Obadike

[www.blacknetart.com/keepingupappearances.html](http://www.blacknetart.com/keepingupappearances.html)  
[www.blacknetart.com/keepup.html](http://www.blacknetart.com/keepup.html)

In *\*Keeping up Appearances\**, a "hypertextimonial," Mendi Obadike's aim is to "investigate the power of using forms which often signify lack of power by using them in concert with each other." In this hypertextual work, she explores what she calls "disclosures" of autobiographical writing, in particular inspired by the works and lives of Faith Ringgold and Audre Lorde.

## BLACKNESS FOR SALE

Keith Obadike

<http://Obadike.tripod.com/ebay.html>

In 2001, "Keith Obadike's Blackness" was auctioned at E-Bay, in the category Fine Art. The description, among many other benefits for a buyer of Keith Obadike's Blackness, lists the use as being for "writing critical essays or scholarship about other blacks" and for using it as a "spare" Blackness, in case "your original Blackness is whopped off you." Instead of the planned 10 days, the work was auctioned for four days, after which E-Bay management removed it, citing it as "inappropriate."

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LEONARDO REVIEWS 2003.10
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This month, Leonardo Reviews publishes another 20 reviews from its increasingly active panel. We are also pleased to welcome more new reviewers, filing for the first time: Bronac Ferran, from the U.K., and Margaret Dolinsky and Allan Graubard, from the U.S., join our regulars. Ferran draws our attention to a major report - \*Beyond Productivity: Information Technology, Innovation, and Creativity\* - by William J. Mitchell, Alan. S. Inouye and Marjory S. Blumenthal. Despite its U.S. origins, this report affects the Leonardo community world-wide. As Ferran concludes, as other countries establish commissions to investigate the "dynamic intersection" between art/design and technology, "the trend towards interdisciplinarity within research appears to be unstoppable." The review is published in full below and the report itself can be downloaded. Allan Graubard's review of George Didi-Huberman's \*Invention of Hysteria: Charcot and the Photographic Iconography of the Salpetriere\* revisits the rhetoric of medicine and the fascination of a period when a new "science" was being developed in response to an apparently unbridgeable gulf between biology (as it was then understood) and consciousness. The extent to which particular technologies of representation contributed to the conceptualization of hysteria has long been argued, but what is beyond doubt is that the images of hysterics subsequently resonated in the work of artists in the early twentieth century and shaped contemporary understanding, from the salon to Hollywood. The social interface of the unstoppable trend towards interdisciplinarity in the present day is the topic of Paul Virilio and Sylvre Lotringer's \*Crepuscular Dawn,\* reviewed by Sean Cubitt. Here, a rather bleaker picture emerges than the one painted by Mitchell et al in their report.

As a trio, these reviews do provide a view of today's (interdisciplinary) world in a grain of sand. As for the 17 other reviews of books, videos, catalogs and exhibitions, I can only suggest a visit to: <http://mitpress.mit.edu/e-journals/Leonardo/ldr.html> to catch up on the latest postings listed below and, of course, the archive.

Michael Punt  
Editor-in-Chief  
Leonardo Reviews

Action and Reaction: The Life and Adventure of a Couple, by  
Jean Starobinski, translated by Sophie Hawkes with Jeff Fort  
Reviewed by Margaret Dolinsky

Beyond Productivity Information Technology, Innovation, and  
Creativity, by William J. Mitchell, Alan. S. Inouye and Marjory  
S. Blumenthal  
Reviewed by Bronac Ferran

Crepuscular Dawn, by Paul Virilio & Sylvre Lotringer  
Reviewed by Sean Cubitt

The Curvature of Spacetime: Newton, Einstein, and Gravitation,  
by Harald Fritzsch  
Reviewed by Robert Pepperell

Depression Dog, by Toby Olson  
Reviewed by Roy R. Behrens

Giants of Delft: Johannes Vermeer and the Natural Philosophers:  
The Parallel Search for Knowledge during the Age of Discovery,  
by Robert D. Huerta  
Reviewed by David Topper

