

Marina Zurkow's Epigenetic Landscapes

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ABSTRACT

THIS ARTICLE ARGUES THAT THE IMPENDING PHASE SHIFT IN PLANETARY CONDITIONS REQUIRES A DE-CENTERING OF THE HUMAN BEING AND THE ADOPTION OF A MULTI-SCALE ECOLOGICAL PERSPECTIVE IN RESPONSE TO GLOBAL CLIMATE CHANGE. NEW MEDIA ARTIST MARINA ZURKOW EXHIBITS SUCH A VISION IN THE ENGROSSING, COMPELLING LANDSCAPES OF HER *MESOCOSM* SERIES: *MESOCOSM: NORTHUMBERLAND (UK)* AND *WINK, TEXAS*. C.H. WADDINGTON'S MID-CENTURY *EPIGENETIC LANDSCAPE* REPRESENTED THE PROBABILITIES OF GENE EXPRESSION IN COMPLEX LINKAGE WITH ENVIRONMENTAL INFLUENCES. ZURKOW'S TWENTY-FIRST CENTURY IMAGES EXTEND WADDINGTON'S MODEL, GIVING US A STOCHASTIC ENACTMENT OF A LANDSCAPE AS A CASCADE OF INTERACTIVE BIOTIC AND ABIOTIC POSSIBILITIES.

I recently reread Dorothy Dinnerstein's wild and passionate book, *The Mermaid and the Minotaur: Sexual Arrangements and Human Malaise* (1999). In this powerfully idiosyncratic contribution to second stage feminism, Dinnerstein argues that human beings are the central agent in our impending planetary destruction.¹ She calls on human beings to come to terms with our anxieties about fleshly vulnerability and to renegotiate the human sexual arrangements that have such disastrous planetary consequences. If we can move from splitting and projection to integration and incorporation, she argues, we may yet be able to bring about a society—and thus even an ecosystem—free of human damage: "This flawed life may yet be capable of outgrowing its birth defects in time to save itself, and the web of life in which it is embedded, from extinction." Further, "There is no way to feel confident that this struggle can really turn the lethal tide," Dinnerstein acknowledges, "but neither can we be certain that it will not. And in either case, to fight what seems about to destroy eve-

¹ In making her argument, Dinnerstein draws on the writings of Norman O. Brown and Lewis Mumford, so bittersweet now in their sense that human life can outgrow its limitations.

rything earthly that you love . . . is for me the human way* to live until you die" (Dinnerstein 1999, 228).

Rereading *Mermaid and the Minotaur*, my attention was captured by the asterisk, and its heart-stopping note:

* No one has the right, I suppose, to say what is *the* human way; but it is surely one essential human way. Another possible way is to withdraw your central love from what seems about to be destroyed—life on earth—and focus it on something smaller: the immediate moment. Or on something larger: the cosmic reality within which the earth itself is insignificant. (Dinnerstein 1999, 228)

I found myself brooding over the way Dinnerstein simultaneously seemed to grasp the broader reality of the earth's position in the cosmos with prescience and yet to refuse the realization, as she reaffirmed an "essential human way" of living. Consider the very different advice given recently by geobiologist Peter Westbroek to human beings faced, as we are, with the impending phase shift in planetary conditions: "Admire, Detach, Orient" (Westbroek 2012a).² While Dinnerstein advocates a gender-focused human struggle in *Mermaid and the Minotaur*, Westbroek argues that we must decenter the human being and adopt a multi-scale ecological perspective in response to global climate change. Withdrawing our cathexis from the intimate territory of the human, we must embrace instead both the smallest and largest temporal and spatial scales, and the full range of things, both biotic and abiotic.

