THE STRUCTURE OF FICTIONING: THE MYTH-FUNCTIONS OF CONTEMPORARY ART AND PHILOSOPHY

by David Burrows and Simon O’Sullivan.
Reviewed by Edith Doove.
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The structure of Fictioning: The Myth-Functions of Contemporary Art and Philosophy seems at first glance very neat and straightforwardly organized—three main sections each divided into two subsections with four to five chapters covering what the authors indicate as the three myth-functions of contemporary art and philosophy: “Mythropoesis to Performance Fictioning,” “Myth-Science to Science Fictioning” and finally “Myotechnoses to Machine Fictioning.” Within this seemingly clear structure, however, all chaos breaks loose. This is certainly due to what the publisher describes as the “rich constellation of recent philosophical perspectives—including those associated with the speculative and ontological turns, non-philosophy, residual and emergent cultures, decolonisation and the posthuman” and its moving “through counter-cultures, performance studies, continental philosophy, anthropology, afrofuturisms, feminisms, science fiction, cybernetics, neuroscience, artificial intelligence research, electronic music and other digital practices.” This whirlwind of references (of which the bibliography of 26 pages is evidence) is further combined with what the authors state as the book’s “necessarily different methods and speeds, operating on a variety of registers,” which they feel is due to the fact that it is a collaboration. Burrows, a reader in Fine Art at the Slade School of Art, and O’Sullivan, a professor of Art Theory and Practice in the Department of Visual Culture at Goldsmiths, University of London, also regularly collaborate with several others as Plastique Fantastique, a collective described on their website as “a mythopoetic fiction—an investigation of aesthetics, the sacred, popular culture and politics—produced through comics, performances, text, installations and shrines and assemblages,” which has clearly informed the current publication.

“Fictioning” here alludes to “an open-ended, experimental practice that involves performing, diagramming or assembling to create or anticipate new modes of existence” and thus not to fiction writing per se, but the book turns out to be just as unputdownable as the best novel you can lay your hands on or as hypnotic as Plastique Fantastique’s tunes for that matter. Almost written as a philosophical whodunit, the book “accelerates” this reader through to the final outcome only to have her find herself at the end of the book together with the authors back at the beginning—as they, and I, still have questions. This looping back comports with what Burrows and O’Sullivan find to their own surprise is the “anamorphic aspect of the book,” its being both an academic survey but equally “a document of a journey, or itself a performance,” referring in a final note to Holbein’s painting The Ambassadors, where a certain confidence about culture,
knowledge and education is undone through the anamorphic skull.

As the kind of fictioning that is discussed by necessity moves away from what is already known, this fascinating and enriching journey, or performance, is strongly future oriented and thus maybe not surprisingly influenced by Deleuzian notions of becoming, including the interest in a “people to come.” At the end of the journey—or, if you want, at the beginning, to stay in keeping with the book’s topsy-turvy—Burrows and O’Sullivan are refreshingly not too certain about things to come. Along the way they have not been afraid to tread dangerous terrain, especially with Prometheus and its potential consequences, but, as they state throughout the book, it is rather through affective fictionings than through rule-bound philosophies that they suggest a people to come can emerge.

If there’s one point of criticism I might have, it is the poor quality of the illustrations. Accompanying mentions of more-often-than-not relatively obscure artists, the small black-and-white illustrations don’t do the artists justice. On the other hand, you could use the book, as I have, as a companion that urges you to delve more deeply into the artists Burrows and O’Sullivan mention and immerse yourself in their fictioning worlds, especially in the case of sound artists. I ended up turning on a soundtrack of Sun Ra, who is extensively referred to in the chapter “Afrofuturism, Sonic Fiction and Alienation as Method.” His free jazz style, questioning known structures and promoting endless creativity and expression in pure awareness of a current state, is in more than one sense illustrative of what this book tries to do (listen for instance to, among others, his “Space Is the Place” or “Nuclear War”). Maybe an accompanying blog or website could be a flexible solution that would also allow for extension? For now, I’ll just take another ride and start from the beginning.

**GRAMMALEPSY: ESSAYS ON DIGITAL LANGUAGE ART**


Reviewed by Jan Baetens.

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A professor at Brown University, where he directs a graduate program in digital language art and teaches a writing course in immersive virtual reality, John Cayley is definitely one of the most important voices in theory and practice of what he is increasingly reluctant to call “electronic literature.” The latter term has been imposed by the double success of the leading professional organization, ELO (Electronic Literature Organization, www.eliterature.org), and the eponymous book by N. Katherine Hayles, *Electronic Literature*, commissioned by ELO (Notre Dame Univ. Press, 2008) and still considered a landmark publication in the field together with Lev Manovich’s *The Language of New Media* (MIT Press, 2001). Although, given their common literary background, Cayley’s work is very close to that of Hayles, his take on the field is highly original and as groundbreaking as Hayles’s, mainly because Cayley’s theoretical and critical writings are deeply rooted in a writerly practice. This practice-based but theoretically very strong approach explains the singular and singularly exciting position of Cayley in the field.

The use of the neologism gramma-lepsy is an easy way to highlight this originality. Clearly referencing Derrida’s grammatology, which redefines language in terms of material inscriptions, and thus questioning the typically Western and metaphysical belief in language as a mere copy of an interior voice, Cayley strengthens and broadens the materialist dimension of Derrida’s theory by foregrounding not so much the production of writing as the reception of language, both oral and written, which he defines as a semiotic process of “grasping” (hence the suffix “-lepsy,” as in narco-lepsy and comparable words), that is, as the process that converts material items in linguistic units. Language does not exist in itself; it comes into being, so to speak, when readers or listeners manage to convert certain objects into signs, more precisely into linguistic signs.

Grammalepsy is logically inseparable from the notion of medium, since linguistic signs do not appear in a void but are necessarily linked with a certain host medium, and Cayley’s work on medium, which is key in his approach, is in its turn linked to the notion of medium-specificity. For Cayley, it does not make much sense to qualify language as “a medium,” since the grammaletically gesture is not linked to a specific support or host medium: Language can appear in different host media, and there is no essential relationship between, for instance, writing (as a specific type of language) and the book. This relationship is the result of various longtime well-established cultural practices and usages, yet it should not be taken as the sign of an eternal or absolute connection, as demonstrated by the current shift from analog to digital forms of writing (which Cayley does not read in terms of supersetion but in terms of a further widening of the medium possibilities of writing).

For similar reasons, Cayley is also skeptical of the notion of electronic literature. On the one hand, he rejects the idea that the computer is a medium—that is, a single medium. Instead of reducing the material and semiotic complexities of this kind of writing (to be read in plural, obviously), he proposes to frame practices of electronic writing as examples of networked and programmable media: programmable, because it is code-based, and he makes very clear as well that code as such is not a language, for the simple reason that normally computer code resists grammaletically understandable, and networked, given the interaction between hardware and software, production and distribution, and writing and reading. On the other hand, Cayley also suggests that
the digital revolution deeply changes the very notion of literature, since the writing produced and processed in networked and programmable media is very different from the type of literature we used to find (and archive) in books. Materially speaking, the signs are changing, in the two senses of the word: They are no longer just verbal signs, but aural and visual signs. Moreover, they are also moving, that is, ephemeral, mobile, permanently mutable. Culturally speaking, the way we make sense of them also uses criteria that are different from those that produced the idea of literature in the era of the printed book (literary quality, for instance, is now challenged by certain quantitative aspects and issues of interaction and appropriation).