Howard Finster: Man of Visions, a film by Julie Desroberts,  
Randy Paskal and Dave Carr  
Reviewed by Roy R. Behrens

Illuminating the Renaissance: The Triumph of Flemish Manuscript  
Painting in Europe, by Thomas Kren and Scot McKendrick  
and

Treasures of a Lost Art: Italian Manuscript Painting of the  
Middle Ages and Renaissance, by Pia Palladino  
Reviewed by Amy Ione

The Imagined World Made Real: Towards a Natural Science of  
Culture, by Henry Plotkin  
Reviewed by Rob Harle

Invention of Hysteria: Charcot and the Photographic Iconography  
of the Salpetriere, by George Didi-Huberman  
Reviewed by Allan Graubard

Twelve Japanese Masters, by Maggie Kinser Saik  
Reviewed by Rob Harle

Matters of Gravity: Special Effects and Supermen in the 20th  
Century, by Scott Bukatman  
Reviewed by Dene Grigar

The Mayne Inheritance, by Rosamond Siemon  
Reviewed by Wilfred Niels Arnold

Memories Are Made of This: How Memory Works in Humans and  
Animals, by Rusiko Bourtchouladze  
Reviewed by Robert Pepperell

Memory and Dreams: The Creative Human Mind, by George Christos  
Reviewed by Rob Harle



Naturoids: On the Nature of the Artificial, by Massimo Negrotti.  
Reviewed by Rob Harle

The Norton Anthology of Theory and Criticism, Vincent B.  
Leitch, et al., eds.  
Reviewed by Michael Punt

Seeing / Hearing / Speaking, by Takahiko Imura.  
Reviewed by Fred Andersson

Women Artists: The Other Side of the Picture  
Reviewed by Aaris Sherin

Zinat: One Special Day  
Reviewed by Aaris Sherin

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BEYOND PRODUCTIVITY: INFORMATION TECHNOLOGY, INNOVATION, AND  
CREATIVITY

William J. Mitchell, Alan S. Inouye and Marjory S. Blumenthal,  
editors.  
Committee on Information Technology and Creativity, The  
National Academies Press, Washington, D.C., 2003. 268 pp.,  
illus. b/w, \$35.00 (\$28.00 web). ISBN: 0-309-08868-2. Library of  
Congress Catalog #2003103683.

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This is a timely and unusual publication, both from the perspective of the Computer Science and Telecommunications Board (part of the U.S. National Academies) and from the perspective of new media studies. It is the report of a committee established under the chairmanship of Bill Mitchell in 2000 by the CSTB, the leading U.S. computer-science policy advisory body, with encouragement from Joan Shigekawa of the Rockefeller Foundation. Its key area of investigation is the "dynamic intersection" between art/design and technology. It tackles issues common to policy-makers, artists, academics and art-technology research institutes across the world. While the specifics of most of its research are related to the United States, many of its recommendations will translate to other geographical contexts and, with some careful mediation, it could also be usefully employed as an advocacy and communication tool elsewhere. On page 2, it sets the agenda and context for the report: "It has now reached a stage of maturity, cost-effectiveness, and diffusion that enables its effective engagement with many areas of the arts and design - not just to enhance productivity or to allow more efficient distribution, but to open up new creative possibilities." The book cites numerous examples of projects in the U.S., and occasionally elsewhere, analyzing why certain activities or trends have emerged and suggesting how these might be built on and extended. To ensure that the ground on which it is standing is demarcated, the committee proposes a new term - Information Technology and Creative Practices (ITCP) - to signify the range of its enquiry. Its scope is impressive: it looks at tools and the influence of art and design on computer science and vice-versa; it considers venues, including public outlets; links with commercial labs and

studio-laboratories; networks of individual artists; regional and local clusters; links with industry; the emergence of high-speed networks and potential for distributed working.