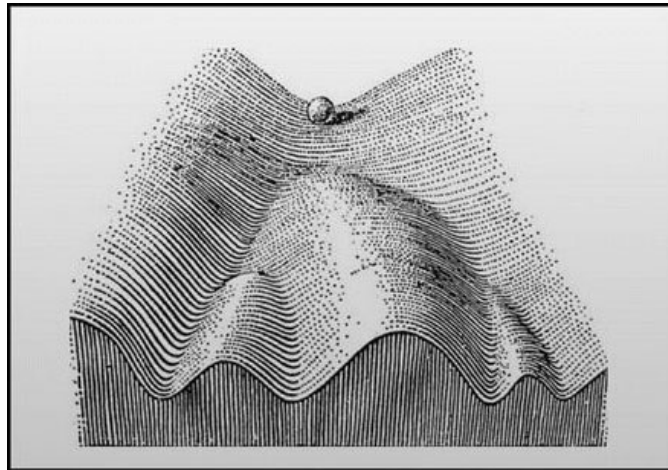


Figure 1. C.H. Waddington (1957), "Epigenetic Landscape"

Such a vision characterizes the engrossing, compelling landscapes of new media art-

² See also Westbroek (2012b, 126–139).

ist Marina Zurkow's *Mesocosm* series: *Mesocosm: Northumberland (UK)* and *Wink, Texas*.³ The scale of her animations is simultaneously tiny and giant. Their pointillist images span the very small (an ant, a crumb, a gnat, a drop of blood) and the very large (a population, a data set, an endless horizon, the night sky). As they invoke the multi-scale perspective of our contemporary ecological moment, they also reflect and extend the epigenetic understanding of development first formulated by embryologist C.H. Waddington in 1942. Waddington formulated the field of epigenetics as a convergence of embryology and genetics. As he imagined it, the field would study the relationship between the genotype and the phenotype: the complete hereditary information of an organism and its actual metabolism, morphology and behavior. To represent the probabilistic mapping of such developmental trajectories, he adopted an iconic image that he called the epigenetic landscape (Fig. 1). This image represents an individual's development as a ball, rolling downhill between increasingly higher hills and mountains. As the space between the valleys increases and the hills become mountains, the individual's development becomes more and more constrained, from the open potentiality of the mountaintop to the specific directions that the ball has bounced, rolled, rebounded, and then settled, as it gradually comes to rest.⁴ While there are philosophical implications to how this concept was narrowed in response to the pragmatic, positivist cast of mid-twentieth century experimental biology, as I discuss elsewhere,⁵ I want here to focus on its spatial and temporal nuances. I argue now that the metaphoric concept of the epigenetic landscape, exemplified in Zurkow's *Mesocosm* series, provides a corrective to humanist limitations of Dinnerstein's vision. In fact, it offers what we might call a nonhuman, or even ironically an inhuman, "way to live until we die."

The epigenetic landscape is an exaggerated comparison or metaphor—Scott Gilbert has called it "[o]ne of Waddington's central conceits," where the image uses a landscape in space to represent "divergent developmental paths (chreodes) that a cell might take upon finding itself in different conditions" (Gilbert 2000, 733). While this phrasing is focused on the cell, the scalar implications of epigenetics extend from the cell to the population, and from the spatially condensed to the spatially dispersed. Its metaphoric resonances reveal events that unfold in big space and slow time, reflecting an alternative understanding of the relations between human beings, living things, and the abiotic world. As Linda Van Speybroek (2002) has pointed out, epigenetics has been reduced in contemporary biomedicine to a set of mathematical models. In contrast, nonlinear relations can be expressed in a fashion far less constrained in works of art, which provide room for ambiguity. Moreover, Zurkow's

³ See Marina Zurkow, *Mesocosm (Northumberland UK)*, <http://vimeo.com/36164236>, and *Mesocosm (Wink, Texas)*, <http://www.o-matic.com/play/friend/mesocosmWINK/>. See also Morton 2010, 105.

⁴ I discuss the relevance of this strategy of representing time spatially to Anders Nilsen's superb graphic novel, *Big Questions*, in the longer version of this article. For Waddington's description of the epigenetic landscape, see Waddington 1939, 187. See also Gilbert (1991). For a very clear discussion of the image of the epigenetic landscape, see Carey (2012).