Grammalepsy is an essential book for many reasons. The quality of the author's theoretical sharpness and reflection is of course one of them, and one will find in this book an in-depth but often somewhat polemical dialogue with the field's major critics and theoreticians. No less important is the interaction with Cayley's own practice, which is always also a very critical practice, eager to explore the often-unnoticed constraints of both the technical tools and the institutional thresholds, limitations and black boxes of the industries that make and sell them (or that sell our use of them when they are offered for free). Cayley's work with Google has nothing to do with new literary genres such as Flarf poetry, which may have challenged canonical values in literature but did not critically question the Internet it used as a new tool of writing. In addition, it is absolutely fascinating to discover a book that brings together the best of Cayley's writing from more than two decades in a way that helps show the progressive thickening and strengthening of the author's creative and critical work. Grammalepsy is much more than a kind of personal anthology; it is a book that has the courage as well as the ambition to disclose a work in progress in time, that is, not a snapshot of the Cayley's ongoing production and reflection (that would just be a work "in progress") but an overview of the way in which this work in progress evolves in and through time (that is, taking the risk to reveal errors and contradictions). From that point of view, one can only admire the pioneering and visionary dimension of these essays, often much ahead of their times. Finally, it is also greatly refreshing to notice that Cayley's framing of the shift from analog to digital is permanently benefiting from the many insights that come from his literary background as both a theoretician and a poet. The lasting impact of book culture and the culture of poetry allows him to develop a critical theory of digital language art that is rich and complex, avoiding the traps of essentializing "electronic literature" while taking seriously the changes previous forms of writing are currently undergoing. Absolutely remarkable in this regard are his observations on the rise of the audiobook, an apparently "poor" and "monomedial" form of literature, which he provocatively links with projections on the dramatic changes of language, which is now no longer digitally processed in only its written but also in its oral forms (speech recognition, automatic translation, etc.).

**Electronic Literature**


Reviewed by Jan Baetens.

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Is it mere coincidence that I am given the opportunity to simultaneously review John Cayley's Grammalepsy and Scott Rettberg's Electronic Literature? Regardless of the very different scope and purpose of these two great books, the former more theoretically and conceptually oriented (although one should not underestimate the strong conceptualization and real theoretical thinking of Rettberg), the latter having a more directly encyclopedic ambition (even if Cayley's book can also be used by all those who are interested in a thorough mapping of the field), their more-or-less joint publication is probably a sign of the times. More and more books are being published that manage to combine the best of both worlds: a large overview of what electronic literature (and, as we know, the term is far from being accepted by all those working in this field) has been yet also currently represents and an in-depth theoretical reflection on the actual meaning and challenges as well as restrictions and obstacles of this type of writing (and it should be clear from the start that the notion of writing can no longer be restricted to written language alone, in spite of the fact that even after the visual and digital turn, written language remains at the center of what is happening in electronic literature at large).

As one of the key practitioners as well as theoreticians in the field, Rettberg approaches electronic literature as a form of experimental writing. This is an important initial claim for two reasons. First of all, it allows establishment of a kind of a priori continuity between analog forms of experimental writing, such as Dada (a movement Rettberg is not afraid of calling the most important artistic movement of the twentieth century—one is, of course, allowed to
disagree, but that's another issue) and electronic literature, not only in its most innovative forms but as a specific type of writing in itself. Second, the experimental take on electronic literature as a whole helps the author avoid some of the pitfalls that have hindered much previous thinking, for instance the idea that electronic writing would supersede analog forms of literature (this is clearly not the case, and the clear framing of electronic literature as experimental immediately dissipates such naïvetés) or the idea that electronic literature has the same role and impact as the giants that currently dominate the market. Instead, the emphasis on experimentalism, which takes into account the relative weakness of this type of literature in comparison with the corporate use and control of the Internet by giants like Amazon and Google, highlights the critical and cultural value of electronic writing for the future of textuality.

Rettberg's ambition in this book is at once very modest and utterly original. At first sight, it proposes an all-encompassing overview of what has been produced in the field. The past tense is not a detail here, since the light-speed changes of technology, hardware and software alike mean that many works have ceased to be accessible—a crucial issue in electronic writing, already the object of another recent outstanding book, *Traversals* (by Stuart Moulthrop and Dene Grigar; in comparison, however, the tone of Rettberg's study is much more optimistic). Yet what is important here is not only the exceptional scope of the material covered in this book (I cannot think of an important work of electronic literature that would be missing) but also the singular theoretical approach that is followed to organize, describe and analyze the material.

Rettberg's starting point is amazingly simple, since he proposes a taxonomy that adopts the traditional category of *genre*. The classification of the complete production along five genre lines (combinatory poetics, hypertext fiction, interactive fiction, kinetic and interactive poetry, and collaborative networked writing for the Internet, eventually complemented with a certain number of practices that blur the boundaries between writing and other practices, such as gallery installations or expanded cinema) is at the same time very transparent, perfectly user friendly and highly efficient, thanks to, for instance, the permanent awareness that the frontiers between genres are porous, that genres can be mixed, that genres are not transhistorical essences but change over time, etc. However, this apparent simplicity should not prevent us from seeing its great explicative power and important theoretical stakes. The apparently old-fashioned instrument of genre theory proves perfectly compatible with a sharp reading of the interaction between text and technology, making room for a revision of general genre theory in light of medium theory and information and communication theory that both revitalizes the notion of genre and avoids the simplifications of technodeterminism. Genre thus proves to be the ideal playground for a thorough rethinking of the creative interplay between writing and technology, which should profit genre theory in analog contexts—and probably other fields such as media archeology (where a traditional concept such as genre is often the object of some a priori distrust).

Two last words on this important book. For all those looking for a sound and perfectly informed introduction to the field written by someone whose inside knowledge and personal experience does not twist or distort an almost jargonless description of the field: This is the book you have been waiting for. And for hurried readers: On pages 14–17, Rettberg even achieves the tour de force of discussing all important critical thinking and major books and authors in a crystal-clear synthesis. For all those eager to continue the theoretical discussions launched by key voices such as, well, those detailed on the abovementioned pages 14–17: Do not think that this book is just a guided tour of what electronic literature stands for today; each page of this work contains theoretical and critical suggestions and surprises, as if it were also a videogame with (intellectual) Easter eggs.

**UNDERLAND:**
**A DEEP TIME JOURNEY**


Reviewed by Allan Graubard.

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This book is a poignant mediation on the underworld, which we cannot readily see but which we can certainly feel, whether as an intimation or as an invitation. In both cases, for the author, it is ready cause for exploration. Its several parts detail his journeys above and below ground, ever seeking access to the phenomenal world within the earth in different places and at various depths. His descents include locations in his native Britain; then Paris, France; the Italian Carso; the Slovenian highlands; and the isolated, brutal glaciered terrains of Norway, Greenland and Finland. The several parts he has designed to structure the book, however, reveal something else about the two passions that drive him and which, in his writing, he uses to effect: acute observation and subjective revelation. Verging now and then on the poetic, and using poetry and myth as touchstones, his descriptions and discussions clarify as they compel quite personal reflections on each place he brings us to, its significance for past and current inhabitants—if any—and the sensibility and emotions they provoke. From the opening part title, *Descending*, which sets the action, Macfarlane moves to *Seeing, Hiding* and finally *Haunting*. Characteristically, while the two former terms are explicit, the latter terms are ambiguous.

