to speak publicly on topics that do not pertain to the realm of other disciplines. The great literary critics of the twentieth century (from Benjamin to Barthes, from Adorno to Lukács) have mastered the debate on values: meaning is socially significant because something which is hard to grasp stays with the text once the text has accomplished other social functions.

I wonder whether we are communicating to our students and readers this very simple fact: we are literary critics because we consider literature a high impact discourse, a discourse marked by the intensity forged in the deployment of aesthetic values. I wonder whether we repeat as often as necessary that we study literature because literature affects us in a special way, due to its formal and semantic density.

It is difficult to say if we are living through the last decades of literature as it has been known up to now. I have the feeling that films are bound to disappear in the *continuum* of the videosphere (not that narrative "things" are not going to be shown in theaters or cable TV, but that films, as the twentieth century invented them, are over). And it could happen that hypertext be in the future not only a convenient way to manage footnotes, remarks or various levels of information, but a new pattern of the syntax that, for centuries, literature has been modeling and changing.

We do not know which developments will take place in the next decades. On one hand, it has been of the utmost importance that literary studies opened themselves up to the perspectives of cultural analysis. The drive had positive consequences in the extension of the universe of discourses we consider, and cultural analysis has benefitted from the techniques of literary criticism. But the moment has come to draw a balance. Literary criticism in its specificity should not disappear engulfed in the mainstream flow of the "cultural." Nobody wants to be one of the last selfrighteous priests of high art. Yet we may not dismiss without heavy losses the opportunity to continue speaking about that special type of discourse still existent (in our case literature) that knits and unravels the intricacy of values, ideologies and forms.

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How Nice to Be an Outsider

Every one of my scholarly/literary activities is outside literary studies as such. Yet to a varying degree all that I do is the subject of the amoeboid activities of the field. I also have, in principle, no vested interest in the flow of students into your departments, nor do I have to worry about jobs for them, nor the level of remuneration of your sluggers and sometime pinchhitters. It seems to me that given this practical disinterest (reading Burke and Kant) I am ideally situated to make aesthetic judgments if not prognoses of the future of literary studies. Which is the reason, I suppose, that I was asked to do so.

1.

But first let me count the ways in which I am marginal. First of all, I am a chemist, of the theoretical subspecies. I have done some good science, even shaped the way that chemists think of the motion of electrons in molecules, and how the electrons determine the shape and reactions of those persistent groupings of atoms we've learned to see without seeing. My and my collaborators' work is divulged, some of my colleagues would say preached, in over 450 scientific articles (our stock in trade, rather than books). Such "texts" have become the subject of a burgeoning field of literary studies of science. But no one would bother with my texts; they are individually unimportant (though what they collectively teach is of value; I think of my articles as chapters in a serialized text, but please don't tell the editors of the journals in which I publish). And perhaps when I write science I am too self-conscious of the central problem of representation for me (or those messages that abandon me) to play the role of an innocent native (or his artifacts) awaiting the sage pseudo-anthropo/sociological investigation of the way I construct knowledge. Also the cognitive, intrascientific background needed to assess my papers is moderately formidable; there is a reason why chemists spend five years in graduate school... So, so far, I've escaped attention as an object of literary studies. I keep my fingers crossed.

Second, I have a modest career as a poet. It's much easier to make a living as a chemist (would I dearly like you to convince me that it is otherwise, by buying my books!), so the poetry is perforce a part-time vocation. Not much need be said about poetry as the subject of literary studies – past, present, and future. Fortunately for me, poetry of middling quality is not usually the object of literary studies. Unless it is written by figures of whom others have written...

Third, I write of chemistry, or I would prefer to say of the intersection of chemistry and culture – for various audiences. I do so for the ephemeral general public, for scientists who are not chemists, and, closest to my heart, just for you, my friends in the arts and humanities. I write for Lionel Trilling, who said:

> Physical science in our day lies beyond the intellectual grasp of most men.... This exclusion of most of us from the mode of thought which is habitually said to be the characteristic achievement of the modern age is bound to be experienced as a wound to our intellectual selfesteem. About this humiliation we all agree to be silent; but can we doubt that it has its consequences, that it introduces into the life of the mind a significant element of dubiety and alienation, which must be taken into account in any estimate that is made of the present fortunes of mind. (13-14)[1]

Some of my writing is "popular," some of it pretends to be scholarly. I also have a range of collaborations with artists. The outcomes are curiously positioned in-between art, literature, and science – an example is *Chemistry Imagined*, a kind of modern emblem book of chemistry that I've created with artist Vivian Torrence.