⁵ Susan M. Squier, *Epigenetic Landscapes* (book in progress).

Mesocosm series gives us a distinctly different articulation of the planetary costs of environmental devastation than did Dinnerstein's *The Mermaid and the Minotaur* because it embodies not merely the planetary landscape in an era of human warfare and environmental degradation, but the *epigenetic landscape* as well, in which human agency is pushed to the margins by the interactive ontology of things.

Consider the mesocosm: an experiment that occurs in a bounded space somewhere between a microcosm (think: test-tube) and a macrocosm (think: universe.) In that bounded space, the experimenter attempts to simulate the conditions of real life so that environmental elements can be manipulated.⁶ I argue that the *Mesocosm* series presents controlled *experiments* through which we can experience (the root word of experiment) how in this new era of the Anthropocene—the era of a “human dominated environment”—we are always responding to, and shaping, our interactions with the non-human.⁷ Zurkow's animations combine the mesocosm—in which she has said she was inspired by Timothy Morton's *Ecology Without Nature* (2009)—with the epigenetic landscape, in which a series of complex relations between individuals and their environments produces biotic and abiotic change over time (Zurkow 2012).

Mesocosm (Northumberland UK) (2011) condenses a year on the Northumberland moors into 148 hours of time passing (one hour to one minute), depicting a “Latour litany” of actants—bees, worms, squirrels, refugees, snow, wind, the subjects of past paintings, bicycles, bottles, HazMat workers, unwelcome invader species—as they interact in slow time (Fig. 2).⁸ *Mesocosm (Wink, Texas)* (2012) condenses a year at the site of a sinkhole, “Wink Sink 2,” at the property of a “private oil company property in the small Texas town of Wink” which “has been widening steadily since it emerged in 2002” (Zurkow 2012) (Fig. 3). Like the Northumberland landscape, the Wink, Texas landscape has a diverse range of actants. Here, it includes “bird life, prairie dogs, insects, pronghorn antelope, HazMat workers and—depend-ing on the season—. . . migrating monarch butterflies, snakes and sandhill cranes” (Zurkow, 2012). While both animations call into question the pristine notion of “nature,” unlike *Mesocosm (Northumberland UK)*, where only the occasional lorry or HazMat worker gestures toward the human impact on the landscape, *Mesocosm (Wink, Texas)* is clearly a site

⁶ According to the Natural Environment Research Council-funded program “Microbial Metagenomics,” a mesocosm is defined as “an experimental system that simulates real-life conditions as closely as possible, whilst allowing the manipulation of environmental factors.” Basically, this means “a large enclosure that we can manipulate” (<http://mesocosm.eu/node/16>. Accessed 1.22.14)

⁷ See Atia Sattar, Ph.D. dissertation, Penn State University, *The Aesthetics of Experiential Medicine: Literature and Scientific Inquiry in the Nineteenth Century* (2012). Scott F. Gilbert and David Epel offer an “Ethics for the Anthropocene” in their eloquent Coda to *Ecological Developmental Biology*, drawing on the works of Chris Cuomo and Donna Haraway: “a commitment to the *flourishing* or well-being, of individuals, species, and communities.” Gilbert and Epel, (2010), 417.

⁸ “The Latour litany gathers disparate things together like a strong gravitational field.” Ian Bogost, *Alien Phenomenology, or What It's Like to Be a Thing* (Minneapolis, Minn. University of Minnesota Press, 2012) Loc. 1114 of 4016.

of environmental pollution at geologic scale: the oil-spewing sinkhole is the direct result of the petroleum industry's extractive relation to the earth.