The report considers (in one of its best chapters) the role of schools, colleges and universities, and also delves into key policy and funding support areas - very helpfully analyzing the differences and strengths that one might find not only within the United States but also, more broadly, in Europe and Asia. Much of this analysis is sure to be used elsewhere in future. On a slightly less positive note, the text is hard-going at times - a desire for inclusiveness has occasionally buried important points under the weight of detail. While it has real value as a reference text, it lacks an index, which is unfortunate. Similarly, the many footnotes carry an enormously interesting storehouse of key references, but are hard to read. It was a great relief to find the whole report available online, and easily downloadable, in PDF format. For details of this and more information about the CSTB, see <http://www.cstb.org>. I shouldn't underestimate the task undertaken by the committee, particularly the editors. Just achieving the objective of mapping and surveying key clusters of activities will have been difficult. The picture that emerges is inevitably a highly complex one, not readily distilled or easily synthesized into a simple set of achievable recommendations.

The sheer enormity of the gaps between established computer science research infrastructures and the bottom-up, networked trends in contemporary media art need acknowledgement and the report does not pretend otherwise. That the gaps can be bridged, though, is an initial premise and the report throws up some useful practical observations, particularly relevant to academic research. It asks a key question about "standards," i.e. "for or against"? It also identifies the lack of parity among disciplines in terms of reward structures, absences of validation mechanisms, difficulties of achieving legitimacy and recognition, failure to sustain experimental models with short-termism (an in-built weakness), the need for maturation of assessment criteria, a need for development of enhanced historical perspectives, challenges of presenting work to panels comprised of specialists in singular areas, the scarcity of data about emergent trends, and the benefits of appointing senior figures, perhaps on a short-term basis, linked to ITCP projects within universities to help raise profile and achieve much-needed advocacy.

Soon in the U.K., research councils will be meeting to discuss ways in which they can collaborate around arts/science/technology interfaces. Collaborative fellowships are being set up, as they are in Canada. Both Canada and Australia are setting up cross-sectoral programs: the trend towards interdisciplinarity within research appears to be unstoppable. This book provides a clear platform upon which further investigations can take place. Perhaps this is a good time to propose the establishment of a network of agencies involved in constructing solutions to the challenges so usefully articulated here

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CREPUSCULAR DAWN

by Paul Virilio and Sylvre Lotringer. Semiotext(e) (Foreign Agents Series), 2002, 185 pages. ISBN: 9-781584-350132.

Reviewed by Sean Cubitt, Screen and Media Studies, University of Waikato, Private Bag 3105, Hamilton, New Zealand.  
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Paul Virilio has long been admired and cited by the theoretically inclined techno-savvy of <nettime>. Nowadays, largely thanks to the efforts of John Armitage (2000, 2002), he is becoming an obligatory citation for many social and media theorists of more traditional kinds. This book forms an excellent career overview and contains plenty of surprises and new material for readers who already know of his earlier work. \*Crepuscular Dawn\* is a book-length interview with Sylvre Lotringer, himself a doughty figure in anarcho-artistic New York as the eminence grise of Semiotext(e), the notorious journal and publishing house. The book's title loses something in translation - in French it probably has the paradoxical music of Eliot's "midwinter spring" - and the translating is at times a tad slapdash (for example, when an English film title is translated back from the French), but these are niggling criticisms of a fluent, likeable and invigorating portrait of an exceptional, even visionary mind at the top of his bent, relaxing with an old friend in cafés around Paris, sparking ideas, thinking aloud and on his feet. Dialogue is more often praised than practiced in contemporary theory: this is less an interview than a conversation, and a particularly eloquent and enjoyable one to eavesdrop on.

Lotringer provides a handy introduction, then leaps straight into the dialogue. Virilio recounts his early days as a radical architect, in some detail, culminating in the Oblique Function (you'll have to read the book to figure this one out). Then on to Nanterre, epicenter of May '68. Every French intellectual alive at the time, and many active since, have placed themselves on the map of ideas in relation to Le joli Mai. Already "anarchist Christian," Virilio marched with the black flags of the anarchists until he had the idea of making himself a transparent one out of clear plastic. With Julian Beck of the Living Theatre, who had been invited to play there but sided with the students, Virilio and his colleagues took over the Odéon Theatre, a major center of the May events. Students who heard him speak there invited him to teach at the Ecole Supérieure d'Architecture, where he has remained, more a thinker - and activist - than a builder of buildings.

