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<u>On the Brink of the Volcano:</u>
Convergence, Ephemeralization, and the Telos of Technology

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Abstract

As the grand convergence of global systems and cultures continues to accelerate, civilization faces the growing threat of a cascading collapse catalyzed by technology, avoidable only by minimizing causes of disaffection and reorienting technology's purpose. Tools and technology originate in the embodiment of spirit and its drive to extend into the world, but the exclusively human capacity to conceive of limitlessness drives the futile quest to transcend all limitation by technical means—to "be as gods". The toxic misuse of technology's power now decimating the biosphere is the outcome of the scientifically unsupported, theologically distorted, morally untenable human self-concept as the supreme species limitlessly entitled to anything the Earth has to offer, at whatever cost to the other species. Fidelity to science, to religion's call to stewardship, and to the survival of civilization require that humanity reconceive itself as the guiding intelligence of all embodied life, awakening to its common purpose: to restore and safeguard the planetary commonwealth of all who sharing Earth's lands, waters, and skies. Fully accepting that destiny could redeem civilization, motivating its transformation to sustainability and environmental harmony, thus heeding the ancient charge: "Therefore choose life".

[Paper]

The "bottleneck" is what I believe humanity's in right now.

—E. O. Wilson[1]

Having reflected gratefully on Prof. Egbert Schuurman's prophetic valedictory essay (2008), I find myself pondering whether the gravity of his warning that civilization itself is teetering "on the brink of a volcano that is about to erupt" (77) is fully appreciated—that literally everything we value is at mortal and imminent risk. After three decades as a professional technologist and twelve years exploring the social and spiritual implications of technological development, I find his warning to be neither hyperbole or metaphysics; instead, his essay can be understood as a meditation on how humanity has arrived at the brink and what can still be done about it.

My response is to consider from an insider's view how and why technology poses the threat of driving history toward a series of events equivalent to what evolutionary biologists call a bottleneck: a period of extremely adverse conditions survived only by a small fraction of a vast and varied population. The convergence of technological systems is one part of the unprecedented convergence of cultures, and also the convergence of environmental, social, and political crises: resource exhaustion, habitat destruction, climate disruption, ozone depletion, desertification of land and seas, proliferation of nuclear weapons, overpopulation, regional pollution, antibiotics resistance, economic instability, extreme poverty, local wars, culture clashes, failed states, and so forth, all converging into a single menacing complex of mutually reinforcing challenges.

Although simultaneous crises have always been with us, this Grand Convergence is unique in that previously discrete crises interact like falling dominoes, requiring only a catalyst to converge finally into a single overwhelming mega-crisis. The catalyst needs only an agent and a means to set the dominoes falling. Jihadist terrorists, racist militias, criminal anarchists, and other disaffected individuals and groups are poised to act as the agent, but random factors—a solar flare, accidental damage to a critical system, a programming error, etc.—could also serve. The means to initiate the cascading failure that would catalyze the bottleneck is being made available by the dynamics of technological development. Such a crucible would amount to history's culmination, bringing either the onset of "a new Heaven and a new Earth" resembling the brightest visions of the prophets, or a global downfall presaged by their darkest revelations.

In the first part of this article, the nature and scope of this peril is described.[2] In the second, the spiritual character of technology is explored to determine how the peril is to be met. In the conclusion, a model to supplant the reigning technological paradigm is outlined briefly, founded on a reorientation of human purpose toward serving as the intelligence of the planetary commonwealth in the service of all beings who share the Earth.

While the sand slipped through the opening,
And their hands reached for the golden ring,
With their hearts they turned to each others' hearts for refuge,
In the troubled years that came before the Deluge.

—Jackson Browne[3]

I. Ephemeralization, Catalysis, and Cascading Cataclysm

In his 1964 magnum opus *The Technological Society*, French social critic and Reformed theologian Jacques Ellul uses the word **Technique** to signify the abstract meaning of what is now usually called technology. For him, Technique is the integrated set of all specific methodologies, components, and systems, organized and united by the principle of progressively optimized efficiency—a streamlined, symmetrical, harmonious quality expressed by the adjective "elegant" or more recently, "cool". Technique operates in ways that impose a mechanistic efficiency on the systems it affects, including their human "components", and in the process "eliminates or subordinates the natural world and does not allow this world to restore itself… ." (*The Technological Bluff*, 79)

Applied as technology, Technique develops to maximize production and meet market demands, and in doing so establishes a positive feedback loop—a self-reinforcing chain of events in which advances in one area enable progress in others. Upgrade by upgrade, inefficiency is squeezed out, sources of inertia and resistance are attacked and neutralized, and a kind of evolutionary process gathers speed and power and inertia over time, culminating in the reshaping of everything "over, under, around, and through" us day by day.

