Image: Ji Lee

Isn't It Time for our Economic System to have a New Symbol ?

"Eco-Value Scale"

The Art and Science of Earth Economics

"Eco-Value Scale" is a public artwork, being developed to creatively address complex issues of real and relative economic value, based on principles of ecological 'Earth' economics. The work will integrate economic analysis software, electro-mechanical interfaces, digital audio/video displays, sculptural elements and a large holographic projection panel, with a publicly accessible, interactive web-based operating system, to be placed in a major global financial center.

"Eco-Value Scale" is not a work about economics; it is intending to demonstrate by example, critical new economic understanding, learning, experimentation, application and creative play. Taking the concept and sculptural form of a classic balance scale, for weight and justice, it is intended to involve people, on-site and online, in learning how to balance our Earth's economy.

"Eco-Value Scale" will be given meaning and credibility by an agent-based economic modeling program (pioneered at the Santa Fe Institute), integrated with 'conjoint analysis', block chain, real-time market data mining and crowd-sourcing, as back-end programs to parse complex data and users' value choices, to create a new economic 'theory of relativity' and to tip the scales.

"Eco-Value Scale" is an ambitious creative work, intended to be a financial-district sited symbol for a new economic system; to be an education and information tool; and to be an inspiring work of art, aspiring to embody truth, beauty and critically needed new eco-social values.

"Eco-Value Scale" will be augmented with a book (MIT Press), web site, educational software, working meetings, public symposia, project documentation and associated artworks exhibitions. It will hopefully inspire a wave of new eco-minded thinking and actions by others, everywhere.

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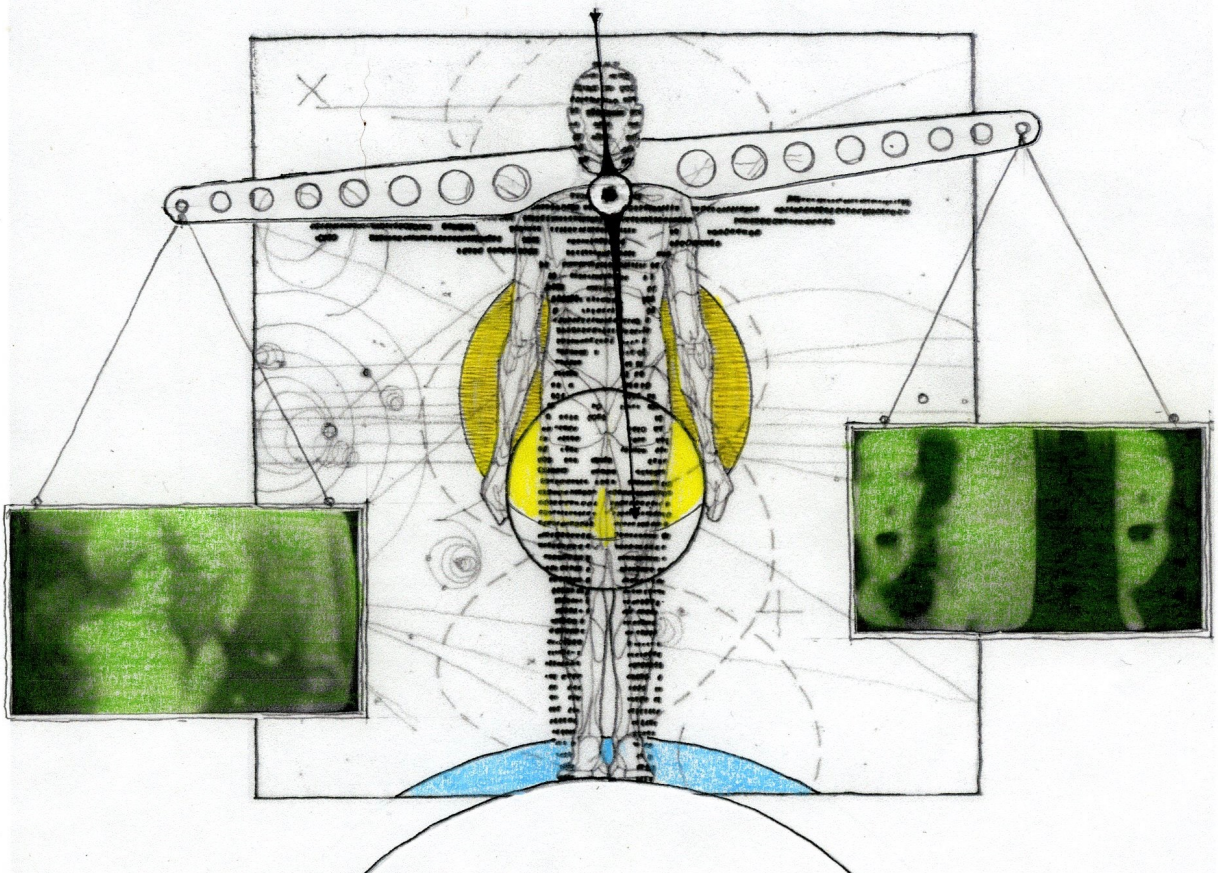
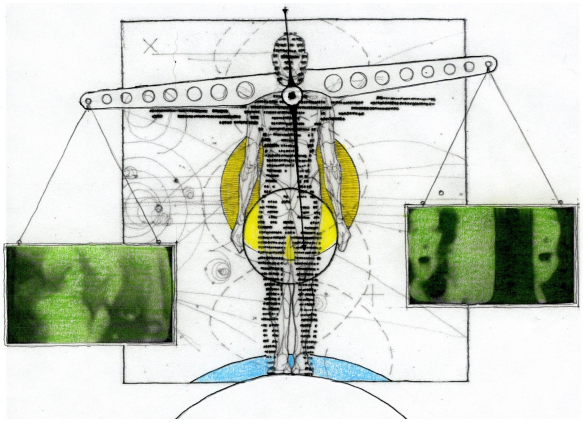
“Eco-Value Scale”