How do *hiding* and *haunting* shape the experiences that Macfarlane writes about? And why is it, when refined observation opens generously to the emotions, the interaction...
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Robert Macfarlane’s vision, renewed and expanded, that he refers to. When “descent becomes a movement toward revelation rather than deprivation,” he is that fellow seeking an encounter that embodies the act, whether in the pitch dark at depth, the low filtered light that percolates ever strangely into the greater obscurity below him, or the deep blue light seen best in crevasses in the arctic ice.

The relationships that exist “between landscape and the human heart,” as Macfarlane puts it, are much more than surficial. The beauty and wildness in nature or the regulated urbanity that we see and, more than not, expect to see, resume in different forms when met in the earth. Mesolithic cave burial sites speak of different forms when met in the earth. Mesolithic cave burial sites speak of other species, radiologic and geologic time scales become an important counterpoint. It is a chromometric expanse that I can forget too easily in the crush of quotidian details that consume me and the speed with which they appear and vanish. Underland: A Deep Time Journey restores something of the balance necessary to understand not only who we are, us humans, and where we come from but something of what we were, what we have become and what ties us to our ancestors and our planet.

A DIFFERENT KIND OF ANIMAL: HOW CULTURE TRANSFORMED OUR SPECIES


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A Different Kind of Animal is based on two lectures Robert Boyd delivered in 2016 at Princeton University as a part of the Tanner Lectures on Human Values series. In these lectures Boyd introduces his theory that biology and culture are both evolutionary, a topic he’s been working on with Peter Richerson for three decades. Needless to say, this is a broad topic, a point brought home by the four commentators’ responses to the lectures also included in the volume. All four commentators endorse the contours of Boyd’s theory, and their critiques also raise valid questions: Is Boyd too reductive? Does Boyd’s view of social learning and cooperation rely too much on copying others? Does he adequately define the ways that norms arise and change? Is he ignoring how individuals manipulate norms?

At the beginning of the book Boyd points out that his lectures are about human uniqueness and cumulative cultural adaptation, not the inventive capacities of individuals. He writes:

We are much better at learning from others than other species are, and equally important, we are motivated to learn from others even when we do not understand why our models are doing what they are doing. This psychology allows human populations to accumulate pools of adaptive information that greatly exceed the inventive capacities of individuals. Cumulative cultural evolution is critical for human adaptation (p. 16).
While he mentions cumulative cultural evolution, one problem throughout the study is that his theory is based on locally based, small-scale ethnographic studies. Indeed, the real downside of the book is that Boyd never sufficiently explains how or why anyone should presume these studies could or would apply broadly. To summarize, Boyd says that social learning accounts for our remarkable success because it includes culturally transmitted information and the rules (or norms) that govern social interaction. As Boyd explains it, in relatively small groups—again, the bulk of the research presented—the benefits associated with third-party monitoring and punishment led to the evolution of a norm psychology that allowed for more extensive small-scale cooperation in early human societies. This, in his view, may have helped weakly related bands seize benefits from social exchange. Boyd additionally postulates that this in turn led to the evolution of a moral psychology, which structured the subsequent evolution of larger-scale cooperation through what he calls cultural group selection. He also stresses that human beings differ from other mammals and have become the most dominant species on Earth. “The claim here is that we can adapt to a very wide range of environments, and other animals can’t, because cultural evolution gives rise to the gradual accumulation of locally adaptive knowledge at a much faster rate than genetic evolution” (p. 42). His phrasing often reminded me of the pre-Darwinian position that humans are exceptional because we are closer to God, although this clearly is not his argument.

More specifically, the first chapter argues that cultural adaptation means that people have to be motivated to acquire the beliefs of the people around them. Here the author endeavors to show that even the simplest hunter-gatherer societies depend on tools and knowledge far too complex for individuals to acquire on their own. Much of this argument rests on the example of lost European explorers Robert Burke and William Wills, introduced at the beginning of this chapter and threaded throughout the book. Wills’s diary revealed that they were saved from starvation by nardoo cakes provided by an Aboriginal group, the Yandruwandha in Australia. Later, when Burke and Wills tried to make their own nardoo cakes to survive, they died, because they didn’t have the knowledge of the Yandruwandha. Boyd attributes this to the Europeans’ lack of information. In other words, according to Boyd’s hypothesis, the Yandruwandha did not have some kind of instruction manual or natural history handbook of their area that explained nardoo preparation, because the required information was implicit knowledge that was culturally transmitted. As outsiders, Burke and Wills were ignorant of what was implicitly known to those within the culture. As a result, the explorers failed to realize the nardoo used to make the cakes contained toxic elements. Because Burke and Wills failed to prepare the plant properly, it provided no nourishment, and its poison no doubt accelerated their demise. Boyd uses various other contemporary forager groups to tease out his points about implicit knowledge(357,908),(642,996)(357,908),(642,996), explaining that we have to look at similar cohorts because we cannot confirm the details with the Yandruwandha—European germs and guns wiped them out.

The second chapter, “Beyond Kith and Kin,” is about cooperation and warfare. It, too, emphasizes localized research rather than an enlarged and cumulative cultural evolution equation. In other words, Boyd doesn’t ask, for example, how “germs and guns” fit within the implicit knowledge hypothesis or why the Europeans survived and the Yandruwandha died out. Rather, his concern is human kinship in the evolutionary scheme of things, or, as he puts it, why it is that humans are the only group in nature that cooperate with those who are not kin. In his words:

Everywhere else in nature, large-scale cooperation is explained by kinship, but in humans it is not. So here’s the puzzle: How could natural selection favor changes in human psychology that led to cooperation among large numbers of unrelated people? (p. 80)

Here Boyd speaks about the impact of a system of norms enforced by sanctions imposed by third parties. Direct sanctions, he tells us, are more effective than reciprocity, an alternative theory, because they can be targeted, because they can be guaranteed by a minority of punishers, because they act as a deterrent and because the magnitude of the damage can be as much as the one doing the sanctioning can afford to administer. This argument is presented through a small-scale Turkana warfare study intended to illustrate that direct sanctions play a role in cooperation. The research on the Turkana, a group of “nomadic subsistence pastoralists who live in the arid savanna of East Africa” leads him to broadly conclude that the production of public good plays a central role in every human society but is rarely observed in other species. I do not dispute that “public good” plays a central role in societies, although given the politics and brushing aside of norms in the United States these days I suppose this conclusion is increasingly open to debate.
The larger point is that Boyd’s supporting evidence does not sufficiently encompass either cultural evolution or biology in terms of the mosaic that exists in the human world now. Presenting the volume as a discussion was an excellent idea, particularly since the core theory seems overly simplistic and reductionistic. That said, Boyd’s responses to the critiques were the most disappointing aspect of the book, because, in my view, he failed to grasp some of the valid criticisms within the commentaries. The response essays also seemed somewhat truncated, suggesting there was a word limit for these authors. H. Allen Orr, an evolutionary biologist, wonders if Boyd’s imitation model is really all that different from the Big Brain model he rejects. Orr also compares Boyd’s work with Friedrich Hayek’s argument that social norms, ethical mores and even institutions are sometimes a product of a sort of social evolution, a Darwinian natural selection. Ruth Mace, an evolutionary anthropologist, critiques the norm thesis, noting that Boyd fails to address how they arise, why they vary and how they are maintained. I found Kim Sterelny’s critique the most compelling, although I wish it had been more developed; his brief led me to think I should look out for his work in this area. A philosopher of science, Sterelny largely endorses the argument that humans are outliers among mammals. However, he asks if Boyd’s overly reductive framework fails to critique some of his own foundational tenets (social learning, trust, etc.). Three key points in Sterelny’s essay are that (1) the lectures fail to ask whether and how social learning has changed across domains and over time, (2) Boyd’s emphasis on copying ignores that we also learn by practice and (3) social learning heuristics may have become more nuanced over evolutionary time.