The constant pull toward maximum efficiency entails specific consequences. Systems tend to converge into more and more densely integrated systems; formerly discrete kinds of systems converge into complexes; economic and political, military and industrial, legal and financial, cultural, medical, and educational operations, and so on, which integrate into mega-systems. This recursive process is continually expanding and minimally constrained because of its innovative and abundant production. The result is a positive feedback loop that accelerates beyond anyone's control. In a speech on globalization and national security delivered on 15 November 2000 to military and foreign policy analysts and broadcast on the C-SPAN cable network, Thomas Friedman, the essayist and author known for popularizing convergence in *The World is Flat*, addressed this directly. There he said that he was asked by the editor of Egypt's equivalent of *Business Week* whether the West could be prevailed upon to slow down the "runaway train" of technological development to enable developing economies to catch up. His answer: "The problem is, there's nobody driving. … Find me the engineer, I'll slow down the train." It cannot be slowed down, because no one is driving. The driving force, in Friedman's view, is technological innovation, itself guided by science and driven by the inchoate demands of the market.

Buckminster Fuller, perhaps the 20th Century's best-known and most passionate proponent of industrial technology, defined its essence in 1922: **to "do more and more with less and less until eventually you can do everything with nothing**." (122) This he saw as an ongoing process, which he called **ephemeralization**—meaning the process

whereby technical means become decreasingly physical and increasingly ephemeral—transient and insubstantial. Performance tends to improve as physicality is minimized, reducing resistance, inertia, entropy, waste, and attendant costs. An example is communications technology, which has evolved from the solidity of carvings on stone tablets that can last for millennia to the ephemerality of microwave signals that invisibly saturate the air and are gone in an instant. As portrayed in the prophetic 1959 film "Forbidden Planet", the end of this process is reached when physical instrumentality has been minimized to nil.

The efficiencies and economies of scale achieved through Ephemeralization enable technological products to become cheaper, easier to acquire, and more intuitive to control, multiplying the ways and means by which technologies can be accessed and acquired. The blessings of technology thereby proliferate.

At the same time and for the same reasons, Ephemeralization has its down side, flinging open to all the Pandora's Box of destructive technological power is flung open to all. As digital, pervasive, integrated, and ephemeral components supplant more substantial instrumentalities, systems lose robustness and become increasingly susceptible to disruption and failure. Frangible systems converge and interact with others, increasing overall complexity and making it all the more likely any such disruption will cascade across multiple systems.

An example is a cascading failure of electrical power generation installations rolling across vast regions after an event as minor as a tree falling across a critical power line shuts down one power plant after another as the resulting overload is automatically switched from each one to the next. A cascading financial crash, often caused by little more than a random fluctuation in the collective mood that destabilizes an already precarious economic system, illustrates the syndrome even more vividly—and expensively.

Ironically, the more rapidly technology develops, the smaller is the relative percentage of effort devoted to shoring up and "failsafe-ing" systems at their points of potential failure— which often cannot be identified beforehand. Designed into today's complex systems are increasingly advanced security measures, the most advanced being those that protect financial and military operations; but innovation and expansion tend to outpace them. A system's defenses may be doubled in effectiveness during the same period its overall complexity and scale increase a hundred-fold. The more protected a system becomes, the more enticing it appears to "crackers" perversely eager to prove their skills by penetrating its firewalls, passcodes, and filters to crash it. The more prominent and essential a system becomes, the more complex it is likely to be, and thus the more vulnerable to attack by those who would disrupt it for their own purposes—enemies (state or stateless), extreme anarchists, and criminals of all kinds. Errors in design or programming, malware that surreptitiously assumes control of millions of computers via the Internet, and merely random events can also disrupt.

As convergence and ephemerality increases exponentially, it is logically inevitable that at some theoretical point at which practically any disruption, intentional or not, could initiate a catastrophic cascade, bringing down not just the systems immediately affected, but the entire complex of converged systems, and with them potentially the infrastructure of the entire social order.