Ecological (Earth) Economy

Low	Entropy	High
Order		Disorder
Increase	Value	Decrease
Life		Death
Resource		Waste
Wisdom		Ignorance
Truth		Deception
Creation		Destruction
Love		War

“Eco-Value Scale”



Relative Eco-Valuation Factors (preliminary)

				Current Approx.	Disorder-Order	Scarcity-Abundance	Need-Desire
Symbol	**Resources**	**Description**	**Quantity**	**Market Value**	**Entropy Scale**	**Supply**	**Demand**
	Goods & Services	Matter, Energy, Information	Units	Yen / Euro / Dollar	1 - 10	1 - 10	1 - 10

Background

What determines economic value: supply versus demand, what the market will bear, rarity? What about intangibles or externalities, irrational exuberance, increased knowledge, art or considerations of sustainability?

Criticism of today’s powerful political-economic systems is growing ever louder and actively consequential in response to the accelerating global dominance of market capitalism, the tele-networking of local-global societies, increasing disparities and tensions between rich and poor, unsound and often corrupt financial practices and recognition of complex ecological frailties, interdependencies and impacts,

Economics has long been referred to as “the dismal science” *(Thomas Carlyle)*. Can art add valued respect to urgently needed new economic and ecological understandings and actions?

“Eco-Value Scale” as a work of art, is not politically motivated. It does not promote a particular ideology. It is not rooted in any economic school of thought. It is simply an exercise; a game; a symbol. Its purpose is to make people think, and to have fun thinking in new ways about how and what we value.

“Eco-Value Scale”, will attempt to make visible and visceral, economic understandings and practices for how to balance our economy, while re-inhabiting the original Greek root word ‘*oiconomia*’: care of home.

“Eco-Value Scale”

Relative Eco-Valuation Factors (very preliminary + incomplete)