The events of May also transformed Virilio's thinking. Initially inspired by the architecture of the bunkers left by the German army along the Normandy coast, the subject of a remarkable early book, Virilio increasingly turned his attention towards time, and specifically towards speed. Of the major figures of the day, Virilio cites Henri Lefebvre and Gilles Deleuze as colleagues with whom he had political disputes, but who also took up, in their own ways and in their own good time, the temporal problematic. Lefebvre is especially important, given his active part in May '68 and his association with the Situationists, especially Guy Debord. Lefebvre's *Production of Space* (1991) is a landmark in the (post)modernization of geography, but failed, in Virilio's view, to understand the vector of time as it accelerates in the post-war period. Virilio's basic discipline remains urbanism and town planning, a field where transportation is a central concern. His uniqueness comes from his understanding that media are also means of transport (he has an eloquent description of the windscreen of the car being a kind of TV screen), an *apperçu* that has become

more complex and richer as networks speed up, become more ubiquitous, and lose their architectural anchorage to become portable and wearable.

Virilio, as is well known, shares with Friedrich Kittler a belief traceable back to Nietzsche that war is the typical state of human societies. Here that idea is extended towards genetic engineering, whose roots Virilio traces back to eugenics and, most of all, to Mengele's notorious experiments on the inmates of the death camps. This issue is, to add a geo-politically particular note, extremely illuminating for New Zealand, where this review is being typed. The last election and key negotiations with the U.S. will be fought on bio-security of a fragile and unique environment and the supposed rights of Monsanto and the others. At the same time, the academic community is being rocked, for the second time in a decade, by a scandal concerning holocaust denial. For Virilio, the two are strictly intertwined. Mengele's experiments and those of bio-engineering are not only usurpations of God's role, from a Catholic phenomenological perspective; they unleash the prospect of the Genetic Bomb.

To clarify this point, we need to bring in another of Virilio's major arguments. The invention of the railway is also the invention of the train wreck, the automobile of the car smash, the computer data crash, and genetic engineering of biological collapse. To the extent that all our media and transportation systems are now networked in real time, the accident stops being a purely local or personal event, and becomes instead potentially global: the General Accident. Virilio here puns on the philosophical term "accidence," an actually existing phenomenon which lacks the necessity of an absolute essence. Essential matters have become inessential, simulacra and simulations, and at the same time they have exploded. This is especially the case with dimensions. Time has begun to vanish in the perpetual acceleration of media, and space threatens to disappear as media and transport systems become more and more integrated into what was once a wholly human body.

It is easy enough to run a critique of these ideas. In these interviews, Virilio is open and unapologetic about his Catholicism, and vocal in his announcement of his phenomenological bearings (among information theorists, he reserves a good word for the phenomenologist Varela). Yet he is not always accurate in his accounts: media are not "instantaneous," nor is there much mileage in trying to find an example of a society without media, or a human body untouched by mediations, from gesture to clothing, language to food. The materialism of contemporary science and contemporary theory looks askance at the prospect of essences transcending the accidence of physical reality. And though in some ways Armageddon has been an option since the arrival of the A-bomb, horror has a way of creeping through the world rather than blasting it in some blockbuster finale.

But it would be wrong to treat Virilio as a systematic thinker, whatever he thinks about the matter. His strength is as an aphorist. "Apocalypse is happening all the time, every day since Genesis. It never stops. Man is the end of the world" he says, or, distinguishing carefully that he is addressing the labs rather than the gas chambers, "Auschwitz was not only a crime against humanity: it is the beginning of the accident of science." For Virilio, there is a certainty, a destiny, involved in human affairs. Fallen humanity sets out on broken paths, all

of which lead by crooked routes to the integral logic of their conclusions. To the extent that the project of Western science has been one of control, it has produced its opposite. To the extent that it aims to secure a better life, it produces not just a worse one, but death, and on a scale that beggars imagination.