Figure 2. still images from Marina Zurkow, *Mesocosm (Northumberland UK)* (2011)

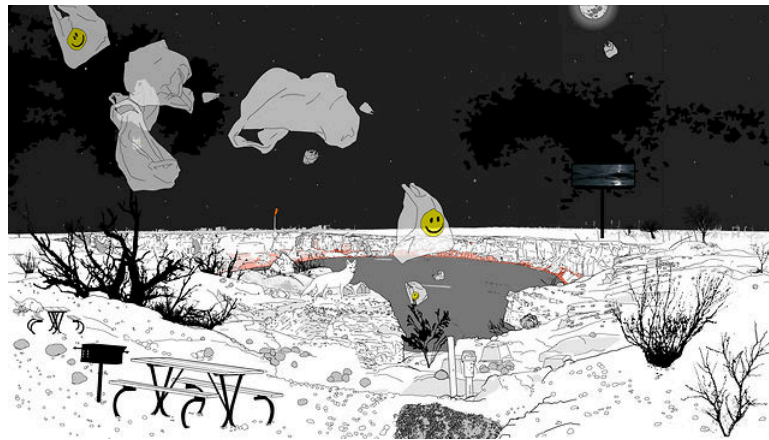


Figure 3. still image from Marina Zurkow, *Mesocosm (Wink, Texas)* (2012)

Drawing attention to the prominence of the frame in *Mesocosm: Northumberland (UK)*, Una Chaudhuri has categorized this work as an example of the "Theater of Species," a practice that takes place at the intersection of ecocriticism, animal studies, performance studies, and theater (see Chaudhuri 2012). While Chaudhuri's reference to the stage is certainly right, Zurkow's borrowing of the concept of mesocosm, like

her enactment of the epigenetic landscape, also directs us to that other theater in which animals, ecology, and performance converge: the theater of proof that is modern science. Ever since the air pump, scientists have worked to understand the properties of the material world by constructing artificial environments, controlled by the experimenter, in which simple manipulations could produce scientific facts. In this other theater, facts are confirmed by witnesses, but as we know, only certain observers have the authority and status to serve as witnesses. The “theater” of science is tightly controlled to ensure that the proper witnesses see the appropriate set of experiments in the appropriately controlled experimental frame, producing the appropriately ordained facts.

Such is not the case in the *Mesocosm* series. *Mesocosm (Northumberland UK)* has as central character and witness a large naked man who sits on a stump at the center of the landscape. He is based on the Australian performance artist, designer, and drag queen, Leigh Bowery, who became a central muse of the painter Lucien Freud (Chaudhuri 2012, 8). This figure, who mostly sits with his back to us, but sometimes strolls, stands, and even dances, “queer[s] the fragile landscape”—“[e]xpressing none of the “anthropocentric voyeurism, self-consciousness, and self-display of traditional stage presence, the Green Man of *Mesocosm* . . . nonchalantly performs a scandalous form of species companionship and ecological intimacy” (Chaudhuri 2012, 8). Moreover, he is witnessing a kind of interactive experiment in environmental unfolding, one which takes place all around, on, and even in and to him, as insects swarm or crawl on his flesh and passing squirrels and birds bite and peck him, drawing blood. The facts he confirms are visceral. *Mesocosm (Wink, Texas)* gives us a theater of risk and risk mitigation, where HazMat workers take a rest on a picnic bench and are visited by Monarch butterflies, an oily sink hole emits petroleum-based plastic bags with smiley faces, and a plume of petroleum-laced smoke swirls off into the night sky, all while a video signboard repeats and reflects the eerie environment.

I have said that Zurkow’s series offers us an epigenetic landscape in the sense that Waddington developed this iconic visual image in the 1940s: “[t]he ball represents a cell in an embryo and, at each developmental branchpoint, it is nudged down one path or the other by the action of embryonic inducing factors and/or homeotic genes” (Slack 2002, 891). Crucially, Waddington’s image is not so much spatial as temporal; it represents spatially the probability that a cell will develop in a certain specific way by reflecting how the ball’s interactions with its environment shape and channel development the way hills and valleys shape and channel running water.⁹ Waddington was deeply influenced by Whitehead’s philosophy, particularly his notion of concrescences and prehensions, and the epigenetic landscape expresses the idea that the material objects scientists study are really *processes*, always changing in response to their surroundings, on micro and macro levels, and in turn always changing them. (Gilbert 1991)

⁹ As Jonathan Bard explains, “The cell starts off as multipotential in the very early stages of development but its fate becomes fixed as time passes (represented by distance down the slope and by the binary choices the ball makes as it becomes canalized or channeled down one or another route” (Bard 2008, 192). See also Slack 2002, 893.

