

Unsettling Knowledge: A Poetry/Science Triologue

Jonathan Monroe
Cornell University

Alice Fulton
Cornell University

Roald Hoffmann
Cornell University

Next

It's not easy not to drown in
the same question twice.

Step lightly
against it, boulder to

shoulder, slide out,
slip down.

What bears
repeating is the way

the handlebars' streamers
went wild in the wind,

rounding the corner
where the hydrant
sprayed its slick
across the sky.

Sans teeth, sans eyes—
What was the question,

and who was it for?
The generic white vase

with its purple lip
pressed against the bookcase?

What contains is contained
in a matter of moments

only to be dispersed
like milkweed vessels

in a manner of vestibules.
Nanoseconds foretell

another black hole
where the newly disappeared
reassemble their luxuries
by the airport van.

Such stock in
securities as we

exchange, begin to
displace us (baryons, mesons,

hyperons, quarks), I meant
to say use, unmentionable

values, dementias,
forms, multi-

mensions to come
beyond particles, waves.

In *Writing and Revising the Disciplines*, a collection of essays on writing and disciplinary in the sciences, social sciences, and the humanities, I asked nine distinguished Cornell colleagues to situate their current disciplinary writing practices in relation to field-specific continuities and shifts over the course of their respective careers. Extending this collaborative investigation to the area of poetry, the discipline (or as I prefer to think of it the "anti-discipline") at the core of my own academic career, the present article features the trans-disciplinary reflections of Roald Hoffmann (a Nobel chemist, poet, and contributor to *Writing and Revising the Disciplines*), and Alice Fulton, (a MacArthur prize-winning poet whose work

has been strongly influenced by chaos and complexity theory), concerning poetry's relation to scientific inquiry.

While the stock of science, both literally and figuratively in the increasingly corporate university as in the culture at large, continues its inexorable rise, the fortunes of poetry have longed seemed continually in question. While poetry was for Ezra Pound the quintessence of literature and thus "news that STAYS news,"¹ it was for Charles Baudelaire a half-century earlier, as he suggests in the prose poem "Le joujou du pauvre" ("The Poor Child's Toy"), a kind of luxury object or toy of privilege?² (Pound 29; Baudelaire 304-305). Where W. C. Williams famously observed (but on what "evidence"?) that although "It is difficult / to get the news from poems / men [presumably women too?] die miserably every day / for lack / of what is found there" ("Asphodel, That Greeny Flower"), W. H. Auden declared, no less famously, that poetry "makes nothing happen" (Williams 318; Auden 52). Culturally coded both within and beyond the academy as antithetical to each other, if not mutually exclusive, poetry and science have come to be perceived in our time (though this perception needs historicizing and complicating, to say the least) as occupying extreme positions along a continuum of so-called "subjective" and "objective," "personal" and "impersonal," "soft" and "hard" modes of inquiry. Indeed, when it comes to poetry, even the term "inquiry" itself tends to give way—as in the newly adopted categories of Cornell's recently revised distribution requirements—to the "expressive." To address concretely this perceived oxymoronic relation and explore what investments and issues may be at stake in their own diverse practices, I asked professors Hoffmann and Fulton to reflect on writing, science, poetry, and their respective locations within the academy by focusing on an exemplary poem or two (or excerpts of selected poems) in which the relation between poetry and science is at issue in their own work. In initiating the exchange, I suggested the following questions, intended not as a template or sequence of response, but as a generative frame:

What do you hope to accomplish in writing poetry, both for yourselves and for your readers? With the rise of Creative Writing as a specialized discipline within the academy over the past several decades, how are we to understand poetry's place within the broader curriculum? What is its received or ideally imagined location in relation to other genres, discourses, and disciplines, as also to the culture at large beyond the uni-

versity? What questions do scientific inquiry pose for poetry in the present context? Are these questions appreciably different now than they were at the beginning of your careers? If so, how? How have your fields evolved over time, and how have the cultural roles of science and poetry changed, if at all over the course of your career? As deconstruction has made us all aware, the positioning of two terms in relation to each other tends to imply a hierarchical relation. In thinking what is called "science" (but we might think here of the more inclusive German term, *Wissenschaft*) and what is called "poetry" together, are we necessarily involved in privileging one over the other? Does science have anything yet to learn from poetry, or is poetry in an unavoidably subservient relation to science, in a certain sense "mute," unable to speak back to it? Bearing in mind the cross-disciplinary scientific/poetic practices of a figure like Goethe, to take one conspicuous example, or more recently the preoccupations of a figure such as Martin Heidegger with questions of writing, disciplinary, science, philosophy, language, poetry, instrumentality, and cultural usefulness, how would you respond to Heidegger's question: "What are poets for?" ("Wozu Dichter?"). Has the answer to this question changed in the half-century since he asked it, in the two centuries since Hölderlin provided for Heidegger an exemplary instance? How would you see your own poetic practice, your own diverse practices of writing and/as cognition, as also the ways these practices have been disciplinarily and institutionally inflected by your positions as teachers in particular fields ("Chemistry," "Creative Writing") within the university? What kinds of response to your work do you find most gratifying, or perhaps most disappointing? What does poetry have to say to science and vice-versa? What kinds of conversation and exchange, what kinds of purposes and audiences, do you understand yourselves to be participating in and contributing to in writing poetry informed by questions of science?