Finally, the response by economist Paul Seabright speaks about norm manipulation and points out that folktales offer insight into how to navigate in a world in which norms conflict. He finds this theme at the heart of the Iliad and the Odyssey, of the Mahabharata and the Ramayana, and of other myths from around the world. His point is that these stories demonstrate that even in ancient cultures it was often hard to know what the general norm required an individual to do in particular circumstances. Boyd’s response to the value of these kinds of narratives ends the book and, for me, suggested he has a very superficial relationship with humanities research and the content of the classics of various cultures:

I agree with Seabright that conflict among norms is an old problem. . . . The problem is that the content of such tales is not determined by some social function, but instead by what people find interesting and memorable, and there are good reasons to suspect that this makes the content of folktales biased in favor of situations that involve conflicts. As an analogy, imagine that sometime in the future, somebody tried to reconstruct twentieth-century English life from a collection of Agatha Christie novels. They’d get some things right but would vastly overestimate the likelihood of murder (p. 196).

His equating of these tales with Agatha Christie suggests a limited understanding of the range of information these kinds of stories contain and seems more like a straw man retort than a thoughtful comment on cultural norms. For one, earlier he writes that warfare and cooperation are a part of all cultures, and yet he rejects the value of these narratives: “The content of folktales is biased in favor of situations that involve conflicts” (p. 196). More concerning is that Boyd doesn’t seem to know that the tales of an oral culture serve as a vehicle for the transmission of its implicit knowledge, which becomes more evident as a culture begins to write down tales. While I do not know if the Yandruwandha who helped the European explorers had an oral literature that served as the kind of handbook Boyd tells us did not exist in regard to nardoo, many cultures did transmit this kind of information orally at first. Because some oral tales, like the Iliad and the Odyssey or the Mahabharata and the Ramayana, were later written down, we can see how they served to educate the culture at large. Indeed, researchers have shown that they cover everything from medical treatment (e.g. of wounds in battle in these tales superficially about conflict) to social norms.

In summary, I question whether Boyd’s narrowly designed studies provide a sufficient entry point through which to think about cultural evolution in terms of large-scale, living cultures. Narrow ethnographic populations hardly mirror how cultures have evolved around the globe and brought us to where we are now. Given the diversity within the global demographic mosaic, I am unconvinced that any of the cultures presented in his research are representative of populations at large. This is not to say that the work isn’t compelling on its own terms. As for the biological aspect of Boyd’s work, I was somewhat perplexed by the lack of attention Boyd gives to studies of the brain per se. While I share his dissatisfaction with evolutionary psychology and agree that theories of mind leave much to be desired, his proclamations about social learning are largely speculative. They seem to exist in a cognitive vacuum in terms of the broad range of studies on learning and education available these days. In addition, unlike Daniel Lord Smail’s On Deep History and the Brain [1], which weaves the deep past before writing on contemporary findings in neuroscience and neurobiology, Boyd seems to find having a model that links to elements of our present culture unnecessary.

As I read, I kept thinking that Gerald Edelman (1929–2014), the American biologist who shared the 1972 Nobel Prize in Physiology or Medicine, offers a counter position that strikes me as a better starting point.
than Boyd’s work. Edelman’s Neural Darwinism theory, built around the idea of plasticity in the neural network in response to the environment, seems more responsive to change. Edelman writes:

Given the parallel, constructive brain processes that underlie consciousness, given the recursive symbolic properties of language, and finally, given the irreversible historical bases for specific symbolic and artistic realizations in society and culture, there can be no fully reducible description of human knowledge. But different spheres of knowledge and different subject domains can be compatible with each other, and their bases in biological and cultural evolution can be understood [2].

Finally, like the four commentators, I endorse the contours of Boyd’s theory. I also differ from them in a way worth mentioning. A striking element that tied the four responses together is that given their familiarity with “Rob’s” (or Rob and Pete’s) work, they all seemed to derive from a particular framework of social biology with its own set of norms. Suffice it to say that while I am familiar with some of the threads of this approach, I was surprised to find that the lectures brought to mind the Two Cultures framework, one I am frequently inclined to take issue with in terms of art and science. As a result, this book convinced me that the chasm is much larger than I conceptualized. Although I, too, think that both biology and culture are evolutionary, and my research aims share some commonalities with Boyd’s perspective, I find it puzzling that my research focus is not at all similar to his, nor does it resemble the alternative theories he dissects and rejects.

Because Boyd’s quantitative analyses rely so much on local ethnographic studies, he misses large swaths of human cultural adaptation. Indeed, because Boyd does not provide sufficient connective tissue for explaining how his theoretical conclusions about cultural adaptation led to various communities of today with long and evolving histories, his discrete studies say little about how the present state of affairs came to be. As he himself notes, “In a contemporary world in which external conditions are changing at a frantic pace, there is no reason to suppose that existing norms are well suited to current environments” (p. 105). Similarly, as even Boyd recognizes, he does not offer a theory that explains something we see around us:

In the United States over the last few decades there have been shifts in norms about smoking, premarital sex and giving birth to children out of wedlock, and same-sex marriage. It seems implausible that any of these shifts were caused by competition between groups. There has been no group extinction or spread and we didn’t copy the new norms of anybody else . . . We don’t have a good theory explaining such shifts in norms (p. 109).

References

THE LONG NOW: PUBLIC STUDIO

Reviewed by Robert Maddox-Harle.
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This book is a comprehensive account of the rather unusual collaboration of a filmmaker and an architect. Filmmaker Elle Flanders and architect Tamira Sawatzky formed a collective, artistic practice in 2011 called Public Studio. Since that time, they have produced numerous “works”—large-scale public artworks, films and immersive installations. The Art Gallery of York University (agYU) was there at the inception of Public Studio, and a long-term relationship has evolved between them, especially through smaller projects such as CIA and What We Lose in Metrics (2016). Both projects are discussed and described in the book.

Public Studio’s work is multi-disciplinary, engaging experts from various disciplines, as required, to work together with Flanders and Sawatzky on their projects. These projects have themes of political dissent, war and militarization, environmental destruction, racism and the rights of animals and nature. The works are confronting, controversial and (unashamedly) challenging. But are they effective? I discuss this further on.

Under the direction of Philip Monk, the agYU has remained at the forefront of cutting-edge contemporary art. As with all agYU books and catalogs I have reviewed over the years, this book is beautifully produced: graphically rich, with an excellent balance of images and scholarly texts. Monk has recently retired as director, and as I understand Emelie Chhangur is filling this role until a permanent new director is appointed.

The book starts with an introduction by Chhangur and Monk, followed by a description of the Centre for Incidental Activisms (CIA). Next we are treated to a long interview with Public Studio, “Extension/Extraction/Exploitation,” again by Monk and Chhangur. This interview really helps us understand where Flanders and Sawatzky “are coming from,” but it is not without its tense moments! This is followed by a description of the Public Studio’s project What We Lose in Metrics (2016). Then there are four excellent essays, as follows:

“Gaming the Environment: On the Media Ecology of Public Studio” by T.J. Demos
“Public Proxies” by Susan Schuppli
“A Dark Meteorology” by Jayne Wilkinson
“There There: Mapping Twelve Digs” by John Greyson
These essays are followed by an extensive section, “Portfolio of Work,” which documents nine of Public Studio’s major works.