As the Ephemeralization of systems continues to accelerate, the odds increase that a malicious catalyzing event will set off a much more terrible set of consequences than even the perpetrators contemplate, collapsing system after system like dominos until the entire socioeconomic edifice is brought down. On 11 September 2001 the world got a taste of the increasing asymmetry between the force needed to set in motion a cascading failure and the eventual consequences of the resulting chain reaction, which in that event far exceeded the expectations of even the conspirators.[4]

Yet as Prof. Schuurman observes, the "Jihadist terrorists", however adept in their destructive uses of technology, are "only the most powerful and the most dangerous expression of the spreading counter-movements ... today found around the world". (77) They are perhaps the most visible subset of the growing number of affinity groups ever more alienated and disaffected from the triumphal march of technological civilization—meeting secretly, demonstrating openly, praying devoutly, or staring angrily at their video screens. Inhabiting not a state but a state of mind, they are more pervasive and harder to neutralize or even to identify than those who identify themselves publicly as "Jihadists".

"The way out of the deadlock will be found through selflessness. The only alternative that can bring a solution will be to stop hating and to love, to stop wanting and to give, to stop dominating and to serve." (18) It is a message consistent with all three Abrahamic religions, but the growing frangibility of technology gives it a harder edge. On the brink of the volcano, the charge of the Prophet Moses becomes our charge as well: "Life and death, blessing and curse, are set before you. Therefore choose life, that you and your descendents may live." As technological civilization hurtles toward its crucible, that admonition can be taken literally.

We are lived by forces we scarcely understand. —W.H. Auden

II. The Telos of Technology and Its Spiritual Challenge

In his contribution to this conversation, René Munnik begins with the Roman Catholic definition of technology and develops it to its profoundest depths, in effect aligning it with the most profound of Augustine's Confessions: *Nos fecisti ad te et inquietum est cor nostrum donec requiescat in te*—"We are made for you and restless is our heart until it rests in you." What Prof. Munnik names as the ultimate motivator underlying the technological paradigm, "the human uncontrollable desire" is the primal longing in each soul for the restoration of that originary union—the longing that humanity perversely or obliviously attempts to satisfy through domination and through liberation from all restraint.

The perspective that technology is in essence a spiritual phenomenon carries with it the implication that the dis-ease infecting technological civilization is not curable by treating symptoms, through ameliorations such as solar panels, hybrid cars, organic farming, tree planting, recycling, carbon credits, condom distribution, land trusts, environmental controls, etc.—however conscientiously applied. Such symptomatic relief is necessary but cannot cure.

In its fundamental nature, technology is rooted in the physical embodiment of spirit. Every embodied being lives its life by extending its being into the faculties provided by its

physical body. Many creatures extend their being yet farther by annexing inert objects—rocks, sticks, strands, the remains of other creatures, and so on. A bird poking an insect out of a hole gripping a stick in her beak, or a primate carefully selecting a series of particularly shaped stones to form a set for accomplishing a series of related tasks, or offer proof that non-humans make and use tools and even systems of tools. For humans and non-humans alike, the experience of tools is the same: all become extensions of the user's being projected into the world in ways that overcome physical limitations. Scientist-philosopher Michael Polanyi named this "indwelling": persons *indwell* their bodies and thence their tools, attending **to** the object of their interest by attending **through** their tools, subsidiarily. Referring to Polanyi's *Scientific Thoughts and Social Realities*, physicist Yu Zhenhua observes:

> Normally, we do not attend to our body as an external object, but we always rely on our body as a means for our intellectual and practical control of the outside world. Polanyi generalizes this point and says: *"We may identify, therefore, our knowing of something by attending to something else with the kind of knowledge we have of our own body by dwelling in it."* (9)

Technology, rather than being exclusive to or definitive of humanity, is a continuum that begins with embodiment itself, relating us in the most fundamental way to the other species facing mortality along with us. From our bodies, we extend their being into tools, making them a part of us and we a part of them. Thence we come to indwell systems of tools, i.e. technology.[5]

What is it that distinguishes human technology from its precursors, other than degrees of complexity and scope? What makes the qualitative distinction between a hungry primate reaching into an anthill using a straw to extract the ants, and a lonely human reaching wirelessly into cyberspace to commune with a loved one on another continent? Why is the development of technology so much more absorbing for humanity—so much more integral to human being?