As is clear from the differing stances of my two Cornell colleagues in relation to these and related questions, the stakes involved in foregrounding relations among poetry, poetics, and disciplinary are likely to depend to a significant degree on disciplinary location. From my perspective as a comparatist specializing in modern and contemporary poetry, Associate Dean and Director of Writing Programs in Cornell's College of Arts and Sciences, and Director of the Knight Institute for Writing in the Disciplines, as well as a writer of poetry, my

interest in poetry and science reflects my concern with poetry's place among competing discourses within and beyond the academy. In "Writing Writing," the afterword to my forthcoming *Local Knowledges, Local Practices: Writing in the Disciplines* (University of Pittsburgh Press, 2003)—a version of which originally appeared as "Poetry, the University, and the Culture of Distraction" in a special issue I edited for *Diacritics* entitled "Poetry, Community, Movement"—I have explored poetry's current and potential role in higher education—including, as the present essay begins, with my poem "Next"—in the context of Cornell's discipline-specific approach to writing and writing instruction and the reigning "culture of distraction" that overdetermines intellectual work both inside and outside the academy.

My interest in the relationship between poetry and science stems in this context from a desire to encourage lovers of poetry to engage with the perspectives and practices of other disciplines and with the intellectual life of the university and of the broader culture more generally. If poetry is to counter effectively what Perelman called its "marginalization," both within and beyond the university, it must resist its own aestheticization—its fetishization as cultural adornment and/or purely affective expression—and enrich its capacity to contribute meaningfully to the vital conversations that concern the culture at large. As the contributions of my two Cornell colleagues suggest, poetry can scarcely find a more important conversational partner for exploring its capacity in this regard than the hard sciences, which reign, together with their double or twin, technology, as the dominant discourse of our time both within and beyond the university. Given the actual fiscal dependence, not only of poetry or even the humanities, but of higher education generally, on revenues generated by science and technology, as both Hoffmann and Fulton understand, it would be a myopic poetry practice indeed that did not seek in some measure to engage poetry and science in conversation, to see what each has to say to the other. It is heartening, in this regard, to see the implicit dialectic that emerges in what follows between Hoffmann's appreciation of the value of poetry as an imaginative practice to the practice of formulating and explaining science, and Fulton's recognition of the potential means and materials science offers for poetry to expand its scope and vision and deepen the intellectual, affective sophistication of its engagement with the world. In the poems

of my "Coda: In Lieu of an Ending," with which the present collaboration formally concludes, as in the e-mail exchange professors Fulton and Hoffmann have agreed to include as an Appendix, the possibilities for further extending this dialectic, in verse and in prose, continue to unfold.

Ronald Hoffmann

I'm a scientist and a poet. Within my field, chemistry, I do not write of my research in an explicitly (I would say "superficially") poetic style. That will not do—it would be too much of a shock; people (if I could get by the editors) would focus on the style rather than the substance. Moreover, as a theoretician peddling a certain worldview, I'm anyway engaged in seduction and subversion. I do not want to have people notice the way I sneak in new ideas. My subversion of the ossified scientific article genre is more subtle, incremental, and subdued.

But actually there is a poetic element in my science. My métier is theoretical chemistry—obtaining quantum mechanical knowledge of where electrons are in molecules, and extracting from that knowledge rationalizations, trends, and predictions of the shapes and reactivities of molecules. The poetry, comfortably ensconced in the cognitive framework of chemistry, is in shaping concise, portable, perhaps elegant explanations. It's in the drawing of unexpected connections (so close to metaphor) between things that at first sight might seem unconnected. An example, making sense to chemists, is the similarity (not identity) I proposed of the disposition of electrons in the very organic methyl radical (CH_2) and the very inorganic triphosphinocobalt fragment ($\text{Co}(\text{PH}_2)_3$). Surprise, economy of statement, structures of similarity and difference—these are the poetic elements in my science.

When I began to write poetry I had naive notions that I could talk of science, maybe teach it, in poetry. Science eventually entered my poetry but in other ways. First there was the language of science—a natural language under stress, therefore inherently poetic. Under stress, because science is continually forced to express new things with the same old words. And to define things in words that refuse to be unambiguous. I spot found poems in this language of science.

I also began to see metaphor, for free, and floating all around in science. Reaching a balance where that metaphor was not used gratuitously, but had meaning both within science and as poetry—that hasn't been easy.

Here are two of my poems in which science figures:

Maya-Spectra

In the Popol Vuh, the Council Book of the Quiché Maya, Hunahpu and Xbalanque are the conquering and playful twin heroes, and players of the Mesoamerican ballgame, in which a rubber ball is hit with a yoke that rides on the hips. They are challenged to a lethal ballgame by the twelve lords of Xibalba, the death-dealing rulers of the underworld.

The bright beam, sent caroming
off four mirrors of the optical
bench, into the monochromator,

penetrates, invisible but intent; like
the mosquito off on his spying
errand for Hunahpu and Xbalanque,

sly heavenly twins of the Popol
Vuh. For that light means to sting
too, inciting the electron clouds'

harmony with a ball, a wave,
to a state-to-state dance; while
the mosquito flies - in dark rain,

the sun yet unformed - down the Black
Road to Xibalba, bites the false
wooden idols, registering their blank

of an answer, on to the first, who,
god-flesh-bit, cries out, jumps
and the next dark lord calls

"One Death, what is it, One Death?"
which in turn the mosquito records;
from the light is drawn energy,

like blood, leaving on a plotter
a limp signature of H bonded to C;
sampling down the row of heart-

reeking gods: Pus Master, Seven Death,
Bone Scepter, Bloody Claws. The row,
stung, name each other, as do
carbonyl, methyl, aldehyde, amine
prodded by the beam, caught in the end,
like the ball in Xbalanque's yoke.

The losers are sacrificed, the twins win
and life is made clear by signals from within.

Quantum Mechanics

Beginnings
are always
classical.
It's chemis-

try after
all - to burn
a log needs
to be near
another.

It's at its
most spooky
while growing.
What one may
see, so does
the other;

there being
no evi-

dence entan-
glement falls
off with sep-
aration.

Mature, it
isn't fazed
by singu-
larities,
a theory
that can ac-
comodate
boundary
tensions.

And how will
it end? Like
a love, in
a world de-
monstrably
false, in the
vacuum,
its place filled
by the new.