Wilkinson’s essay mainly discusses Public Studio’s projects concerned with climate change and environmental destruction. She sums up Public Studio’s raison d’être so well I will quote it extensively:

These (self)-destructive conditions of contemporary life are the back-drop against which Public Studio’s charged and densely researched projects operate. Working within a world of excessive visual data, proliferating documents, oppressive government surveillance, and violent images of environmental destruction, their multi-faceted installations and exhibitions offer us different ways to think through the atmospheres of the present . . . . Through collaborations with poets, sound artists, technologists, and computer programmers, their work complicates the politics of asymmetrical warfare, environmental violence, and animal-human relations by making the aesthetics of politics present (p. 108).

This essay, and presumably by extension Public Studio’s projects discussed therein, are rather depressing and excessively doomsdayish. To my mind, “better to light the smallest candle than curse the darkness”; that is, go ahead and rub the approaching disastrous environmental collapse and extinction of humans and animals in the public’s face—but perhaps offer some glimmer of hope and a way out of the mess. No easy job to be sure. As an example to illustrate my point, while Google Search generates income for Google only with each search done, Ecosia’s search engine generates income that is used to plant trees to help the environment—over 50 million to date! This is real-time activism for the “everyman,” with tangible results, not preaching to the converted in an insular art gallery scene.

In the interview mentioned earlier, by Monk and Chhangur, the pressure of making art to save the world is no easy task, if at all possible. To quote Sawatzky concerning these very issues, “I think there is a bit of a crisis, and we’re rethinking art making and whether this really is the thing we should be doing. I think we’re often unsure whether it’s still meaningful to us: feeling like a production studio” (p. 31). In the same interview, Flanders and Sawatzky discuss authorship, analyzing when they have done enough in a project and should hand over the next phase to collaborators. This adds to the abovementioned dilemma that I imagine most artists working in collaboration face from time to time.

The above criticisms aside, I think Flanders and Sawatzky are very courageous individuals. They have tackled head on the whole neoliberalist abomination, delved deeply into the most shocking racial tensions in the world (Visit Palestine) and exposed the anti-human, antilife actions of many military regimes. I thoroughly recommend this book to all artists and activists who have an interest in employing art as a means for bringing about social, cultural and environmental change.

ERWIN SCHRODINGER’S COLOR THEORY: TRANSLATED WITH MODERN COMMENTARY


Reviewed by Ernest Edmonds and Mike Leggett, Creativity & Cognition Studios, University of Technology Sydney. Email: legart@ozemail.com.au.

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Schrödinger is perhaps best known for proposing in 1935 the thought experiment involving a cat in a sealed box with an atomic particle. The particle was about to liberate itself at some point in time and thereby release a death-dealing dose to the cat—but opening the box to determine the cat’s fate would be interference and therefore nullify the experiment.

As one of the team credited with proposing the theory of quantum mechanics a decade earlier, Schrödinger, with this thought experiment, riffed on the flighty nature of early research in particle physics; however, Schrödinger’s broader interdisciplinary research engaged mainly with several fields of observable physics as well as with psychology and perception, including the area of color theory, the subject of this volume. In the early 1920s a series of papers published in Germany detailed his earlier research, and nearly 100 years later, Niall has brought all the papers together in translated form for the first time. (In acknowledging the vicissitudes of translation, two of the eight chapters are reprinted in the original).

The translator’s introductory essay jumps right into the issues, assuming of the reader a level of familiarity with physics research and its methodologies, commencing with Newton’s light experiments through to Fechner’s Law and Helmholtz’s work with geometric axioms. Schrödinger was in a scientific tradition that set out to explain color and the relationships between different colors in some form of mathematical structure. We are very used to color wheels and other geometric pictures of color relationships, and it is not misplaced to see this work from the perspective of geometry.

An example of a key question that might be answered from an effective color model put in lay terms is “Are these two colors of the same brightness?” This is surely an issue that exercises many visual artists. It relates closely to a problem that Schrödinger worked on: the formal meaning of brightness. We see in these papers a clear understanding that, for some researchers, the very notion of defining “equal brightness” is altogether impossible. However, he shows that, using his model, empirical studies (studies that he seems to have left to others)
can be defined that can answer the question. That oversimplifies it, but the point is that he worked toward a solution and, perhaps most significantly, was very open about the possible outcome.

While Schrödinger’s mathematics is formal and precise and does not bring color to life in an imaginative sense, it is the kind of thing we need if we are to deal with color computationally. Interestingly, the digital arts still show many examples of color being selected “by eye,” in the traditional sense, or being used as markers of difference and so essentially selected arbitrarily. The computation, systems, analysis and generation of color and color relationships in digital art are less common, although some artists (including one of the reviewers) certainly do this. To them, this formal modeling of color is vital, and the problems that are associated with it very real. To use such models in digital art it is useful to have discrete mathematical descriptions, rather than the continuous mathematical formulations seen in these 1920s papers, but that is a relatively small matter to overcome.

A fundamental issue that Schrödinger takes very seriously is the relationship between color differences according to formal physical models and according to human perception. The scientific view is that perception is distorted and limited in various ways that offer a challenge to finding a reliable mapping between the two, something that we read about in these papers. An artist might turn that issue on its head. Color is something we perceive, and the physical models that scientists have developed so far, based admittedly on the physics of light, etc., are struggling to describe it accurately. Either way around it remains a problem. The papers in this book show that Schrödinger was an important figure in the history of attempts to solve it. Indeed, we read interesting investigations into the properties of human vision in which he seeks to understand the physical basis for our perception of color and even postulates developments in human evolution that could explain certain characteristics of that perception.

Particularly impressive in all of Schrödinger’s writings presented here is the frank, tentative and open approach that he takes; for example: “It seems to me that a complete explanation of the subjective color of starlight is provided by . . . ” He is often careful in what he claims while providing very tightly woven arguments.

For all the positive things that we can remark on in relation to the papers translated here, it is not possible to be so praising of the book itself. The subtitle is Translated with Modern Commentary, but although it is true that the papers are translated, the commentary is fairly brief. Although it is clearly written and does not include mathematics directly, it does assume a certain level of familiarity with the technicalities of the field. The selected papers are collected and presented in English translation, which is certainly helpful. However, as indicated above, the work is interesting and valuable to nonexperts, such as some artists who might find the mathematics hard going. For this broader readership, an introduction with more explanation and a lay summary of each paper would have helped. An index is another element that would have been helpful but is missing.

**Leonardo da Vinci: A CLOSER LOOK**


Reviewed by Giovanna L. Costantini. Email: gjf3165@gmail.com.
https://doi.org/10.1162/leon_r_01848

To mark the 500th anniversary of the lifetime of Leonardo da Vinci, the Royal Collection Trust under the auspices of Queen Elizabeth II has published a lavish edition of the drawings of Leonardo, one that investigates the various materials and methods employed in the extraordinary collection of Leonardo drawings housed in the Print Room at Windsor Castle. Revealed through an array of scientific technologies that include visible infrared transmission, ultraviolet and multispectral imaging, optical microscopy, X-ray fluorescence, Raman spectroscopy and synchrotron-generated XRF microanalysis, drawings were scrupulously examined to expose paper composition, ink compounds and hidden media, implement imprintation, preliminary sketches, erased marks, inscriptions, watermarks, luminescence and other features of artworks obscured for over 500 years.