The Genesis story shared by the Abrahamic religions draws the line differentiating human from all other terrestrial embodiments of being. In Genesis 3, the story of Adam and Eve symbolizes the advent of the first humans to manifest our defining trait. "For [when you gain the knowing] your eyes will be opened, and you will be as gods, understanding good and evil." (Genesis 3:5) That promise, passed up the chain of being from animal consciousness to Eve to Adam, can be articulated as: *by their own outreaching, extending themselves into the physical world, mortals can transcend the limits imposed by their physicality*. To be tempted by that promise requires a power available only to humans (as far as we know): the power to comprehend **limitlessness**—to grasp that more and more (of anything) can lead to more and more, and then more and more, without end. To conceive limitlessness is to know something of the divine, if only its shadow. From the human perspective, it is the possession of limitlessness that distinguishes divinity from mortality—which entails freedom from any and all bounds imposed by physicality, hence immortality, and hence the unlimited power to instantly actualize one's intentions unimpeded by physical inertia or even by the need for physical instrumentality. From this soaring perspective, even God becomes defined by limitlessness, as "that than which nothing greater can be conceived" (Anselm, Avicenna).

The primal desire innate in all animals, whether human or non-human—that there be no impediment to fulfilling one's immediate desires—becomes transformed when experienced by a being capable of conceiving of limitlessness. That knowing initiates the quest for limitless wealth and unlimited power, limitless beauty and absolute perfection, limitless discovery and unconstrained innovation, limitless conquest and endless empire, limitless freedom and ruthless domination, limitless truth and infinite justice, limitless progress and optimal efficiency—the scope of the quest is... limitless. It is that same knowing that engenders the human presumption that technology can advance indefinitely to solve all problems—even those caused by technology itself—and that the resources and capacities to do so can be extracted inexhaustibly from the lands, seas, skies, and the denizens thereof.

The technological dynamic of always striving to "do more and more with less and less" puts technology on a trajectory that ends only in limitlessness. Whether one realizes this or not, each time one uses technical means to overcome obstacles and effect intentions, and then feels drawn toward the horizon of ever better means—new! improved!—one is in quest of limitlessness: omnipotence, omniscience, and omnipresence; the power to do everything while requiring nothing, in other words to actualize all desires without the need for physical instrumentality—***to be as gods***. Offered this choice prior to his gaining moral insight, Adam is too naïve to discern the cruel twist: though a mortal may strive to be ***as*** a god, a mortal can never ***become*** a god—cannot transcend mortality to achieve limitlessness. Because entropy is of the essence of physicality, mortality is of the essence of physically embodied being ("From dust you were made..."), and thus limitedness is of the essence of mortality. In his naïveté, unaware that his being lives eternally in the midst of God's becoming, Adam and his descendents choose the self-separation from God that occurs whenever the quest to be ***as gods*** supplants the experience of abiding ***with God*** in caring for each other and for God's garden world.

Thus technology is **telic**—proceeding toward its ***telos***, meaning the outcome entailed by its fundamental nature from its very beginning. The technological ***telos*** is unattainable because, as in relativity theory, approaching the asymptote of limitlessness generates an equal and opposite tendency toward disruption. As the converged mega-system of technological civilization approaches the asymptote of limitless power from limitlessly ephemeral instrumentality, it simultaneously approaches the asymptote of infinite frangibility. Somewhere between there and where we are now is the practical limit of technological progress, beyond which lies the chasm.

If technology is not to drive civilization and its environment into unsustainable frangibility and ultimate cataclysm, its all-consuming positive feedback loop must be contained and redirected by some guiding influence. That benign constraint cannot result from a reactionary Luddite suppression of technology, which is , bound to produce its own reaction. . What has to be supplanted is the subconscious striving for **omnipotence**—the "Monster of the Id"[6] in whose image technology now too often configures itself. Only a **conscious** purpose with the power to inspire a new paradigm for a sustainable, fulfilling world system can do so.