On the other hand, in the closing section during a discussion of the Unabomber, Virilio recalls another biblical episode that puts all this predestination into perspective, as if fate were the product of a scientific principle - the principle, presumably, of predictability. "That's what our job is," he argues, "to wrestle with the genetic bomb as human beings - not as gods. To wrestle with the information bomb so as to produce something other than cybernetics. To wrestle with the atom bomb so as to avoid blowing everything to kingdom come. So I don't believe the world is finished, either. I am not a nihilist. I am simply saying that we have to fight like Jacob. Each person must wrestle with the angel."

Sadly this does not extend to many of the artists involved in Leonardo. Stelarc ("futurist") and Eduardo Kac both get a pasting. And the editor of these digital reviews is name-checked as a "sorcerer's apprentice," but mistakenly identified as the "semi-living" tissue work, the work of Oron Catts, not Mike Punt. But the epigrammatist who asks us to reflect on whether reflection has become reflex, and habitat a habit, has as his task to spur us into thought - and action. Accuracy is a virtue for accountants. The true visionaries will have to have it in abundance, but till they arrive, it's good to have someone there to remind us how high the stakes are that we are all playing for.

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Henri Lefebvre, \*The Production of Space,\* trans. Donald Nicholson-Smith (Oxford, Blackwell: 1991).

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#### INVENTION OF HYSTERIA: CHARCOT AND THE PHOTOGRAPHIC ICONOGRAPHY OF THE SALPETRIERE

by George Didi-Huberman. MIT Press, Cambridge MA, 2003. 375 pp., illus. Trade, \$34.95. ISBN: 0-262-04215-0.

Reviewed by Allan Graubard, 2900 Connecticut Ave., NW, Washington, DC 20008, U.S.A.  
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"What the hysterics of the Salpetriere could exhibit with their bodies betokens an extraordinary complicity between patients and doctors, a relationship of desires, gazes, and knowledge. This relationship is interrogated here." (\*Invention of Hysteria: Charcot and the Photographic Iconography of The Salpetriere\*, p. xi)

With this, George Didi-Huberman opens his work on the rediscovery of hysteria by Dr. Jean-Martin Charcot, founder of neurology and a major influence on Freud. Since the book's first publication in France in 1982, we still cannot avoid its poignant reflections on the history of medical diagnosis and the doctor-patient relationship. For, in the shadow thrown by this book, there are still questions worth asking. They are not about how far we have come, which is evident, but what we have overlooked or refused to admit along the way. In effect, where do epistemological issues intrude upon medical science and how, within medical practice, can we fail to recognize that meaning is an applied value? That these issues then had about them an erotic and sexual significance, hysteria being predominantly a "woman's" disorder, treated by men in a large institution where control presided over cure or release to excess, reveals something else about late nineteenth-century medicine at the Salpêtrière: its exclusionary function and its theatrical context; the latter, I suggest, still has not left us, however radically its terms have altered.

In another sense, this work is as much a study of a transitional moment in medical analysis - when the search for the biophysical "lesion" turned to the characterization of a psychological "disorder" - as a study of the limitations of that analysis and the critical need to understand its cultural and technological context, the advent of photography legitimating Charcot's work with a cutting irony that Didi-Huberman captures from the start. The visual identification of the "seat of the illness," along with all its lexical derivations, deprives the patient of an essential indeterminacy, the individual uniqueness she desperately searches for through her symptoms and, if called on, her appearances at Charcot's Tuesday lectures. There is little hope for a way out, however efficiently the patient satisfies her doctor's expectations in terms of symptom type or kind, and the resulting constriction of space, both internal and external, even perhaps of hope, cannot mask a violation, which, for Didi-Huberman, turned to "hatred."

The medical science we know, or wish we knew, seems far afield here. But then the title of this book, with its stress on invention, carries the point throughout with a vivacity often lacking in other historical works. For Didi-Huberman, the argument evolves not only through the eye and his analysis of the photographic oeuvre on hysteria, but in response to how poignantly that oeuvre touched him. Indeed, it is difficult at times not to recoil from the therapies inflicted on these women by their doctors, whether performed to alleviate suffering or in pursuit of a specialized bit of knowledge.