				Current Approx.	Disorder-Order	Scarcity-Abundance	Need-Desire
Symbol	**Resources**	**Description**	**Quantity**	**Market Value**	**Earth Scale Entropy**	**Supply**	**Demand**
	Goods & Services	Matter, Energy, Information	Units	Yen / Euro / *Dollar	1 - 10	1 - 10	1 - 10
	Solar Radiation			Free	1	10	1
H	Hydrogen		Lb.	$ .50		10	
O	Oxygen	Essential to life	Liter	$7		10	1
C	Carbon		Ton	$50		10	
U	Uranium Ore		Lb.	$52			
U-235	Uranium 235		Kilo	$5,600			
Au	Gold		Oz.	$1,250			
C	Diamond		Karat	$2,000	10		
Cu	Copper		Lb.	$ .75			
	Oil	Crude	Barrel	$60			
	Electricity		MWH	$30			
H2O	Water		Gal.	$1		5	1
	Clean Air						
	Information		Bit		10	10	
	DNA		Gram	$1.3 M	10		1
	Tree	Black Walnut	1	$60 K	10		
	Lear’s McCaw	Endangered	1	$60 K	10	2	
	Sculpture	Giacometti: Walking Man	1	$104 M	10	1	10
	Painting	Van Gogh’s Dr. Gachet	1	$82.5 M	10	1	10
	Gutenberg Bible	1987 auction	1	$5.4 M	10	1	9
	B2 Bomber		1	$10 M	10		
	Food		2000Cal’s	$10			1
	Shelter	3 Bedroom Ranch House	1	$250 K			
	Real Estate	Downtown Tokyo	100 sq.ft.	$2 M			
	Human Baby	In-vitro fertilization	1	$12.4 K	10		
	Human Heart		1	$57 K	10		
	Human Labor						
VIP	Corporate Exec.	Bill Gates	1 year	$1 B			
	Education	University	1 year	$40 K			
	Time		1 hour			10	
	Happiness						
	Trust						
	Love						2

Where is the art in economics?

To be creatively successful, this cannot just be a work *about* economics. It must be an artwork that sets example *for* economics. To realize this objective, the economic science elements of this work must be as credible and furthering of the field, as the artful aspects of the work must aspire to inspire.

Developments in open-source software and agent-based modeling, photonic technologies, understandings of economic limits, extents and interdependencies, and the essential place of the arts, creativity and innovation in our increasingly networked information society, are among the factors now converging to make this project possible.

Research will be conducted and a paper will be published on development of the "Eco-Value"™ program, and on its integration with technical systems operating the "Eco-Value Scale" artwork.

Techne

"Eco-Value Scale", as it is now developing, will physically integrate holographic interferometry, digital audio/video, a sensor controlled robotic sculpture and the "Eco-Value" ™ software program, activated in real-time by crowd-sourced 'players' via an interactive project web site.

A large holographic back-plate and steel sculpture (Gaia holding the Earth) will be fabricated. Two flat panel displays of equal size and weight will be suspended at each end of a balance-beam carried on Gaia's shoulders. The displays will show digital media images (with text and audio) and their relative eco-value, as aggregated by users; on-site and online.

A project web site will serve as front-end for a dynamically evolving operational database and for interactive control of selected items, factors, values, displays and balance. Playing the online "Eco-Value" ™ program settings, users may select resources (commodities or intangibles) and other factors from a menu, to affect and adjust the relative value and balance of displayed items.

"Eco-Value"™ open source, agent-based software being developed for this artwork, is built upon newly applied knowledge about ecologies, economies, societies and life, utilizing a matrix of code, categories, comparative factors and complex variables to determine relative value. The "Eco-Value"™ program is intended to also be an economics education and planning toolkit.

This is a sophisticated work which once realized must operate with minimal maintenance for many years. Continued adjustments will be needed over time. But, for this to be more than a 'technology museum' exhibit, and to have a long life, the techne, the art and the integration of economic valuation elements must inspire and invite long-term support.

Developmental contacts and conversations have been in process with experts, critics and supporters at the Institute for New Economic Thinking (Soros), NASDAQ, Santa Fe Institute, Gund Institute for Ecological Economics at UVM, U.S. Department of Commerce, Stanford University, IntercontinentalExchange, plus European and Asian colleagues + co-conspirators.

“Eco-Value Scale”

References

Following is an abbreviated list of research references that are informing development of the “Eco-Value”™ data processing ‘engine’. A collaborative research paper will be published on development of the “Eco-Value”™ program and integration into the “Eco-Value Scale” artwork.

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The Origins of Value: The Financial Innovations that Created Modern Capital Markets, edited by William N. Goetzmann and K. Geert Rouwenhorst, Oxford University Press, 2005.