"Maya Spectra" is a riff of little substance. Just fun. My problem in the poem is that I'm imposing on the reader two (probably) unfamiliar fields of knowledge—Maya mythology and analytical spectroscopy. Note my desperation in providing an explanatory epigraph. I had the conceit that the playful tone of the heavenly twins fooling the nasty twelve lords of Xibalba via their mosquito stratagem might actually be of use in explaining (oof, here's that heavy word) to people how spectroscopy is used to "interrogate" molecules and reveal their secrets. Shades of Francis Bacon's metaphor of vexing nature... My other small stratagem was to see if by accepting the strange *names* of Maya mythology—those of the twelve lords of Xibalba, the twins—I could ease the way for the reader to also dance with the sound of apparently strange scientific terms. You have to decide if it works.

"Quantum Mechanics" is much more serious stuff. My problem here was to say reasonable things about the evolution of quantum mechanics in the 20th century, while getting away with something no serious quantum mechanic would dream of doing—seeing the parallel to a love. But...withholding, if I could, the realization in the reader of that parallel being drawn (hey, drawing parallels is a scientific metaphor!) until the poem was near its end.

In my mind, the poem began with reading in *Physical Review Letters* of some recent experiments (related to Schrödinger's Cat arguments) that seemingly showed that entanglement (cat dead, cat alive) did not fall off with distance. Isn't that a poem by itself? Do we need more proof of the natural connection of science and poetry?

Alice Fulton

Jonathan asks what pertinent questions scientific inquiry poses for poetry today, and whether these questions have changed during the course of our careers. I thought I'd respond by describing some aspects of science that have attracted my interest and infused my poetics over the years.

Around 1985, I happened across the chaos or fractal theory of Benoit Mandelbrot, which showed that many phenomena thought to be irregular or chaotic (the coastline of Britain, tree bark, cracks in mud, the firing of neurons, the distribution of galaxies...) actually have pattern and shape. In the 1980s, a small but vocal faction of poets were insisting that only poems written in traditional meters and forms (such as

blank verse or sonnets) have structure. When I happened upon fractals, I thought they offered a good analogue to free verse: a dynamic, turbulent form between perfect chaos and perfect order. Fractals offered a way to imagine and construct answers to questions about structure that—for good or ill—dominated the discussions of the day. In 1986, I published my first essay on fractal poetics, "Of Formal, Free, and Fractal Verse: Singing the Body Eclectic."

In the 1990s, fractal theory was subsumed within complexity studies, a field that draws upon physics, artificial intelligence, mathematics, biology, and other disciplines as a means of understanding turbulent systems. Throughout the '90s, my conversations with John H. Holland, Professor of Complexity at University of Michigan, suggested directions for postmodern poetics that I explored in a second essay, "Fractal Amplifications: Writing in Three Dimensions." Like chaos theory, complexity emphasizes dynamic rather than static structures: eccentric forms balanced between strict, Euclidean order and raging entropy. In the '90s, as now, poetry needed to consider large questions of power, equity, and beauty as a means of checking its propensity for lyric narcissism. Complexity studies suggested ways to move beyond formalist, confessional modes into realms that encountered suffering beyond the self: the inconvenient knowledge at the heart of justice and loveliness.

Complex adaptive systems, as described in Holland's book *Hidden Order: How Adaptation Builds Complexity*, have no master plan: no center or hierarchy. They are open, exploratory, inclusive. Rather than seeking equilibrium or stasis, they continually unfold and "never get there." There is no there. The space of possibilities is so vast that a dynamic structure can't declare an optimum. In poetry, the optimum might be analogous to the sublime. Rather than a single transcendent lyric ultimate, complexity suggests a sublime that happens here and there as part of the ongoing, a plurality of optima in-between other textures and gestures. Moreover, the eternal process of complex systems, their continual unfolding and surprise, suggests a maximalist aesthetic large enough to include background as well as foreground.

In *Hidden Order*, Holland notes that when reading formal structures we decide to call some aspects irrelevant: we agree to ignore them. "This has the effect of collecting into a category things that differ only in the abandoned details" (11).

The form of Petrarchan sonnets, for instance, differs only in those structural aspects we choose to overlook. These effaced elements become the ground that allows the dominant figure to emerge. The poetics I've termed "Fractal" is concerned with the discarded details—overlooked aspects of structure, and more importantly, the dark matter of content: knowledges that remain unspoken because to attend to them would be inconvenient, if not dangerous. In such a way the tenets of complexity theory can suggest ethical as well as aesthetic dimensions.

Of course, it takes more effort to notice blind spots than to rely what is already visible and acclaimed. But rather than being culturally correct, popular and cute, poetry needs the courage to go against the grain. I don't mean to suggest contrariness as a good thing in and of itself. I guess I'm answering Heidegger's question, which Jonathan put before us: "What are poets for?" I've always slightly mistrusted the utilitarian tone (or assumptions) of this query. Yet the question provokes a valuable examination of intent. Let me try to answer. I believe the poet's purpose is to revise language into a vehicle of unsettlement capable of dismantling assumptions that suppress justice and contaminate love. In practice, this means poets must risk their necks in the name of fairness (i.e., equity and beauty) rather than play it safe. I hate this requirement of poetry, but it is the only justification for spending one's life in league with it.

In the mid-eighties, it seemed almost enough to re-imagine the structure of free verse by way of fractal descriptions. But even then, I thought a poetics limited to formal concerns would be deeply lacking. Science is most important to poetry when it suggests something about content rather than form. Whatever science has to teach us about suffering—how to voice it while still keeping poetry poetry—is the most important lesson. Let everything else be en-route to this eloquence, this process of difficult witness. Of course, a poetry directly concerned with suffering is in some sense political. And "political poetry," in particular, needs to go in fear of polemics. In the 90s, the behavior of complex adaptive systems, as described by John H. Holland, suggested ways to reconfigure structure so that form itself might signal content, eliminating the need for didactic explanation and helping poetry retain its ineluctable subtlety.