A very Faustian choice is upon us: whether to accept our corrosive and risky behavior as the unavoidable price of population and economic growth, or to take stock of ourselves and search for a new environmental ethic.[7]

—E.O. Wilson

We are stardust—we are golden—billion-year-old carbon,
And we've got to get ourselves back to the Garden.[8]

—Joni Mitchell

Conclusion
Beyond the Technological Paradigm: the Planetary Commonwealth
By updating both the idea of nature and the self-concept of humanity to reflect the freshest scientific findings, the most sensitive ethical insights, and the wisest spiritual counsel, conditions could be propitious for the emergence of a truer model to guide us through the crucible. The three ideas discussed previously—critical frangibility, the lure of unattainable limitlessness, and the kinship of living beings—suggest three objectives to guide that endeavor.
Critical frangibility. The threat that the increasing vulnerability to disruption as technology advances will catalyze a cascading collapse of civilization can be met sustainably in only one way: by alleviating, insofar as possible, the motivation for any person or group to bring down what they perceive to be the apparatus for injustice, ruthlessness, indifference, and corruption. The new model must therefore provide that justice, integrity, and caring for all persons are to be so deeply ingrained in every social institution and interpersonal encounter, so pervasively throughout the world, that alienation and disaffection in general are minimized.
This objective comes first because it is prerequisite and *sine qua non* for a sustainable technological civilization. Although strong security measures are needed to guard civilization's technical edifice, none can be so perfect as to obviate the need for this florescence of justice and mercy. And although such measures are mandated by every faith and every moral and ethical code, self-interest has heretofore enjoyed the luxury of routinely trumping and trampling on the moral imperative. What is required for our collective survival is to act from the realization that self-interest is now perfectly aligned with the moral imperative.
The lure of limitlessness. Achieving a sustainable civilization requires living within the limits imposed by our mortal finitude and planetary resources. That in turn dictates the second objective: a worldwide rectification in the ways most human beings sustain themselves and their families, pursue happiness, and define fulfillment. For the peoples of the developed nations, such a rectification implies a drastically curtailed dependence on acquiring and consuming material goods and cheap energy, and a repurposing of those

whose employment depends on the produce-consume-discard economic paradigm. For the peoples of developing nations, that entitlement carries with it the responsibility to drastically curtail birth rates (as with China's one child policy) in exchange for the assurance of a universal social safety net, since the established fact is that a reliable social welfare system and sufficient material sustenance are the only guarantors of achieving the significant, enduring, and voluntary reductions in human birth rates required for a sustainable planetary ecosystem.

The kinship of living beings. The first two objectives enable the third: the awakening of humanity to its unique, noble, and destined purpose. For the first time humanity is in a position to understand that its collective mission—the reason for having evolved from the elements of this planet—goes beyond survival and reproduction, domination and control, the limitless pursuit of ultimately worthless worldly rewards, and the ultimately futile pursuit "to be as gods".

Reconceiving both the natural and human worlds—constituting the one and only known biosphere in the universe—as a single community of mortal beings, each of whom is entitled to a share in the pursuit of happiness, reveals Nature in her true glory. Nature is neither a verdant recreational preserve or unfenced zoological garden between our cities, nor a teeming impersonal force whose legions are at war with humanity, but instead is an ecological commonwealth encompassing humanity as one species among millions of others engaged in the most wondrous miracle imaginable: the confluence of fiery spirit with the remains of stellar explosions in just the way that brings forth life on Earth.

Humanity is the species most capable of comprehending and appreciating that miracle. That fact alone should point to a purpose beyond the mundane. It is of the essence of the new paradigm that humanity realize its destined role as a special and integral part of the "natural" commonwealth of all beings—special not in privilege and dominion, but rather in capacities and responsibilities. "Commonwealth" in this expanded context it refers to the interdependence of all living beings in their natural harmony—a balance to be restored, safeguarded, and enhanced by the governing intelligence native to the Earth, which we call humanity.

Neither science nor religion dictates that humanity's destiny is to be the species whose intelligence brings on a planetary mass extinction—a cataclysm that has not happened for many millions of years, yet is already underway. Such an outcome of the human story exposes the failure of something essential to the reigning paradigm—the meaning it ascribes to *homo sapiens imago Dei*.

If it is not to implode, that paradigm can only be burst from within, as a cocoon is split open during metamorphosis when the being inside reveals itself transformed, or dies in the attempt. A paradigm cannot burst itself; revolutionary ideas must be put forward that the Spirit can charge with passion and commitment—ideas that, once articulated, become self-evidently the next step in the long Spirit-led progression toward humanity's salvation.