Like Waddington's image of the epigenetic landscape, Zurkow's images of the Northumberland landscape in *Mesocosm: Northumberland (UK)* and *Wink: Texas* also use an algorithm to determine what aspects of the natural scene (living and non-living) emerge at any point in time. And like Waddington's image, in this work emergence is ongoing, embedded, and most importantly *mutual*. Zurkow explains that she created *Mesocosm* by generating a number of animation files each of which contained one of the various creatures who would walk (skip, fly, hop, or crawl) 'on-stage.' Then, she created an algorithm to determine which files "came on" the stage at any point, based on the interaction of all of them. The very process of this animation is probabilistic, Zurkow explained to me. There is a master file that lists "all the characters who might get called to the stage when it is their turn" and "that file controls the stage management and calls a character -- say, a flying pair of ravens - to enter the scene, applying a percentage of probability to that event. At a specified time of day (dawn, day, dusk or night), in a specified month, there is a *chance* (for instance a 12% chance) that this raven pair will come out onto the stage."¹⁰

So, just as Waddington's image of the epigenetic landscape represents the probabilities of gene expression based on the effects of environmental influences (chemical, metabolic, climactic, and social), Zurkow's animation also gives us a stochastic representation of life as a cascade of interactive possibilities. As she explained her project in September 2012:

I look to create a slow down in my animations, a closeness over time or through proximity with my subject matter. And to embrace a larger world of agents including bees, worms, squirrels, refugees, snow, wind, the subjects of past paintings, bicycles, bottles, HazMat workers, unwelcome invader species; in other words, a world not entirely in control by me as an artist and cultivator, and one that attempts to challenge human exceptionalism.¹¹

Although Chaudhuri's theatrical interpretation of *Mesocosm: Northumberland (UK)* stops at the level of species, the *Mesocosm* series actually includes not only a variety of living species (humans, oxen, foxes, squirrels, bats, rabbits, birds, caterpillars, mosquitoes, gnats, trees, bushes, and other small plants) but also stones, a stump, roads, fences, weather (rain, cloud, mist, calm), earthly machines (a truck, a motorcycle, a bicycle), celestial objects (moon, stars, shooting stars), synthetic objects (plastic bags, HazMat suits, picnic tables and a barbeque), and even fantasy figures (a cartoon bear and a fairy.) Zurkow draws them together both to testify to the envi-

¹⁰ Marina Zurkow, email correspondence with author, December 28, 2012.

¹¹ Marina Zurkow, "Agency, Intimacy, Change," remarks presented on "Buddhism and the Non-Human" session, annual meeting of the Society for Literature, Science, and the Arts, Milwaukee, Wisconsin, September 27-30, 2012. My thanks to Marina Zurkow for a copy of her remarks.

ronmental and social upheaval that exists (refugees mingling with HazMat workers, petroleum gushing beneath the flaring of oil gas plumes) and to propose a solution (by challenging human exceptionalism.)