As I learned about complex systems, I also become acquainted with the thinking of Karen Barad, a feminist physicist who writes on the philosophy of science. In her essay "Meeting the Universe Half-Way" (*Feminism, Science, and the Philosophy of Science*), Barad moves beyond binary constructions (nature/culture, objective/subjective) to suggest that knowledge arises from the "between" of matter and meaning. Her theory of agential realism offers an alternative to objectivist accounts of scientific knowledge, in which "what is discovered is presumed unmarked by its 'discoverer'.... Nature has spoken" (187). Neither does she side with subjective social constructivist views that fail to account for the effectiveness of mathematics or admit that materiality matters. Rather than taking sides in the duel between dualisms, Barad theorizes the nature/culture and object/subject binaries "as constructed cuts passed off as inherent" without denying the efficacy of findings that might arise from such categories (188).

Heisenberg's uncertainty principle challenged the Cartesian split between agent and object by suggesting that the observer does not have total control of matter: the world bites back. "Neither does the object have total agency, whispering its secrets, mostly through the language of mathematics, into the ear of the attentive scientist," Barad writes. "Knowledge is not so innocent...." Thus "nature is neither a blank slate for the free play of social inscriptions, nor some immediately present, transparently given 'thingness.'" Nature is slippery: a neither-nor. Light cannot be both particle and wave. Yet it is. The two categories dismantle one another, "exposing the limitations of the classical framework ... Science is not the product of interaction between two well-differentiated entities: nature and culture." Rather, "it flies in the face of any matter-meaning dichotomy...." As Barad sees it, subjects and objects both have agency without having the "utopian symmetry" posited by objectivist accounts (188). She proposes "not some holistic approach in which subject and object reunite ... but a theory which insists on the importance of constructed boundaries and also the necessity of interrogating and refiguring them." Her theory of agential realism calls for "knowledges that reject transcendental, universal, unifying master theories in favor of understandings that are embodied and contextual" (187).

The work of feminist scientists and philosophers (such as Sandra Harding, Donna Haraway, and Karen Barad) critiques the authority of science, which—like every powerful belief system—needs such self-scrutiny lest it becomes smug and claustrophobic. Of course, the categories unsettled have enormous real world consequences, as when the association of women with nature and man with culture undermines women as artists, thinkers, and human beings. Binary constructions of reality, unchecked by skepticism, have a pervasive, destructive magnitude. When one considers their effects, it's evident that the questions posed are ones literature needs to address, until the world is just—which is to say, forevermore.

Jonathan has asked us to focus on examples from our own poetry that (latently or manifestly) address science. The title of my most recent book, *Felt*, suggests the immaterial past tense of the verb "to feel," and the material noun, meaning fabric or textile. I'd thought I'd trace the word "felt" through the book's first section as an arbitrary means of showing some ways that science permeates my work. Proximity is one of the book's obsessions. The word "felt" first appears in these lines excerpted from the opening poem, "Close" (as in "near"):

Though we could see only parts of the whole,
we felt its tropism.

Though taken from the vocabulary of science, "tropism" is a word most nonscientists will know. The first definition, as found in *Weber's Ninth New Collegiate Dictionary*, is "an involuntary orientation by an organism or one of its parts that involves turning or curving by movement or by differential growth and is a positive or negative response to a source of stimulation." I'm not sure about "involuntarily," which seems to imply agency thwarted. It's true that a plant can't help its leaning toward the light, but that orientation seems neither voluntary (chosen) nor involuntary (against the plant's wishes). Perhaps agency, as in Barad's theory, is an interaction located between the plant and the light, or as the poem would have it, between us and "the whole." The lines suggest the universe as a great organism leaning toward or away from us, reacting to and with us. We can see only parts of this structure; there is no unifying vision or complete essence possible; rather we're left with dribs and drabs of truth, inflected by our time, position, and instruments of perception. Of course,

a "trope" also is a figure in a literary work. I suspect that the "tropism" of science and the "tropes" of literature both derive from the Greek *τροπος*: turn, manner, way, style. To feel the trope of "the whole" is to sense affect or manner in the universe, to intuit a cosmos with style, an aspect of poetics often regarded as suspect or superficial.

The word "felt" next appears in "Maidenhead," a poem that blurs hymen and mind, suggesting the brain as the ultimate private space. Here Emily Dickinson's spinsternhood, her fetishized white dress, and her mind's spectacular solitude, merge with the life of a 17-year old girl. I cite well-known Dickinson lines throughout, omitting quotation marks so that her words will blend into the ground of the text, enacting the blurring that is part of the poem's interest. Dickinson was fond of gem imagery, and "Maidenhead" lifts one of its recurring metaphors from the optics of gemology. In the following "felt" passage, however, the optics of contemporary medicine are juxtaposed to a line from Dickinson's poem 280:

...There is a lace

of nerves, I've learned, a nest of lobe and limbic
tissue around the hippocampus, which on magnetic
resonance

imagining resembles a negative of moth.
She felt a funeral in her brain....

The technical aspects of science, its highly analytical language, the specificity and exactitude of its instruments, such as the MRI, offer fresh perceptions for poetry. To cite another instance, while reimagining the myth of Daphne and Apollo for my book *Sensual Math*, I became enthralled by a technical book on deviant wood grains. This dry text offered a fresh take on Daphne's prospects after she'd turned into a tree. It also helped me to imagine her transformation from the tree's point of view. As to the Dickinson quote, her poem 280 actually begins "I felt a Funeral, in my Brain..." I took the liberty of changing the person from first to second. I also switched Funeral and Brain to lowercase type and removed the midline comma caesura, modifications that flattened the line, embedding it within its surround (128).