Expository writing about science has been a less popular subject of literary studies, I think. Curiously enough, the cognitive thornhedges around contemporary mainstream science have led literary scholars who seek to penetrate the barriers to rely much on just such expository writing. But critics have reflected little, I think, on the representational and narrative stances taken by the creators of the "better" popularized science genre. Some students of scientific texts and of scientists have become prisoners of the accessible metaphor. We have a curious situation that while humanists (and I) have been pushing scientists to accept the value of the metaphor within science, as a wellspring of creativity and an inevitable sidekick of just plain human thinking – while we have been desperately trying to do that, some people are applying insufficient caution to the knowledge received (in perforce metaphorical language) from science. Thomas Pynchon, a Cornell graduate who knows a lot of chemistry, writes: "The act of metaphor then was a thrust at truth and a lie, depending where you were: inside safe, or outside lost" (129).

Let me be specifically provocative: the interest, to put it mildly, expressed by humanists in chaos, fractals, and "order out of chaos" is totally out of proportion to the significance of these ideas in contemporary science. Now that is guaranteed to get me into trouble with some of my scientist friends, but I stand by it. Do ask some of your friends in mainstream science

1 I owe this quotation to Fritz Stern.

(who are not members of the Santa Fe Institute).

Triply an outsider, I have, however, great sympathy and empathy for your field. It's not only that I read, and sit in on your courses like any student. I also had the great fortune of listening to Mark Van Doren, Andrew Chiappe, and Donald Keene at Columbia in the fifties – sometimes I think I haven't grown up, I'm still in their classes... I do have as much fun as anyone reading of your internecine tribal conflicts, but that's just voyeurism. More seriously, theories of representation, semiotics and narrative are not only of intense interest to me, but they are personal ways to think about my science, within the science, and the presentation of that science to the outside. You might (only in weak moments, I know) think that your work is of little use – I tell you that I use it, in the most respectful way, i.e. without acknowledgment. So maybe I should take back what I said above about being disinterested. I'm very interested.

How nice to be an outsider, as I said. But as just a producer of science, literature, and genre, but not of literary studies, what can I then tell you – certainly nothing about the profession, but even about the purview of the enterprise? Let me essay two ideas about direction, and call these, loosely (1) a focus on audiences, and (2) the return of the subject.

2.

I think that writing (and scientific research, and teaching) are best seen as existential human acts within an overlapping spectrum of audiences. In the beginning there is glimpse of understanding, in the case of poetry just a phrase, or even a word that seems right or is reaching out to be connected. In that genesis understanding forms in some inner dialogue between parts of me, me and an imagined audience of one, me and a blurred, ever-shifting audience of teachers (yes, those Columbia professors), gurus, the dead or absent father, in the lonely emotionally polyglot dialogue with the voices of skepticism and self-doubt, and of joy at understanding that are all me, all of me.

And if the voices fail the writer, he or she makes the existentialist mark on paper, the initial inscription. Without fail, that sets the ghostly audiences into motion; they rise, are driven, make themselves out of the desperate necessity to tell a story to someone. It's not all so dark – if I think I understand, as I sometimes do, I rejoice too. In any case, I want to tell it to others, "go tell it on the mountain." Not to the drawer, but to live people.

Let me talk about writing science, for scientists, for this I know best. In the next stage of my research (that is what the outside calls it – I call it teaching myself, teaching others) the audience expands to my research group. In the act of talking to them the depth of my understanding of the discovery deepens, takes a stronger hold on reality.

Then I write a technical paper. Now my audience is out of my control. I can't grab that removed chemist in Poznan or Puna and tell him, no, you must read it that way, and not this way. It has to be all there, in the words with which I struggle. It has to be there – the substance of what I found, and the argument to convince him or her, the absent reader. And I write for that audience from a position of substantive ignorance about it – I don't know the readers' preparation, their level of sophistication, their willingness to work to reach enlightenment! It begins to sound an awful lot like teaching.

The writing of a chemical research paper to me is in no way an activity divorced from the process of discovery itself. I have inklings of ideas, half-baked stories, a hint that an observation is relevant. But almost never do I get to a satisfactory explanation until I have to, which is when I write a paper. Then things come together. Or maybe I make them come together.

A technical seminar at another university introduces still another audience. Sure, I want to impress my colleagues, claim precedence, power, please real or constructed parents. Many things go on subliminally in the course of any talk. Yet most of all I want to impart real new knowledge. But the audience includes people of disparate backgrounds. I want to teach all. Incredibly, we can do it, speak to many audiences at the same time. That's what teaching (and writing) is all about.

To me, the steps from a thought, to a research seminar, to writing a paper, to teaching a course at any level, graduate to freshman – all of these are small moves in interacting with a continuous, overlapping spectrum of audiences.