To be sure, there have been changes in the theater of science in the last several centuries, and Zurkow's cascade of characters reflects them in its mingled litany of actants. The restrictive category of witnesses, which in the days of Bacon and Hobbes strictly excluded women and the working class, has gradually opened up. The assumption of normative heterosexuality grounded (if mistakenly) in Darwinian evolutionary theory has been challenged. Now even the dominance of eukaryotic life over its prokaryotic precursors has been upended by the detailed explorations of Lynn Margulis.¹² So, the lichen on the tree stump in *Mesocosm* indexes the symbiogenesis through which life developed from its chemical and bacterial origins to our nucleated forebears, while the HazMat workers in *Wink, Texas* reference epigenetic medicine's attention to the heritable effect of environmental toxins or environmentally present endocrine disrupters. In reflecting the process by which biotic and abiotic objects emerge, interact, and transform each other over slow time, Zurkow's epigenetic landscapes not only harness the biological field of epigenetics as well as the insights from ecological developmental biology (with its very long view of systems biology) but they enact its central conceit. Thus Zurkow's *Mesocosm* series offers a powerful rejoinder to Dinnerstein's human-centered vision in *The Mermaid and the Minotaur*: a poetic, probabilistic image of a landscape in which all things are actants with the potential to shape the course of social, environmental, and planetary development.

REFERENCES

- Bard, J.B.L. 2008. "Waddington's Legacy to Developmental and Theoretical Biology" *Biological Theory* 3(3): 188–197.
- Carey, N. 2012. *The Epigenetics Revolution: How Modern Biology is Rewriting Our Understanding of Genetics, Disease, and Inheritance*. New York: Columbia University Press.
- Chaudhuri, U. 2012. "Queering the Green Man, Reframing the Garden: Marina Zurkow's *Mesocosm* (Northumberland UK) and the Theatre of Species." *Scapegoat: Architecture/Landscape/Political Economy*, Issue 02 (Materialism): 6–11.
- Dinnerstein, D. [1976] 1999. *The Mermaid and the Minotaur: Sexual Arrangements and Human Malaise*. New York: Other Press.
- Gilbert, S.F. 1991. "Induction and the Origins of Developmental Genetics." In S.F. Gilbert, ed., *A Conceptual History of Modern Embryology*, 181–206. Baltimore: Johns Hopkins University Press.
- Gilbert, S.F. 2000. "Diachronic Biology Meets Evo-Devo: C.H. Waddington's Approach to Evolutionary Developmental Biology." *American Zoologist* 40: 729–737.
- Margulis, L. and D. Sagan. 1997. *Slanted Truths: Essays on Gaia, Symbiosis, and Evolution*. New York: Springer-Verlag New York.

¹² See in particular Margulis and Sagan (1997) and Margulis and Sagan (2002).

- Margulis, L. and D. Sagan. 2002. *Acquiring Genomes: A Theory of the Origins of Species*. New York: Basic Books.
- Morton, T. 2009. *Ecology Without Nature: Rethinking Environmental Aesthetics*. Cambridge, MA: Harvard University Press.
- Morton, T. 2010. *The Ecological Thought*. Cambridge, MA: Harvard University Press.
- Slack, J.M.W. 2002. "Conrad Hal Waddington: The Last Renaissance Biologist?" *Nature Reviews Genetics* 3: 889–894.
- Speybroek, L. Van. 2002. "From Epigenesis to Epigenetics: The Case of C.H. Waddington." *Annals of the New York Academy of Sciences* 981: 61–81.
- Zurkow, Marina. 2012. "Agency, Intimacy, Change." Paper presented at the Society for Literature, Science, and the Arts, Milwaukee, Wisconsin, September 29, 2012.
- Waddington, C.H. 1939. *Introduction to Modern Genetics*. New York: Macmillan.
- Waddington, C.H. 1957. *The Strategy of Genes: A Discussion of Some Aspects of Theoretical Biology*. London: Allen & Unwin.
- Westbroek, P. 2012a. "Coming to Terms with Global Change: Technology is Not Enough.: Paper presented at "Earth, Life, and System: An Interdisciplinary Symposium in Honor of Lynn Margulis," Texas Tech University, September 14, 2012.
- Westbroek, P. 2012b. "Fishermen in the Maelstrom: Big History, Symbiosis, and Lynn Margulis as a Modern-Day Copernicus." In Dorion Sagan, ed., *Lynn Margulis: The Life and Legacy of a Scientific Rebel*. White River Junction, VT: Chelsea Green Publishing.