The next appearance of the word "felt," also in "Maidenhead," invokes scale, a concept dear to fractal science:

...The phantom pains,
 escaping diagnosis, led to bolts of shock—
 and tines of shudder—volting through
 her mind, my aunt's, that is—stricken into

strange, her language out of scale to what
 she must have felt, and Dickinson's metaphors—

And then a Plank in Reason broke—no help.

Geometric fractals repeat an identical pattern at various scales. That is, the fractal's smaller parts replicate the form of the entire structure, turned around or tilted a bit, and increasing detail is revealed with increasing magnification. (A little like the relation of "felt" the word to *Fell* the book.) Fractals have a substructure that goes on indefinitely, replicating itself in various dimensions. This recursiveness revises hierarchical relations to suggest new dimensions of figure and ground. In the passage quoted, language is said to have scale, a size or dimension relative to the feeling it seeks to express. There is always a gap between intention and words, or sign and signifier: language is such an imperfect instrument. Yet poetry sometimes aims to make a language commensurate to feeling, impossible as that is. In addition to capitalizing the first word of every line, Dickinson used uppercase letters within her lines, in effect changing the scale of selected words. The midline capitals in the line quoted (again from poem 280) magnify Plank and Reason while underscoring their symbolism. The words leap from the line and assert themselves with the authority of proper nouns. This personified quality, along with the enlarged scale of Plank and Reason, helps create the sense of terror in Dickinson's terrific poem.

Fell contains two poems that work the textile as metaphor. The book's first section closes with one called "Fair Use," which I'll quote below in full. "Fair Use" draws upon the idiosyncratic properties of felt cloth to describe both the interconnectedness of what is and the qualities of my only mystical experience. Until this poem, I'd never written about it, maybe because epiphanies are so Romantic, so prepostmodern. Epiphany! What a word. But there you are. Chancing embarrassment is part of this too. Epiphanies are wont to exist outside of time, space, and social constraints.

Yet, to riff on Barad, transcendence is not so innocent. "My moment of brocade" (Dickinson, poem 430) was laced with specifics: I understood that I was all others, including specific others (206). The poem's first sentence likens the glittering material of a sofa with the immaterial glittering of the speaker's mind or being during the moment of "trans-ferment." But the head undergoing revelation is also a head with a hairstyle: a '60s flip. "Flip" (as in flip out or lose control) turns epiphany, for the span of one word, into a thing of its time, slangy, girly, so that the instant of understanding, like Barad's description of knowledge, is "embodied and contextual." Kennedy and the TV set also infect the lyric moment with time and specificity. In fact, it wasn't as if I transcended the mundane so much as saw more deeply into the dross material of everything. Speaking of dross, fabric is said to have "a hand," meaning weight or texture, and I tried to imbue enlightenment with this material quality via the line about "Incandescence." "Fair" in the title is meant to connote both justice and beauty, co-creative qualities, surely, that require each other to exist.

Fair Use

As for the sofa, its fabric is vermiculite,
 glittering, as is trans-
 ferment. My head's already in its sixties flip,
 Kennedy's already dead. Incandescence
 has a heavy hand. For all I care,
 the TV might be an airshaft

when the statics of *is* widen and show everyone
 meshed, a fabric of entanglement ==
 my consciousness felted with yours,
 although I didn't know you then.

It is not metaphorical, the giver is
 literal beyond prediction about this:
 what happens to others happens to me.
 What joy, what sad. As felt

is formed by pressing
 fibers till they can't be wrenched apart,
 nothing is separate, the entire planet
 being an unexpected example.
 Is this fair use, to find

the intergrown of difference
 severing self from == nonself == gone.
 I grasp the magnetism between
 flesh and flesh. Between

inanimates: the turrtable's liking for vinyl,
 the eraser's yen for chalk,
 the ink's attraction to the nib.

What lowercase god sent this
 == immersion ==
 to test my radiance threshold?
 From then till never == time, space, gravity
 felt to a single entity,

though the backlash of epiphany wasn't all epiphany's
 cracked up to be. Synthesis is blistering.
 I've often wanted to get rid of ==
 it. I couldn't get rid of it. It

resists wear and as it wears, it stays
 unchanged. There is no size
 limitation. It
 expands equally in all directions as more

fibers are pressed in. No matter how stripped
 of cushion, needlefelted, one
 becomes there's no unknowing what
 can be compressed a thousandfold
 undamaged, won't ravel, requires no
 sewing or scrim. What is

absorbent, unharmed by saturation.
 What draws and holds, wicks, that is,
 many times its weight in oils or ink.

Listen, I didn't want your tears in my eyes.
 I wanted to keep my distance, put a silence
 cloth == ironic == lining == frigid == interfelt ==
 between us. My
 students == teachers == parents == children ==
 get your hearts out of mine,

I wanted to say. It can be hard
 enough to drill or carve or turn
 on a lathe. It can be sculpted.

It dyes well. The colors lock. At times
 I've prayed that the unfrayable gods who gave it
 would give it to a rock.

"Needlefelted" and the verb "wick" come from the felt making industry, as do the descriptions of felt's marvelous properties. But I think the poem also contains some quasi-scientific neologisms—trans-ferment, intergrown, radiance threshold, interfelt—of my own devising, though I'm not entirely sure I devised them. The "between," so important to feminist philosophies, figures here as the space where everything happens. This interstitial realm is part of what I hope to signal by the double equal sign == that appears throughout "Fair Use." In *Felt*, I've tried to get this punctuation mark, which I've called the bride or sign of immersion, to work syntactically and suggest aspects of content. By the end of the book I hope the sign will have, to some degree, defined itself. Ordinarily, punctuation marks affect the rhythm of the sentence but have no meaning; we efface them as we read, allowing only words to figure. The == sign reverses this relation of ground and figure by calling attention to itself, juggling the poem's depth of field. In "Fair Use," I hoped the visual effect might be as if the page were turned inside out, so the seamy side showed, the stitching. I also wanted the == sign to be one of those "constructed boundaries" that gets in the way of holistic union. If, as the poem says, synthesis is blistering, then == is a blister. I've often wanted to get rid of == it, the poem says. I couldn't get rid of it. And in that way, it's like con-science. Inconvenient. Sterling. Controversial. Mysterious. Impolite. Annoying. Sublime. Limiting. Rich. Awkward. Impolitic.