Structure of the World Economy: Outline of a Simple Input-Output Formulation, Wassily Leontief, Proceedings of the IEEE, Vol. 63, No. 3, March 1975.

The Entropy Law and the Economic Process, Nicholas Georgescu-Roegen, Harvard University Press, 1971.

The Economy as an Evolving Complex System II, Santa Fe Institute, W. Brian Arthur, Steven N. Durlauf, David A. Lane, Eds., Addison-Wesley, 1997.

Human Well-Being and Economic Goals, Frontier Issues in Economic Thought, Vol. 3, Neva Goodwin, Ed., Island Press, 1997.

The Value of the World’s Ecosystem Services and Natural Capital, Robert Costanza, et. al., Nature, Vol. 387, May 15, 1997 (updated and published in 2013 and 2014).

EcoInformatics Collaboratory, Economic Valuation of Ecosystem Services, University of Vermont, http://ecoinformatics.uvm.edu/projects/projects.html

Total Economic Value Calculating Matrix (TEVCM) to Valuate Ecosystem Services, Eugenio Figueroa and Roberto Pasten, Universidad de Chile, 2009, www.openmeeting2009.org/pdf_files/.../Figueroa%20day%202.pdf

“Peer to Peer and the Commons: A Path Towards Transition, A Matter, Energy, Thermodynamic Perspective”, Céline Piques and Xavier Rizos, P2P Foundation, 2017.

“The Future of Economics: From Complexity to Commons”, Paul B. Hartzog, Sept. 1, 2017. www.resilience.org/stories/2017-09-01/the-future-of-economics-from-complexity-to-commons/

The Way: An Ecological World View (Appendix 2: What is Information?) Edward Goldsmith, U. of GA Press, 1992/1998

System of Accounts on Global Entropy Production (SAGE-P), Anthony Friend, Asia-Pacific Environmental Exchange, 2005.

Beneficial Use Values Database, University of California at Davis, http://buvd.ucdavis.edu/
Participatory Economics, Robin Hahnel, Portland State U. and Michael Albert, Z Magazine, http://www.participatoryeconomics.info

Ecosystem Marketplace, http://ecosystemmarketplace.net/

IntercontinentalExchange (ICE), Global Commodity, Currency, Credit & Equity Index Markets, The Volatility Exchange (VolX), www.theice.com/homepage.jhtml

Conjoint Analysis Tutorial, http://marketing.byu.edu/htmlpages/tutorials/conjoint.htm

Artificial Adaptive Agents in Economic Theory, John H. Holland and John H. Miller, Santa Fe Institute, Economics Research Program, 91-05-025.

Agent-Based Modeling, Marco A. Janssen, Indiana University, International Society for Ecological Economics, Encyclopedia entry, March 2005.

Agent-Based Computational Economics (ACE), Growing Economies from the Bottom Up, Leigh Tesfatsion, Iowa State University, 2005, www.econ.iastate.edu/tesfatsi/ace.htm

Jamel: Java Agent-based MacroEconomic Laboratory, http://p.seppecher.free.fr/jamel/

The Future of Trading, Biology-Based Market Modeling at Nasdaq, Mike Brown and Vince Darley, Technology Watch, www.santafe.edu/~vince/pub/FutureOfTrading.pdf

Agent-Based Modeling of the U.S. Economy, Doyne Farmer, Rob Axtell and John Geanokoplos, Santa Fe Institute, 2011- *(INET funded).*

Beyond Supply and Demand: The Dynamic Equilibrium Between Global Thresholds and Allocations, James Bernard Quilligan, March 9, 2018

Toward a Sustainable World Economy, William E. Rees, Institute for New Economic Thinking, 2011 annual conference, Crisis and Renewal: International Political Economy at the Crossroads.

Toward Global (Environ)Mental Change: Transformative Art and Cultures of Sustainability, Sacha Kagan, PhD, Heinrich Böll Foundation, Ed., 2012, https://www.boell.de/en/content/toward-global-environmental-change

Cooperative Games and the Ecological Data Economy, Kyle Birchard, REGEN Network, 8.21.2018. https://medium.com/regen-network/cooperative-games-and-the-ecological-data-economy-df993338cdff

Info/Eco

Economics/Information/Ecology

What's the Matter? What's the Difference? What's the Use?