Authored by Alan Donnithorne, Conservator of Prints and Drawings at the British Museum and Chief Restorer of Drawings at the Royal Library, the study was undertaken by one uniquely positioned to examine the renowned collection of nearly 600 drawings held at Windsor Castle. Based in part on prior research projects carried out with the British Museum’s Department of Scientific Research, this text offers the first in-depth study focused exclusively on Leonardo’s drawing materials and working methods “seen through a microscope.” As a complement to esteemed studies by Kenneth Clark originating in 1935, followed by Carlo Pedretti’s focused catalogs of Leonardo’s nature studies, anatomical drawings and horses in the Royal Library, Donnithorne’s investigation provides invaluable primary evidence for Leonardo scholarship in areas of conservation, art history, fine art and collection. It also expands significantly upon the acclaimed *Leonardo da Vinci, Master Draftsman* catalog issued to accompany an exhibition at the Metropolitan Museum of New York in 2003 through penetrating scientific scrutiny that points up the import of every facet of Leonardo’s artistic process.
Sections of the text provide in-depth examinations of the lines and brushstrokes, papers, styli, metal points, inks, chalks/charcoal and brushes used in the production of the drawings. Analytics common to conservators reveal the artist's manner of working, the pressure and direction of his hand, differences of touch and the way the drawing tool was moved across the paper. These factors serve to identify such features as the sharpness of outlines, the softness of blended shadows, the thin transparency of washes and accretions of ink. Placing primary emphasis on disegno, the act of drawing as the artist's means toward the realization of ideas, the author inspects the many kinds of marks described by Leonardo as outlines and lines that curve to one side or another, broad or fine, blended without strokes in parts to achieve the highest degree of brightness and shadow.

In the papers chosen by the artist, Donnithorne emphasizes the importance of support in the appearance of the drawings, the character of the marks left on the surface intimately dependent on the paper’s integral composition and the way the artist's drawing tools interact with it. He considers a variety of papers favored by Leonardo, from the finest white to the coarsest brown, along with the subjects and treatments the artist reserves for each. This chapter includes an account of the origins of papermaking in the west from its foundations in thirteenth-century Italy and a detailed description of artisanal papermaking in the early Renaissance. Among Leonardo's studies Donnithorne notes qualities of color, brilliance, texture and luster impacted by the paper together with fabrication details such as fibers, laid lines, deckle and watermarks made evident through transmitted light. An especially evocative drawing of an old man with flowing beard, for example, one of the last by Leonardo, is full of fibers that include straw and rope, knots and shive, accented by an imperfection in the paper, a lump above the eye in the drawing's upper center.

Chapters on styli and metal point examine drawing instruments in brass, the lead and silver styli referred to as silverpoint and grounds of powdered bone applied as coatings for metal point. Elemental maps and specular reflections show the relative distribution of silver in a metal point study of a horse on blue-gray prepared paper; logarithmic scale graphs indicate their silver, copper and mercury content; and brilliantly colored magnifications display the heightened contour of a horse's legs. On a design for an equestrian monument, Donnithorne writes that the "lines of thin-drawing positively gleam with metallic intensity when viewed at an angle against the light" (86).

The eloquent correspondence between particular subjects, their virtuosity of rendering and the materials and methods employed in their facture rises at times to a level of poetry. Within a sheet filled with diagrams and notations for various mechanical apparatuses, an infrared transmission discerns the watermark of a mermaid with perfect clarity. Other watermarks, unveiled beneath the head of a youth in profile and studies of the heart, include the hind legs of a prancing dragon, a Catherine wheel and an eagle in a circle. These emblematic drawings seem to emerge from the very core of the support, soul-like, drawn in light. Exposed through ultraviolet-induced imaging, glints of white heightening over red chalk on pale red paper take on the appearance of ethereal luminosity in The Alps Seen from Milan. Carbon black imbues the drapery of a kneeling figure with tender poignancy; wetted chalk suffuses the head of Saint Anne with a delicate sfumato halo. There are punch marks used for charcoal-dust transfer and blind stylus diagrams of polyhedrons, cubes, circles and arcs—geometric tracery made with instruments such as compasses tipped in steel.

This publication's quintessential beauty extends beyond the elegance of Leonardo's drawings to the incomplete, often fragmentary images captured through state-of-the-art technology—the haunting, partially erased underdrawing of a human skull, the faded metal point of neck and hands, the black chalk muscles of a human leg. Artfully interwoven are the works of the artist with other Renaissance paintings, manuscripts and frescos; passages from such sources as Cennino Cennini's Il Libro del Arte and Giorgio Vasari's Lives of the Artists; exacting diagrams and graphs; and photographs that include spectacular full-color microscopic and macroscopic details. Not confined to medium or epoch, Donnithorne's text integrates multiple perspectives, contexts, cultures and chronological periods in authoritative historical exposition. It is especially commendable in its seamless integration of science, art and technology together with an approach that fuses logistical analysis with art historical interpretation. Emblematic of the embryonic/gestational nature of Leonardo's inspiration, and pointing to the promise of future research, Donnithorne's study opens and closes with one of the artist's best-known drawings—a fetus in the womb (1511), executed in pen and ink, red chalk over black chalk, with notes on reproduction and sketches of the fetus in the womb on the verso. It alludes obliquely to Leonardo's spirit of inquiry to which, in the words of Kenneth Clark, "the vast corpus of modern scientific knowledge owes its origin," and to Leonardo's own conception of disegno, inscribed in the drawings as his advice to painters to apply themselves first through draftsmanship "to giving a visual embodiment to your intention and the invention which took form first in your imagination.”
ROBOT RIGHTS


Reviewed by Eugenia Stamboliev.
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The title Robot Rights immediately struck me as problematic. But this hesitation—anticipated by Gunkel in the first chapter—became a motivator to engage with this publication. Gunkel does not aim to resolve any dispute on robots (not) deserving any rights; he instead brings up different camps, arguments and concerns to discuss, and then challenge, the view of robots as anthropomorphic entities. Despite a lack of agreement on what robots actually are, Gunkel argues in the last chapter that, to understand robots ethically, we must take a relational approach to robotic agency and status, not an ontological one.

Gunkel begins by contextualizing the initial resistance to debating robot rights as he works around this critical reflex by researchers and various legal bodies such as EU institutions. He grounds this by synthesizing historical and theoretical discussions that exceed robotics literature, science fiction dreams and philosophical simplifications. To create a framework for discussing robot rights, he then applies a Humean approach to recognise how the verbs “is” and “ought” organise qualitatively different kinds of statements and modes of inquiry. The former concerns ontological matters or statements of fact; the latter consists in axiological decisions involving what should be done or what ought to be done (p. 4).

Consequently, the middle chapters address four angles through which robots—could/should; could/should not; could not/should not; and could not/should have rights. It seems as if Gunkel uses the question of robot rights as a “backdoor” to discuss how we have been assigning/depriving rights historically—be it to humans, animals or robots. Within these categories, different agency statuses and perspectives are brought up and linked to wider frameworks, including ontology/ethics, appearance, anthropocentrism, moral sentimen-
talism and legal arguments—to name a few.

The historical background on robots as mechanical slaves seems worth mentioning as this topic has received more attention recently. By revisiting this problematic ambition, Gunkel unpacks the wide-ranging statuses of robots today—between agents, bodies, tools, objects, workers or companions—which guide their legal and moral status equally. He significantly links historical property, ownership and slavery debates to the very act of designing robots and to robot imaginaries in early cybernetics and science fiction (section 4.2.3, “Slavery 2.0”) shifting our awareness to a crucial and neglected contingency; between robotic design and racializing practices engrained in the mechanizations of human bodies and labor [1].