In closing, I'll respond briefly to Jonathan's question, concerning poetry's relation to other disciplines and to the culture at large. Poetry is an absorbent art: maybe it can include other fields more readily than they can include it. In any case, it doesn't have to defend itself or be "for" something: it isn't obviously pragmatic. It's playful, having qualities of the joke, in that the "point" happens between the lines. It also has the famous "elegance" of good science. Writing poetry is probably the best way to teach people to love language and words. But whether it's needed or found or appreciated within academe, poetry will continue. It's a force, a pleasure. A beautiful complexity. Beginning poets often blame poetry for its peripheral status. But it seems to me that our culture's lack of appreciation for poetry says more about cultural deficiencies than it does about poetry. What would it mean to be popular in a context that mostly prizes formulaic, easy reads? Can any art retain subtlety, ambiguity, courage, integrity, and endear itself in such a context? Can any art question cruelties that make us comfortable, upon which our culture rests, and expect to be rewarded? When you imagine what poetry would have to do and be in order to be central, it seems poetry's marginal standing is one with its circumference: its strength.

Coda: In Lieu of an Ending . . .

If good theses make good neighbors (and do they?) within, between, across the academy's "fields" (ag/ed lexicon), as elsewhere, something there is in the encounter between science and poetry that inspires—from my dual perspective at least as a specialist in poetry and Director of the Knight Institute for Writing in the Disciplines—some mischief. What's proper to the properties, we might ask, of poetry and science, one or the other, one in, with the other, one not as the other, both and? In the diverse lexicons and discourses of science—astronomy, biology, chemistry, geology, physics, zoology—a stone's throw away is the perfect Metaphor, that is, if metonyms don't get in the way . . . If the value of science is taken to reside primarily in its service to technology, what's the use of in poetry = = as = = of writing "across the curriculum"? What kinds of writing do we want from our students, and what does poetry have to contribute to our goals across the disciplines, beyond being an "object de luxe," or mere ornament, beyond "self-expression"? What kinds of inquiry does poetry propose and proffer? What gets included and excluded under that

name? Assuming, as we say, "for the sake of argument," that the values and uses of poetry and science are not singular, as my colleagues' examples and reflections above demonstrate (but which parts are "examples," which "reflections?"), that they are instead plural, overlapping, interrelated, intersecting, uncontaminable, I close not with what is called (perhaps too uncritically) "exposition," or "commentary," or "analysis," but with four poems, in verse, in prose, and in between:

Guns, Squirms, and Squeals after Jared Diamond

Wheat, barley, rice, pulses.
Goats, sheep, cows, pigs.

Question. Thesis. Development.
Claims. Evidence. Conclusion.

See Words

Cells within cells. The celebrities celebrated. Celibates sealed uncertain news. Selective service, sealed in their sediment. Celluloid cellulite's cell of fame.

Juncture

Deep space motive, quadrant nine. There on the graph, the still point vanishes. Vectors catch a glimpse of rose. One corner grasps it. That place where the jewel erupts, unfolds. Where negative counters. Starved, in hiding, the child's eyes match the camera's lenses. Pulled back, longing, Hubble calm.

Prescription

Precisely because this will be of no use to you, you will find it essential. It contains no calories, no fats, no proteins, no nutritional value of any kind, no value-added, no artificial ingredients, no fortified nutrients, no sources of vitamins or minerals. Like the neutrino, it bears the incalculable weight of the universe, inside out.

Works Cited

- Auden, W. H. 1958. *Selected Poetry of W. H. Auden*. New York: The Modern Library.
- Barad, Karen. 1995. "Meeting the Universe Half-Way." In *Feminism, Science, and the Philosophy of Science*, edited by Lynn Hankinson Nelson and Jack Nelson. Dordrecht and Boston: Kluwer Academic Publishers.
- Baudelaire, Charles. 1970. *Oeuvres complètes*, edited by Claude Pichois. 2 vols. Paris: Gallimard, Editions Pléiade, 1975. 1:304–5; cf. *Paris Spleen*. Trans. Louise Varèse. 1947 reprint, New York: New Directions.
- Dickinson, Emily. 1960. "280." In *The Complete Poems of Emily Dickinson*, edited by Thomas H. Johnson. Boston: Little, Brown and Company.
- _____. 1960. "430." In *The Complete Poems of Emily Dickinson*, edited by Thomas H. Johnson. Boston: Little, Brown and Company.
- Fulton, Alice. 2001. "Close." In *Fell*. New York: W.W. Norton.
- _____. 2001. "Fair Use." In *Fell*. New York: W.W. Norton.
- _____. 1999. "Fractal Amplifications: Writing in Three Dimensions." In *Feeling as a Foreign Language: The Good Strangeness of Poetry*. St. Paul, Minn.: Graywolf Press.
- _____. 1995. "Give: A Sequence Reimagining Daphne and Apollo." In *Sensual Math*. New York: W.W. Norton.
- _____. 2001. "Maidenhead." In *Fell*. New York: W.W. Norton.
- _____. 1999. "Of Formal, Free, and Fractal Verse: Singing the Body Eclectic." In *Feeling as a Foreign Language: The Good Strangeness of Poetry*. St. Paul, Minn.: Graywolf Press.
- Holland, John H. 1995. *Hidden Order: How Adaptation Builds Complexity*. Reading, Mass.: Addison-Wesley.
- Monroe, Jonathan. 1987. *A Poverty of Objects: The Prose Poem and the Politics of Genre*. Ithaca: Cornell University Press.
- Perelman, Bob. 1996. *The Marginalization of Poetry: Language Writing and Literary History*. Princeton: Princeton University Press.
- Pound, Ezra. 1961. *ABC of Reading*. London: Faber and Faber.
- Williams, William Carlos. 1988. *The Collected Poems: Volume II, 1939–1962* edited by Christopher MacGowan. New York: New Directions.