It is Prof. Schuurman's insight that the supplanting paradigm will "differ from the previous [paradigm], yet [incorporate] the old in a process of transformation…" (76) The new paradigm, implying as it does a continuum uniting humanity in the entire body of life, positions homo sapiens as the head that guides and heals the body of life instead of the ravening beast that consumes it. The conceptual reintegration of the being of humanity into

the being of nature requires a fundamental revaluation of the very idea of "species", as the world has struggled to revaluate the concepts of race and gender that have facilitated exploitation from time immemorial. Species must no longer be understood as the grounds for privileging humanity to do what it will with all other species.

Such a revaluation does not contradict the special spiritual status ascribed to humanity by the Abrahamic religions, intertwined as it is with our special responsibilities of stewardship and our God-given capacity for especially conscious discourse and communion with the Divine. That will become evident in the means by which the various religions and worldviews, in all their differences and particularities, find common ground to sanctify a new paradigm through which their faithful can survive and find fresh meaning in their faith.

To actualize this vision involves the globalizing of human purpose—an unprecedented transformation equivalent to the shift ages ago from hunter-gatherer to agrarian culture. A decisive transformation is indeed already underway, but not one favorable to life. Some scientists have named the present geological era the *Anthropocene*, because of its anthropocentric character—because humanity rather than geology or climate or cosmos is now determining the fate of the Earth. At present, "Anthropocene" has a shameful definition: the fleeting epoch during which the intelligence of one species perpetrates the Earth's sixth mass extinction while extinguishing its own culture. Yet "Anthropocene" could come to mean something entirely different—something noble, even redemptive: the time marked by the awakening of Earth's planetary intelligence just in time to circumvent catastrophe and ensure the safeguarding of all life.

Although the model presented here seems implausible given the ugly reality of the course of history, it derives plausibility from the likelihood that "choosing life" in this particular way may be the only alternative to plunging the world into a depthless dark age that would surely efface all but the most minuscule traces of science and crumbs of culture, once and for all enshrouding the great religions in a contemptible tyranny of taboo and superstition. Truly we would be the children of Sisyphus.

The array of human intelligences—intellectual, emotional, physical, spiritual, each illuminating the others—is the source of so much shameful devastation and revolting venality for so long, and now such incalculable danger; yet equally the source of so much power and so many marvels, of such insight and beauty. It is human beings who are most gifted to mirror God's love for this rich, beautiful, delicate, and precious world and all who share its lands, waters, and skies. It is we who hold the fate of the Earth in our nimble grasp, gifted as we are with the technical means to assure the planetary commonwealth's healing and harmonious continuation. Bound to Nature yet uplifted by Spirit, divinely called to choose life by serving rather than destroying it, humanity is commissioned to care as no other species can for life's only known harbor in the cosmos—this small blue planet, still steeped in its dream.

[End]

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Notes

[1] Interview of Edward O. Wilson by Ben Wattenberg, PBS Think Tank television program, 12 December 2002. Transcript: www.pbs.org/thinktank/transcript1021.html

[2] As noted below, the dynamics of technological development entail an ongoing process that can be called ephemeralization, so named by Buckminster Fuller, whereby technical means become increasingly transient and insubstantial. Performance tends to improve as physicality is minimized, reducing resistance, inertia, entropy, waste, and attendant costs. An example is communications technology, which has evolved from the solidity of carvings on stone tablets that can last for millennia to the ephemerality of microwave signals that invisibly saturate the air and are gone in an instant.

[3] Jackson Browne, "Before the Deluge", *Late for the Sky,* © 1974 Elektra/Asylum Records

[4] A videotape made of a conversation involving Osama Bin Laden immediately after the fall of the World Trade Center, and subsequently captured by US forces, revealed that none of the conspirators had the slightest idea that such a grand result was possible. Stephen Tanner, *Afghanistan: A Military History from Alexander the Great to the War Against the Taliban* (Cambridge: Da Capo Press, April 27, 2009), 279

[5] This is an experiential rather than an ontological description, and not a claim of substance dualism. The dynamics of an embodied entity's phenomenological and experiential encounter with physicality do not necessarily imply a substance dualist ontology.

[6] Phrase from science fiction film *Forbidden Planet,* dir. Fred M. Wilcox, screenplay Cyril Hume, story Irving Block (Metro-Goldwyn-Mayer, 15 March 1956).

[7] Journal of Soil and Water Conservation, 05/01/06 (online publication at www.jswconline.org/)

[8] Joni Mitchell, "Woodstock", © 1969 by Siquomb Publishing Company.