The dynamic radiative information environment, the flow of information, and the sensory and communicative nature of information, have not been included in most whole-systems ecological thinking and applications, to date. It is a major error in human understanding that will have troubling consequences, as we increasingly interact with and manipulate this fragile ecosystem.

Ecology is the study of the complex relationships between living and non-living, inter-dependent dynamic systems. It describes the fragile balance in which such systems interact and by which they co-evolve. Information Ecology extends our basic understanding of ecology to include the physical, social and economic transformations being wrought by fundamental thermodynamic processes to human scale rapid developments in information technology, networked learning, and by our becoming an increasingly networked "society of mind".

Information is not just data or bits. It is not simply a useful natural resource; a commodity that can be sent and received, bought and sold, and regulated. Information must also be considered as patterns of perception, genetic expression, cognitive relationships and differences. The flow of information determines the course of social evolution. Decisions regarding spectrum allocation, regulatory interventions, copyright, property, privacy, digital divides, technology development or "new economies" cannot be effective, if made without an ecological context.

Today's Information Revolution, if it is primarily a technology mediated revolution, will likely result in increased consumerism, social systematization, bureaucracy, waste and war. The more cumulatively energy consuming and less ecologically sustainable, the more fragile technological progress will become; and ultimately more disruptive in its potential (inevitable) failure.

There is much to do to integrate matter, energy and information into a whole systems ecology. Becoming a bit smarter about the way the world works, may also be dangerous, coming into conflict with long dominant, vested-interest belief systems and ideological fictions. Education, thoughtful exchange, research, creative examples and respect for differences are needed. There is no solution, however. We can only begin to take small "steps towards an ecology of mind".

"From a purely physical viewpoint, the economic process only transforms valuable natural resources (low entropy) into waste (high entropy). The true economic output of the economic process is not a material flow of waste, but an immaterial flux: the enjoyment of life."
N. Georgescu-Roegen

ECOLOGY
MATTER – ENERGY – INFORMATION
ECONOMY

A Grand Challenge: To develop a scaled 'ecological unified theory', holistically integrating co-evolving physical, biological, environmental, social, information and economic sciences.

To date, ecology is still a marginalized scientific concept, applied primarily to biology and the earth environment, and distractingly argued when extended to other realms of 'the natural order' or 'care of home'. If our often stated desires for sustainability are to be at all realized, they will have to be based upon more pragmatic understandings of the dynamic interrelationships and interdependencies of complex evolving systems, from micro, to human, to macro scale. Only when we better take into account the evolutionary development of human understandings, beliefs, emotions, dynamic differences and failings, might we begin to construct life-serving political, organizational, educational and economic systems that that will help to guide us from where we have come, to where we are going.

"Big Science", ever seeking an elusive 'unified theory' has lost its sense of perspective. While our best and brightest explore furthest inner and outer spaces, local-global, earth-scale actions and effects are becoming increasingly jeopardized. Science will only be more accepted and supported by people when it takes on the ultimate challenge of this most human dilemma.

Science must work to develop a fundamental ecological theory of matter-energy-information relationships, as the basis for a more intelligent system of economic valuation. Our economic systems must more adequately account for the day to day experiences and needs of life on earth: from the delicate balances and chaotic turbulences of energy and information flows; to war, peace and processes to settle human conflicts arising from dangerously 'myth-understood' beliefs about territory, property ownership, resource consumption, work, waste processing and life affirming irreconcilable differences. This daunting task takes us to the feared heart of complexity. Yet, not to take certain altruistically intentioned necessary revolutionary actions, makes us accomplices to progressively self-consuming crimes against nature.

Constructing, supporting and conveying a global, lifelong, bottom-up educational framework that spreads the word, while respecting the differences counter to its acceptance, is our equally grand challenge and requirement.

Ultimately, 'a grand ecological unified theory' would move our understandings, actions and intents beyond the defined limits of science; to a most challenging and controversial, yet ultimately most important humane goal of our tele-networked contemporary society: demosophia (people wisdom).

"Words ought to be a little wild, for they are the assault of thoughts upon the unthinking."
John Maynard Keynes

Earth Economics

Economics has not been an art or a science to date.
It has been a political fiction made up as we went along,
historically rooted in and shaped by trial-and-error learning,
vested-interests, needs for social organization and control.