Appendix

E-mail exchanges of Alice Fulton (July 8, 2002) and Roald Hoffmann (August 3, 2002)

Dear Roald and Jonathan,

I was struck by three words in Roald's piece, so I thought I'd send some questions and preliminary thoughts as a means of continuing the conversation.

The three words that I'd be interested in pressing further are "style," "prediction," and "natural":

Style Your first paragraph, Roald, addresses the question of style in science. I wondered if you could say more about the word "style." What does that term mean to you? Do you think differently about style (or the perhaps synonymous terms linguistic surface or poem plane) when writing poetry? You make a distinction between style and substance in the context of scientific writing. In your view, does this difference—between style and substance—exist in poetry also?

For my part, I've come to think that style is part of substance. The poem's surface (effects that call attention to language) is perhaps its most material or substantive aspect. In other words, the ways in which language makes meaning, its textures, syntax, grammar, etc. are part of the subject or meaning for me rather than conduits for meaning. The surface is a good part of the subject. Yet surface connotes superficiality, and so I prefer the term poem plane (analogous to the picture plane in painting.) Just as we understand the painterly effects of the picture plane to be part of the painting's meaning, I hope we might understand the linguistic effects of a poem to be part of its meaning. Poetry distinguishes itself from the scientific article by means of a surface that draws attention to its ways of making meaning; poetry foregrounds the stuff of language itself; its surface gets in the way, gets in your face and demands to be read as a facet of meaning. Readers of poetry are supposed to be distracted by the line, visual placement of words on the page, textures of language, prosodic effects, various dictions, etc. If, as Roald suggests, scientific writing today aims to be a transparent tool for meaning (pragmatic, utilitarian?), poetry (to varying degrees) goes the other way: toward nontransparent, resistant planes. The poem plane

or linguistic surface asks readers to stay with it, be with it, know it, chew it, ruminate upon it, before or in conjunction with knowing the meanings it gradually yields. Scientific writing (as Roald describes it) seems analogous to water: we drink it, it's important, necessary. But poetry is analogous to wine. It calls attention to the materiality of nourishment: the bouquet, nuances. We don't gulp wine to hydrate ourselves. We smell it, savor it, analyze its notes and drink it for pleasure. If scientific articles were to give the surface its own life and importance, that layer of meaning would detract from the information the article exists to provide. Yes. But poems don't exist to provide information; perhaps they exist to provide an experience, cerebral or emotive. So, to end my ramble on a coherent question for Roald: does style work differently for you when writing poetry?

Prediction Roald mentions prediction as one facet of his work in theoretical chemistry. It seems to me that science's ability to prophesize (to use an old word) is one reason for its ascendancy. The poet used to be the prophet; the scientist has taken on that role. The wish to forecast is ancient; the ability to predict an event still has a latent aura of magic. If we can see something coming, we can control it. Indeed, prediction is a form of control. Our fear—of nature, terrorists, epidemics—makes us long for prediction and the control it provides over forces that might otherwise do us in. No wonder we revere the form of learning that helps us control the calamities that might kill us.

Poetry makes no such claims. It's heartening to me that Roald thinks poetry matters; that he chooses it. What a high compliment, coming from someone who could devote all his energies to science. But if poetry no longer prophesizes, what IS poetry's claim? We might as well ask what is the claim of beauty, if by beauty we mean the widest euphorias and unsettlements, fresh enchantments and engrossments. Is poetry's wonder induced by words? Not just wonder. Pleasure, including the deep pleasure of thought. Poetry need not evoke or replicate emotion (make us laugh, cry, etc.) to be effective. But it must thrill, given a chance, given the time it demands. Just as science wants reproducible results, poetry wants reproducible delights. Yet a poem is a mystery machine. We can't explain it by breaking it down or taking it apart. The ineffable is part of the mechanism. Poems have layers, stratas of meaning, beyond explanation. They seem bottomless, mys-

terious. Not muddy or incomprehensible but resistant and withholding. We sense that something lurks behind the linguistic veil. With each sighting, we get closer without ever quite reaching it. The sublime? Yes, if the sublime can be understood to operate within cultural and political contexts. If we can have a postmodern sublime that tries to perceive and revise its own blind spots: the cruelties, inequities on the periphery of transcendence.

Poetry's unnatural surface exists to slow the reader and resist the forward pull of narrative, of ending: poems resist the teleological drive to GET THERE. Thus, the effect of a poem is in the moment of reading. And so, while science, like narrative, is about what happens next, poetry is about what happens now.

Natural What do you mean, Roald, when you call the language of science "a natural language?" Are some languages more natural than others? In calling the language of science a natural language, are you contrasting it with other language that seem unnatural? (Computer languages?) Are you contrasting it to poetry? Is poetry unnatural in that the poem plane is wrought (i.e., is musical by design and differentiated from everyday speech to varying degrees)? Poetry uses formal devices (meter, line, grammar, syntax) to de-naturalize itself, make itself over, make meaning freshly. Poetry, then, seems artifice when compared to speech or transparent prose. But is poetry's artifice an extension or hyperbole of the unnaturalness of all language? Or, conversely, does the artifice of poetry arise from natural (biophysical) causes and drives? If so, poetry is deeply natural and the perception of it as artifice is perhaps puritanical and suspicious, an unfounded cultural assumption. I have thought of poetry as unnatural and revealed in that perception. But now I call it into question... thinking about the other side of the argument.