Here again I take the author's tack and style as a strategic difference that distances him from the kind of "confirmation" that the photograph provided then, and which in our visual culture also raises the stakes to a critical breaking point, where voices such as Artaud and Bataille's resonate, especially in regard to the hysterical body, the body dispossessed of itself. A retrospective examination of "Charcot and the Photographic Iconography of the Salpêtrière," as the subtitle to the book terms it - yes, of course, but this retrospection, intense, sustained and supple, approaches us without the usual cautions, laying bare an invidious passion that the hysteric's cry, at last, contravenes: the theatricalization of a diagnosis, the staging of the body of disease.

Structured in two sections - "Spectacular Evidence" and

"Charming Augustine," referring to Charcot's prize hysteric, whose photos in extremis would later captivate the surrealists - the work concludes with important appendices of source documents, including Augustine's account of a delirium that her doctor(s) provoked by ether.

\*Invention of Hysteria\* is a significant examination of an often blurred landscape between pain and performance that we, in the twenty-first century, continue to build our households in, all wishful thinking aside.

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LANGUAGES FAMILIAR TO THE AUTHOR

English

THESIS TITLE

"Public News Network: Digital Sampling To Create a Hybrid Media Feed"

ABSTRACT

A software application called Public News Network (PNN) is created in this thesis, which functions to produce an aesthetic experience in the viewer. The application engenders this experience by presenting a three-dimensional virtual world that the viewer can navigate using the computer mouse and keyboard. As the viewer navigates the environment she sees irregularly shaped objects resting on an infinite ground plane, and hears an ethereal wind. As the viewer nears the objects, the sound transforms into the sound of television static and text is displayed which identifies this object as representative of an episode of the evening news. The viewer "touches" the episode and a "disembodied" transcript of the broadcast begins to scroll across the screen. With further interaction, video of the broadcast streams across the surfaces of the environment, distorted by the shapes upon which it flows. The viewer can further manipulate and repurpose the broadcast by searching for words contained within the transcript. The results of this search are reassembled into a new, re-contextualized display of video containing the search terms stripped from their original, pre-packaged context. It is this willful manipulation that completes the opportunity for true meaning to appear.

KEYWORDS

Sampling, Streaming Video, OpenGL, Virtual Reality, Navigable Space, New Media, Electronic, Context, Art, Online, Internet

YEAR IT WAS PUBLISHED/EXAMINED

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What is the value of artistic practices, techniques, inventions, aesthetics and knowledge for the working scientist? What is the value of scientific practices, techniques, inventions, aesthetics and knowledge for the artist? When does art become science and science, art? Or are these categories useless at their boundaries and intersections? Can an individual excel at both science and art, or is even a passing familiarity with one sufficient to influence significantly the other? Do the arts ever contribute significantly to scientific progress? Where will current scientific innovations lead the arts in the next few decades?

\*Leonardo\* will publish a series of special sections over the next three years devoted to exploring these questions. Submissions can be from artistic scientists who find their art avocation valuable; from scientist-artist collaborators who can demonstrate a scientific or artistic innovation; from scientifically literate artists who draw problems, materials, techniques or processes from the sciences; or from historians of art or science looking at past examples of such interactions.

Interested authors are invited to send proposals, queries and/or manuscripts to Guest Editor Robert Root-Bernstein, 2201



ISAST NEWS
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#### PAMELA GRANT-RYAN CELEBRATES 20 YEARS WITH LEONARDO

Leonardo Managing Editor Pamela Grant-Ryan this fall celebrates 20 years working with the Leonardo network. Under Pamela's leadership, the Leonardo publication landscape has been transformed. Twenty years ago Leonardo was a small quarterly academic journal published by Pergamon Press. Today the Leonardo publications include the now bi-monthly Leonardo, including the Leonardo Music Journal and CD Series, the Leonardo on-line publications, Leonardo Electronic Almanac and the Leonardo Book Series, all now published with MIT Press. Pamela oversaw the transition from traditional print to desktop and now to full hybrid on-line and print publication. Each issue of the journals appears simultaneously on line and in print, reaching a diverse international audience. This growth reflects the explosion of interest in the intersection of the arts, sciences and technology, but the success reflects Pamela's broad experience, thirst for change, curiosity and community building. She has worked with thousands of Leonardo authors, helping drive texts into statements that can be understood by readers of diverse cultures and levels of background.