We have too long been held hostage by the ‘isms
(capitalism, socialism, communism),
political economies that deny a true, whole system accounting
of our tangible and intangible resources, exchanges and values.

The greatest of all challenges that we have today is not
climate change, or population growth, or our energy future.
It is how to transition towards understanding and practicing
Earth Economics.

Earth Economics is the only way forward.
But its practice will take time and it will be difficult,
as the forces of willful closed-mindedness fight against
creative, caring change with all their destructive power.

Together, step by step, example by example,
we must illuminate a life-sustaining path,
by taking steps towards an ecology of mind,
learning, growing and sustaining an Earth Economy.

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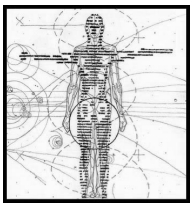

1st-Mile Institute

1st-Mile Institute, founded in 2006, is a think-and-do-tank, currently stewarding two programs:
The New Mexico "Broadband for All" Initiative, and SARC (Scientists/Artists Research Collaborations).

Scientists/Artists Research Collaborations

SARC (Scientists/Artists Research Collaborations), successfully piloted in 2012 as a featured program of ISEA2012, is now structuring and realizing long-term eco-cultural programming. Participating science institutions and supporters to date have included the New Mexico Consortium, Los Alamos and Sandia National Laboratories, University of New Mexico and Santa Fe Institute. SARC cultural partners have included the New Mexico School for the Arts, Institute of American Indian Arts, Santa Fe Center for Contemporary Art, Santa Fe Art Institute, 516ARTS in Albuquerque, CURRENTS New Media Festival and the Thoma Foundation.

While developing its regional cultural and educational initiatives, SARC is actively participating in networked national and global interactions. 1st-Mile Institute/SARC was a co-sponsor of UNM's NIH funded "Art of Systems Biology and Nanoscience" program in Santa Fe, March 2013, and it has produced special 'Arts/Sciences' programs for the CURRENTS New Media Festival, annually since 2011. SARC director, Richard Lowenberg was an invited participant at a special NSF funded, SEAD (Science, Engineering, Arts and Design) program, with NEA, NIH, DARPA, NASA, other federal agencies and White House officials, May 16, 2013 at the Smithsonian Institution, DC.

SARC is co-producer, with Cabine Voltaire (NL), of an online Google Hangout series on Arts/Sciences, having begun with the International Space Arts Workshop (ISAW4) held at the NASA Ames Research Center and SETI Institute, Mountain View, CA, in May + July, 2013. Invited SARC presentations were given at the XVIII ISA World Congress of Sociology, 'Facing an Unequal World: Challenges for Global Society', session on 'Fostering Trans-Disciplinarity Amongst the Social and Natural Sciences, Engineering, Arts and Design', July 2014, in Yokohama, Japan, and at Balance/Unbalance, held at ASU, Tempe, AZ, in late March, 2015. SARC is featured in "Steps to an Ecology of Networked Knowledge and Innovation: Enabling New Forms of Collaboration among Sciences, Engineering, Arts, and Design", a Leonardo MIT Press Ebook, 2015. SARC hosted "New (+ Old) Media: Restoration, Preservation, Archiving & Access", workshops and symposia as featured programs of CURRENTS 2015 + 2016. The Institute co-organized the Internet Society's "Indigenous Connectivity Summit", held in Santa Fe, Nov. 2017. "The Energy & Information Eco-systems of the Colorado Plateau: An Arts/Sciences Field Study" is now in process. http://www.mappingmeaning.org/mapping-meaning-the-journal-issue-1 (pgs.94-105).

The SARC **"ECOS"** initiative is being structured with intent to creatively address local-global "Grand Challenge" issues of climate, energy, economics and the ecology of the information environment.