I am always wary of the word "natural" because it has been used to describe the way things are (rather than the way they might be.) That is, we often confuse what-is with what-is natural. Thus it seemed natural that women were domestic, confined to the house, child-raising, etc. The ancient association of women with nature and men with culture seemed "natural." Heterosexuality seemed natural. And on and on—I'm sure you can cite many other examples. To transgress the bounds of natural is (in the eyes of culture) to be monstrous, aberrant. Yet "the natural" has often been a cultural con-

struct, a convenient means of maintaining the status quo: regulating business as usual. It follows that great social/cultural changes at first seem unnatural. (Till such changes are naturalized.) Culture then assumes things have always been this way and that a contrived imposition arose from nature. The imposed trait or quality is thought to be essential to the ur-quality of a being or object, part of its fundamental identity. I don't mean to suggest that nothing is natural. I mean only to speak to the ways in which nature has been used as an excuse for human wishes. Of course, humans are part of nature, not separated out or different. And in that sense, every single blooming thing (and things that don't bloom too) is (are) natural. Given this welter of association, in what sense is science a natural language?

Stylistically, predictably, unnaturally,

Alice

Dear Alice,

Your essay is beautiful, and the fullness of its content, and being granted by this exchange the gift of a reading of it, is the only thing that allows me not to feel too bad about the slight piece that I wrote. It's good to see the "more," in yours. It was wonderful to read "Fair Use" again, in this new context. Remind me to show you an unusual felt fabric I found at the Penland School of Crafts in June.

The statement you make of poetry's place, and your own evolution in the nexus of science and poetry is great. Let me make a couple of comments here that emerge from reading what you say:

1. You make good use of complexity theory and fractals (Incidentally, Benoit Mandelbrot will appear in my *Entertaining Science* series on Sept 1 in NYC. I've paired him with Emily Grosholz, who will read some of her poems on mathematical themes. Still looking for some music to go with that). I must say that I am skeptical of complexity theory, even as I all the time plead for a valuation of complexity in science, and rail against the simplicity of simple mechanisms, one enzyme, beautiful equations, the powerful hold over us of symmetry and order. There is probably a good biopsychological evolutionary reason that we, who represent a local defeat of entropy in our bodies ourselves, in our poems and the molecules

we make, that we should favor the defeat of entropy in our minds.

First, and less important, chaos studies/ catastrophe theory/ complexity are intellectually seductive in this terrible and beautiful world. Seductive in the bad sense of the word. Admit it.

In the real world of practicing chemistry, physics, biology, if you look at papers in meetings or journals (subject to fashion, yes) you find the number of papers in these fields small. OK, so science should not be a popularity poll. But I think there is more, and this is the second point: chaos/complexity/catastrophe are good at describing things. But they aren't *productive*, in the sense of stimulating experiments (or theories). They don't make many predictions either.

So there's my minor tirade against these fields. I would say they offer intimations of understanding, not much more. But yet you draw such interesting parallels from them...

I feel a little better about fractals.

2. Your statement of the poet's purpose is "to revise language into a vehicle of unsettlement capable of dismantling assumptions that suppress justice and contaminate love;" I think I know what you mean, and I approve of the inherently subversive nature of art (though I think artists get too easily drunk on this notion). But what you say somehow emphasizes the negative to me—"revise, unsettlement, dismantling" are the words you use. I feel as I write poetry—and I think others do too—that it is much easier to revise, unsettle, and dismantle than to create in the first place, come to true peace with, and construct. (Though the incredible thing about human beings is that even in negation they create. So something good even comes out of literary critics (I'm smiling?!)). Might it not be a greater challenge to write honest poems of love's affirmation than its loss (if loss is the common condition; I'm projecting)? I also have trouble with "justice" as a natural category in the multicultural world.

Somehow the statement you make seems more reactive (in a political sense) than affirmative of the creation of new meaning and emotion (which entails revising language, sure) through poetry. This is what "Fair Use" does.

Roald

I agree writing poetry is the best way to teach people to love language and words.

Endnotes

- ¹ Pound's famous dictum, "Literature is news that STAYS news," appears in *ABC of Reading*. The single quotes and capitalization are his. Over time, reflecting the centrality of poetry in Pound's oeuvre, in the retelling "Literature" became "Poetry."
- ² For an analysis of "Le joujou du pauvre" in the context of what I've called Baudelaire's "social re-inscription of the lyric," see my *A Poverty of Objects: The Prose Poem and the Politics of Genre* (Ithaca: Cornell University Press, 1987, pp. 106–109).



About the Authors

Nancy Abrams teaches middle school science in The Park School, a K-12 independent school in Baltimore, Maryland.

Patricia Connor-Greene is Alumni Distinguished Professor of Psychology at Clemson University.

Nadine Feiler teaches middle school language arts and social studies in The Park School, a K-12 independent school in Baltimore, Maryland.

Alice Fulton's sixth book, *Felt* (W.W. Norton 2001), was awarded the 2002 Rebekah Johnson Bobbitt National Prize for Poetry from the Library of Congress. This biennial prize is given on behalf of the nation in recognition of the most distinguished book of poetry written by an American and published during the preceding two years. *Felt* also was selected by the Los Angeles Times as a Best Book of 2001. Her work has been included in five editions of *The Best American Poetry* series as well as in the 10th Anniversary edition, *The Best of the Best American Poetry, 1988-1997*.

Elizabeth A. Hatmaker is a doctoral candidate at Illinois State University, where she teaches creative writing and composition. Her work has appeared in *Social Epistemology*, *Epoch*, and *Another Chicago Magazine*.

Ronald Hoffmann is a winner of a Nobel Prize in chemistry. He finds it easier to make a living as a theoretical chemist than as a poet. His newest poetry collection, *Soliton*, was published by Truman State University Press in 2002.