Gunkel’s major contribution, however, is in the final chapter, in which he offers a progressive perspective on thinking otherwise (p. 159) as he contests ontological and dichotomous views by repositioning robots as relational others. Inspired by Levis-

nas’s philosophy on difference, face-to-face responsibility and the ethics of otherness, Gunkel here suggests that we must rethink otherness, instead of tracing and reducing “apparent” (or “essential”) differences between robots and humans. This shift is intended to interrupt an associative chain between human resemblance, personhood and moral/legal rights. For readers unfamiliar with Levinas or with poststructuralist ethics, this last chapter could be a difficult read, despite Gunkel’s clear contextualization of a complex philosophical tradition. Yet it is a crucial outlook, since it highlights concerns on how the resemblance of the robot body and face to human features still guides essentialist and anthropomorphic pseudo-causalties around their status.

Gunkel’s ethical reformulation is more than timely and needed, but I miss a discussion between the relational approach and the legal or commercial intricacies around, for instance, humanoid care robots, which also impact privacy or ownership rights of vulnerable people exposed to them. Clearly, this is not central to his philosophical contestation of the “very means by which we have gone about trying to articulate and formulate this problem [the moral and legal status of robots] and its investigation” (p. 185). Hence, questions on the legal concerns around the implementations of robots as digital commodities fail short.

Robot Rights offers a valuable discussion on how to critically contextualize the moral and legal status of technological manifestations like robots, although it essentially destabilizes the very ground for thinking robotic ontologies so that research can move beyond “fun” questions on personhood (according to Floridi [p. 37]) toward exploring concerns of robots as new forms of digital agencies. This book could be demanding for those only used to digesting philosophical backdrops or for those not familiar with robotics and robot ethics. However, for those interested in critical or posthumanist theories,
yet unaware of relational or affective turns, or posthumanist critique of anthropocentric ethics, it is worth reading, especially the last chapter. Simultaneously, it demands some attention from digital media researchers/posthumanist philosophers, who often dismiss robots as foreign to their research and risk ceding a pressing discussion on this contested digital technology to robotics-led disciplines completely.

Reference

1 For more on this, see Neda Atanasoski and Kalindi Vora, Surrogate Humanity: Race, Robots, and the Politics of Technological Futures (Duke Univ. Press, 2019) and Jennifer Rhee, The Robotic Imaginary: The Human and the Price of Dehumanized Labor (University of Minnesota Press, 2018).

VITAL REENCHANTMENTS: BIOPHILIA, GAIA, COSMOS, AND THE AFFECTIVELY ECOLOGICAL


Reviewed by Jane Hutchinson.

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The three books at the heart of Lauren Greyson’s Vital Reenchantments—Biophilia (1984), Gaia (1979) and Cosmos (1980)—are considered works of popular science, a term that has unfairly acquired rather derogatory connotations associated with dumbing down scientific content for a lay audience. However, the best popular science, exemplified by these three books that are the focus of Vital Reenchantments, relates science to our lived realities. Furthermore, when written by such “poet-in-scientists” (p. 13) as the chemist and environmentalist James Lovelock, who “embodies an alternative, more affectively informed science” (p. 139); the scientist and naturalist E.O. Wilson, whom Greyson describes as an ecological magician; and astrophysicist and science communicator Carl Sagan, we are directed to the affective wonder and enchantment we can experience by paying attention to the here and now (p. 29). Greyson explains how the poetic-science writing of Wilson, Lovelock and Sagan reveal to us the complex entanglement of the ecological mesh of which we are part. It also encourages us to act in our ecological present, rather than directing our efforts toward some always vague and nebulous future: a present in which hope is not always invested in children and images of the “last” polar bear [1] encourage a problematic sentimental ecology in which solutions are “endlessly deferred” (p. 234).

Although the focus of Vital Reenchantments is upon Biophilia, Gaia and Cosmos, Greyson’s analysis is informed by a comprehensive range of sources, from the “scientific elite” in their “ivory tower” (p. 233) to widely accessible works of popular science, art-pop, performance, television and film. She draws our attention to the wonders of the biosphere, Gaia and the cosmos and our place in and as a measure of these through discussions of, for example, Sagan’s telling of the real and imagined instruments of the Hubble space telescope and the dandelion seed “Ship of the Imagination”; E.O. Wilson’s imaginary “motion picture projector of magical versatility,” which enables an affective experience of ecological time by speeding up the projected image (p. 133); and Bjork Guðmundsdóttir’s multimedia creations [2] inspired by her reading of Biophilia. These allow us to experience the enchantment that arises from affective wonder as we encounter the umwelt of things normally out of the sphere of our experience in scale and complexity.

In Vital Reenchantments, Greyson defines affective wonder as “an intense engagement with the present,” describes its relationship to enchantment as “the experience of and attenuation to novel effects” (p. 14) and explains its value to an affective ecology. She acknowledges the difficulty of describing concepts that arise from intensity and sensation (p. 105) and explains how wonder expands the worldview and affect involves change: a difference between two states (p. 109) and an aesthetic excess from which spirit—immanence rather than transcendent—arises (p. 103). Greyson draws upon the work of social philosopher Howard L. Parsons to explain how all three texts draw science and poetic sentiment together to reveal a spectrum of wonder, from the “signifying interest” of an active, fully conscious subject to the profound, mystical and ineffable wonder that involves innovation or novelty (p. 79). Yet all three present an anti-sentimental environmentalism: in terms of the biosphere, Gaia and the cosmos, human life is no more special than any other (p. 243) and affective wonder is not sentimental either (p. 183), hence the problematic portrayal of polar bears facing imminent extinction [3].

One chapter in turn is devoted to analysis of Biophilia, Gaia and Cosmos and their contribution to the enchanted materialism of an affective ecology. These follow an extensive introduction and contextualization of Greyson’s project in which she sets out her themes of wonder, affect and enchantment, popular science and ecological ethics; explains the pertainence of Biophilia, Gaia and Cosmos to current debates about climate crisis [4]; and reviews a diverse range of...
influences drawn from science, literature, philosophy and politics upon her analysis of the three texts. The three-part conclusion, “Enchanted Popular Science and Its Afterlives,” neatly draws the various discussions together.

A discussion of Weber’s formulation of the term *disenchantment* and his attribution of it to agency and power, scientific understanding and technological know-how, and rationalism and intellectualization begins Chapter 2. This is followed by a critique of the disenchantment fantasy, which Greyson explains is now inseparable from modern science and its fusion with technology and our alienation—even total separation—from nature. The discussion moves on to consider the entanglement of vital, incorporeal and agential materialisms and explores how these may offer a possible way out of the disenchantment fantasy. Greyson draws the chapter to a close with a review of sources from the seventeenth century through to the present to examine the phenomena of affective and scientific wonder and how these are expressed in order to bridge the worlds of the readers with the world being discussed by the three poet-scientist authors.