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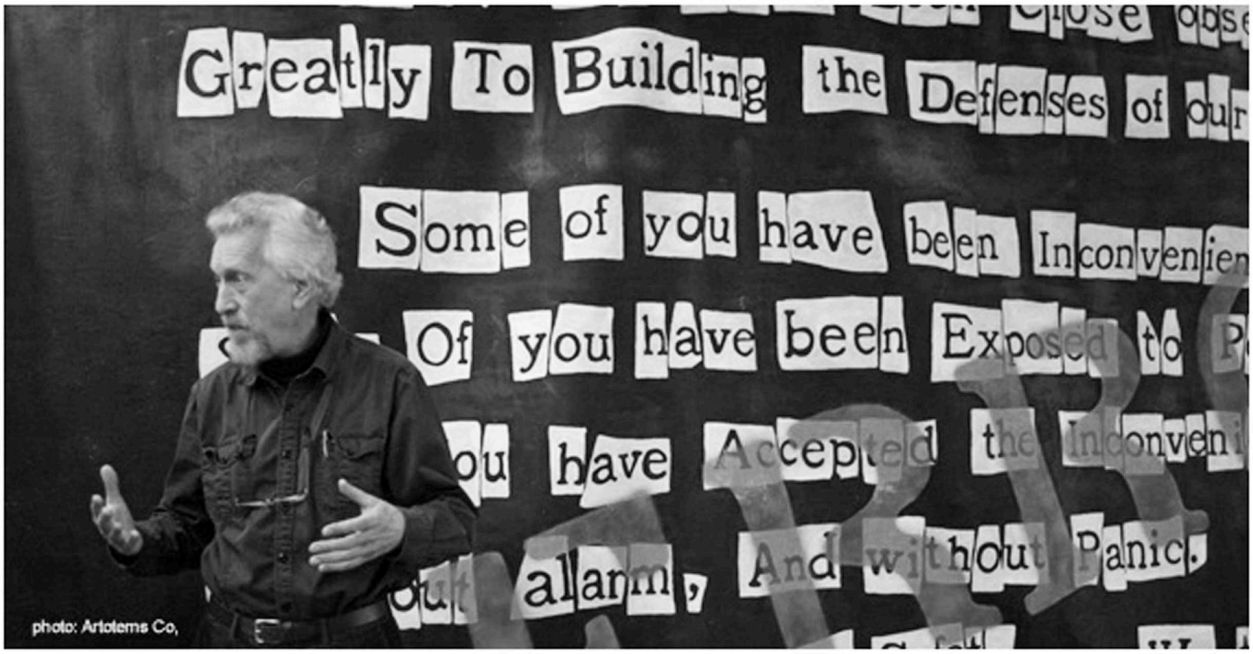
Richard Lowenberg, born in Haifa in 1946, is an artist, planner/designer and eco-cultural activist. He has dedicated his creative life to understandings and creative realization of works exploring and setting examples for an 'ecology of the information environment', and via arts/sciences collaborations, demonstrating emergent opportunities for development of a 'cultural economy'.

Richard is Founding Director, 1st-Mile Institute, its New Mexico 'Broadband for All' Initiative, and SARC (Scientists/Artists Research Collaborations) programs. Living on an organic farm in Jacona, NM, he serves on the Board of Parallel Studios' CURRENTS: Santa Fe International New Media Festival. He co-organized the Internet Society's "Indigenous Connectivity Summit", held in Santa Fe in early Nov. 2017, and was a June 8, 2018 Leonardo LASER presenter.

Richard studied design and taught at Pratt Institute, initiating its Electronic Media Arts program in 1971, and was one of the founding team of the Kitchen in NYC that year. He was founding Programs Director of the Telluride Institute, from 1984-96, helped initiate and taught TechnoCulture Studies at UC Davis and was Artist-in-Bioregional Residence there, 1998-2006.

Personal interdisciplinary design, media arts, installation, performance and art/science works have involved collaborations with Los Alamos and Sandia National Laboratories, UNM, Santa Fe Institute, NASA, Gorilla Foundation, military labs, intelligence agencies, numerous high-tech companies and research institutions. Artworks have been presented internationally at: the Kitchen, Whitney Museum, San Francisco MoMA, Kunstmuseum Dusseldorf, NTT-ICC, Tokyo, Santa Fe CCA, 1986 Venice Biennale, MIT List Center and ISEA2012. Grants/support awarded by the NEA, State Arts Councils (CO, CA, NM), Art Matters, National Space Society, Apple, SECA, CPB, NTIA, IBM, JVC, Lightwork, McCune Charitable Trust and Thoma Foundation.