It is often hard for people to understand that the Leonardo "empire" is piloted by a small group of five part-time staff, in collaboration with hundreds of volunteers internationally. Leonardo is, like all small visionary activities, financially unstable; the Leonardo office has been in more than nine different locations over these 20 years, reflecting the continuous struggle to survive. Yet over 20 years, over 100 issues, Leonardo has always appeared on time.

Through all this turmoil, Pamela has insisted on rigor, originality and clarity, as well as ethical honesty. Our community is the beneficiary of her dedication and professionalism. We look forward to working with her over the years to come to help Leonardo mutate yet again as we adjust to the changes in the world around us. She is now working with a new "Leonardo Experimental Issue" project to pioneer new ways to bring new ideas and innovative work, especially from younger scholars and artists, to the attention to a growing planetary community seeking to build a sustainable new culture that contributes to human development. Those of you wishing to join us in thanking Pamela for her dedication to the Leonardo network may wish to send an email to [pgr@sfsu.edu](mailto:pgr@sfsu.edu).

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#### ROBERT ROOT-BERNSTEIN JOINS LEONARDO EDITORIAL BOARD

Bob Root-Bernstein obtained his A. B. in Biochemistry from Princeton University and his Ph.D. in the History of Science with Thomas Kuhn at the same institution. He then did post-

doctoral work with Dr. Jonas Salk at the Salk Institute in La Jolla, where he was awarded one of the first MacArthur Fellowships. He is currently Professor of Physiology at Michigan State University, where he studies the evolution of metabolic control systems, autoimmune diseases, drug development, scientific creativity and arts-sciences interactions. He is himself an amateur artist and photographer who believes that understanding can be achieved only by active participation in a discipline, and integration through understanding. He can be reached at Root-Bernstein@psl.msu.edu

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#### MARC BATTIER ELECTED PRESIDENT OF LEONARDO/OLATS

Marc Battier has taken up duty as President of the Board of Directors Scientific Counsel of Leonardo/OLATS. Battier has been composing computer music for over 30 years (live and tape). His latest CD, Nine pieces on works by Matta, with poems by Zeno Bieanu, will be released in the Fall of 2003. As an author, Battier has written books and numerous articles on electronic and computer music. His research interests include the history of electrical and electronic musical instruments, past of audio technology, interaction with other arts, use of audio in literature and poetry, development of electronic and computer music and analysis methods for electronic music. As professor at the University of Paris Sorbonne, Battier heads the MINT research group (Musicologie, Informatique et Nouvelles Technologies). Battier is also Vice-President of the Electronic Music Foundation.

Battier has been deeply involved in the Leonardo network on many levels. He has published in Leonardo and Leonardo Music Journal and is a Leonardo manuscript reviewer on the subjects of technology, French culture, and European culture. Battier joins a distinguished group on the Leonardo/OLATS governing board: Annick Bureau, Jean-Daniel Gardre, Julien Knebusch, Jean-Paul Longavesne, Roger Malina, Ramuntcho Matta, Christine Maxwell, Samuel Okoshken, and Vincent Winter. Battier may be reached at marc.battier@paris4.sorbonne.fr.

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#### ARTMEDIA VIII SYMPOSIUM PROCEEDINGS

The latest issue of the journal \*Ligeia\* is dedicated to the proceedings of the International Symposium "Artmedia VIII: From Aesthetics of Communication to Net art." Under the title "Art et Multimedia," the texts of the December 2002 symposium in Paris, co-organized by Annick Bureau, Fred Forest and Mario Costa, will be published in French, as well as a selection translated into English. Information related to the symposium is available on-line on the Leonardo/OLATS web site at <http://www.olats.org/setF11.html>.

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