Chapter 3 offers a thoughtful and thorough analysis of Wilson’s *Biophilia*. The book and its author are clearly held in high regard by Greyson, who describes *Biophilia* as both an evolutionarily driven hypothesis for solving the problems of modern life and an explanation of the depth and breadth of human affiliation to all life that alerts us to the sheer destructiveness of a single species (ours). Greyson illustrates Wilson’s scientific humanism through his use of biological metaphors, for example, his descriptions of leaf-cutter ants as superlative athletes, or how a handful of earth holds an infinite number of unseen “beings of another order” (p. 120) and how the richness and order of energy flowing through the forest in Surinam is illuminated with an intensity of light in which every living thing becomes an incandescent point (p. 112). In an anthropocentric conservation ethic, affective wonder is the “luxuriance and excess” that is woven in the mind from the evidence of life (p. 104). Such an ethical ecology, for Greyson, has a key role in our ability to rethink our ecological situation and its consequences. The chapter concludes by examining an ecosystem conservation project in the Galápagos Islands to eradicate thousands of goats descended from those left behind by sailors in the sixteenth century. Greyson discusses the ecological ethics of decision-making when we attempt to redress the balance of human influence upon other life by creating “reservoirs of wonder” (p. 132).

Chapter 4 explores Lovelock’s formulation of Gaia, the only concept, Greyson notes, that has the status of a heavenly body (p. 152) and a hypothesis that was ridiculed by some notable academicians and scientists (including those who write for lay readers) as pseudoscience and a work of metaphor. Her analysis of its significance and influence is illustrated through reference to Bruno Latour’s lectures, Kosmokolos and the Gaia Global Circus project and the BBC series *The Edge of Darkness*.

“Cosmos,” Chapter 5, begins with an account and analysis of Sagan’s Voyager Golden Record project and the *Cosmos* book and TV series that followed, in which he is portrayed as our tour guide on a voyage through the universe. Greyson explains how *Cosmos* makes apparent the affective connection we have to that beyond Earth. She goes on to examine the sentimentality (alleged by Dawkins) of Sagan’s cosmic perspective that allows us, through his evocation of affective wonder and our primordial experience (p. 208), to regard life on earth as something in need of nurturing.

_Vital Reenchantments_ is a reminder of the value of reviewing and reexamining the claims and interpretations of earlier work in the altered circumstances of current contexts and problems affecting us now. Greyson considers *Biophilia*, *Gaia* and *Cosmos* as works of reenchantment (p. 231), and none of their liveliness is lost through her analysis. _Vital Reenchantments_ does just what Greyson praises Wilson, Lovelock and Sagan for doing: it turns what might otherwise be cold examination into animated exploration and critical evaluation of the capacity of science, in the hands of poet-scientists, to mobilize wonder and enchantment not only as instruments of understanding and action but also as ends in themselves (p. 89).

Greyson’s text is structured as a report, with headings and numbered subheadings to guide the reader through the discussion, although, as she writes with clarity, the reader would have no difficulty without them. Each chapter provides a rich analysis of its respective theme. The only thing missing for this reader is an index. _Vital Reenchantments_ will fit neatly on an Ecological Humanities shelf in an academic library and also, as befits its concern for recognizing the value of popular science, in a public library. In addition, six months after publication, the book is made available to download or read online by its publisher, Punctum, which provides open access to the writing and intellectual inquiry of researchers working across the sciences and the humanities.

**References and Notes**

1 Notable among a number of books for children about the “last” polar bear is the story of a young boy and his grandmother who paddle their kayaks out to sea to save a polar bear cub drifting away on an ice floe (Jean Craighead George, _The Last Polar Bear_, illustrated by Wendell Minor [Katherine Tegen Books, 2009]) and an adventure story told through a grandfather’s letters to his grandson about his journey to fulfill his dream of seeing how polar bears really live before it’s too late (Harry Horse, _The Last Polar Bear_ [Peachtree, 1993]).


99 Variations on a Proof
Reviewed by Robert Maddox-Harle.
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This book is "one-of-a-kind"—could be a textbook but it’s not, could be a history of mathematics but it’s not, could be a philosophical treatise but it’s not; it subsumes all these possibilities into 99 investigations of one equation—If $x^3 - 6x^2 + 11x - 6 = 2x - 2$ then $x = 1$ or $x = 4$!

Ording wrote this book to prove mathematics does not have only one style:

The received wisdom is that mathematics, the universal language of science, has one style—the mathematical style—characterised by symbolic notation, abstraction, and logical rigor. This book aims to challenge that conception of mathematics (p. ix).

It succeeds admirably through logical rigor, a quirky sense of humor and a vast knowledge of mathematical processes.

The book is very nicely produced, starting with an introductory preface followed by 100 "proofs" (you’ll have to read the book to find out why not just 99), then a postscript, acknowledgments, notes, sources and an index. The book does not have to be read in sequence; one may dip into any of the proofs arbitrarily depending on how inquisitive one is. The proofs have tantalizing titles; here are just a few examples: Slide Rule, Neologism, Psychedelic, Doggerel, Interior Monologue, World Problem—these examples will give you an idea of what you are getting into with this book.

99 Variations on a Proof is NOT for the general well-educated reader. Despite its frivolity and broad scope, on a reader without a fairly high level of mathematical expertise, Ording's mathematical brilliance is unfortunately wasted. Philip Ording is a professor of mathematics at Sarah Lawrence College, New York. One of the problems with many academics is they forget what it is like to know very little about the subject that they know virtually everything about. The publisher's blurb does not mitigate this conundrum: "Readers, no matter their level of expertise, will discover in these proofs and accompanying commentary surprising new aspects of the mathematical landscape" (back cover). This is a misleading statement; I do not have a high level of mathematic ability and selected this book to review because of the assurance that I did not need to have one. The base cubic equation is simple enough, but some of the proofs are so complex as to be unintelligible to me. In Proof 30, for example, Ording states:

The difficulty remembering Cardano’s formula isn’t just that it’s so long, there’s also a subtlety at work in the cube roots. Just as one needs to account for both positive and negative square roots in the quadratic cousin to this formula, there are additional solutions resulting from different complex cube roots (p. 70).

Oh really!

In writing this book, Ording was inspired by the philosophy behind the Oulipo movement. This group experimented with literary forms constrained by various rules and restrictions. Raymond Queneau, a radical mathematician himself, was an original founder of this group. Members insisted that chance and inspiration had no part in the writing of original literature [1]. Ording’s book is a mathematical take on Queneau’s Exercises in Style, a collection of 99 retellings of the same story.

“The most vivid form of mathematics for many is likely to be the exam. ‘Math Test’ is a powerful linguistic collocation not unlike ‘splitting headache’ or ‘excruciating pain’” (p. 26). By analogous association, for a nonmathematician trying to understand the equations in this book, similar maladies are likely to occur!

This book is an insightful addition to mathematical literature, but I believe it is only suitable for mathematicians and higher-level mathematical students.

Note
1 I have shown elsewhere that these particular beliefs are untenable. See my thesis "The Myth of the Freudian Unconscious and Its Relationship with Surrealist Poetry" (Deakin University, 2000) or, more recently, my essay published in Setu Bilingual, "Creativity, Chance and the Role of the Unconscious in the Creation of Original Literature and Art" (www.setumag.com/2018/05/creativity-chance-Unconscious.html).

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For the first time in history, all issues of Leonardo journal are now available on ARTECA, our curated space for essential content linking the arts, sciences and technologies. ARTECA has a growing collection of books, journals, podcasts, videos and gray literature. In addition to the published content regularly added to ARTECA, the platform will become a home for the community of artists, curators, educators, and researchers—a space to network and to explore the literature, ephemera and other working archives. Leonardo, founded in 1968, has become an international channel of communication for artists who use science and developing technologies in their work. Subscribe to ARTECA to read the very first issue: arteca.mit.edu.