Now what does this have to do with literary studies? I think it would also be productive in analyzing meaning in literature to think of divergent and convergent, overlapping audiences. There is one in the writer's mind. It is hardly static, for the work develops in time. And so much of the peopling of the writer's conceived audience is subconscious – the psychic work of early childhood, turbulent flows of emotion whose origins are lost or suppressed.

The text emerges, somehow (it's a miracle it does), and audiences for it immediately spring up. First, there are friends and editors, who can be influential (think of Pound on Eliot). Then, if the work is fortunate enough to be published, there comes the audience of book reviewers and literary critics, sharpening knives or stuffing into pigeonholes, shaping meaning for their own purposes, and for consumption by others. If the writer is luckier still, there also emerges the singular and collective audience of thousands of readers. Each is indeed a multitude, for each receives the text within the well-populated mental landscape of his or her own psychic forces, literary predilections and sheer prejudice, not to speak of the state of their body when they read the work.

Audiences may be small or large, real or imaginary. If there be a perfect match (impossible) between the intended audience of the writer and the real audience of one reader, then actually nothing interesting happens. My soul sister doesn't need my poem. In my field, this would be routine, paradigmatic chemistry. But from the almost inevitable mismatch of audiences – intended, perceived, incoherently shaped – the kind of meaning springs forth that engenders change (Rilke's "Archaic Torso of Apollo"– kind-of-change) and compels a segment of the audience past the high of catharsis (which suffices) to the creation of the new.

I think it's intriguing to think about how overlapping audiences come to be, and what authors, critics, and society do to shape audiences.

3.

Let me preface some comments on the return of the subject (who never left) by some observations on aesthetic motivation within science.

If one can make any generalization about the human mind, it is that it craves simple answers. This is no less true in science than it is in politics. The ideology of the simple reigns in science, whereas every real fact argues to the contrary. So we have the romantic dreams of theoreticians (e.g. Dirac) preferring simple and/or beautiful equations.

The intricacy of any biological or chemical process elucidated in detail points clearly in the opposite direction. Think of hemoglobin, a jumbled molecule of ten thousand atoms, whose beauty patently resides in its complexity, a complexity absolutely essential for its function. Or consider the following chemical and biological vignette, the story of the sex attractant pheromone of the cabbage leaf looper moth, Trichoplusia ni. Insects are the greatest chemists. When the pheromone was first discovered in 1966, it was thought to be a simple molecule, ((Z)-7-dodecenyl acetate in our code). A few years later a second active ingredient was found, and more recently some clever biosynthetic reasoning by Biostad, Linn, Du and Roelofs led to the discovery that a blend of no less than six molecules was needed for full biological activity.[2]

There is a remarkable resistance on the part of scientists to coming to peace with the complexity of this beautiful and terrible world. Chemists are quite schizophrenic in this regard. On one hand they crave the elegantly simple, loving molecules that have the form of Platonic solids. And if they don't find it, they sculpt the facts and hypotheses into a simple shape, often using Ockham's Razor (another story, told elsewhere) for the purpose (see

2 Obviously it takes six for sex. For an introduction to this story see Bjostad/Linn/Du/Roelofs; for more on telling stories in science, see Hoffmann 2000.

Hoffmann et al, 1996).

On the other hand, I think chemists are more accepting of complexity. After all, we are squarely in the middle, dealing not with the smallest, nor with the largest. The middle is complex, it's where human beings are. Chemists like a molecule shaped like a dodecahedron. And they like the fact that a pheromone emerges as a perfumer's blend.

But now we must face up to a psychological problem. Simplicity, symmetry, order ride a straight ray into our souls. Perhaps (this is far out) we have evolved a psychobiological predilection for the qualities of the world that rationalize our existence as locally contraentropic creatures. But what if the world is determined to be – by us, by scientific us – to be complex, unsymmetrical, and chaotic? How do we find satisfaction, and I do mean psychological satisfaction, in such a world?

I think the answer is simple, at least for a chemist. We construct with ease an aesthetic of the complicated (so there is a biochemical reaction, sure enough, that connects the six pheromone ingredients), we adumbrate reasons and causes. We do so by structuring a narrative to make up for the lack of Platonic simplicity. And then we delight in the telling of the story.

I would suggest that narrative becomes the substitute for soaring simplicity in the operative aesthetic structures of chemists, and – I think it's the same even for the most hard-core reductionist physicist. Continuing the story is the motive force for experimentation and weaving of theories.

Let me make the transition to literary studies by the following little story:

There appeared a nice, perceptive article about the language of science by a German critic. I liked what he said, and I wrote to tell him so. In the course of my letter I innocently made some remarks about narrative, much as above. For some reason that ticked him off, for he proceeded to tell me, in no uncertain terms, as they say, the following: Narrative is fine. But ever since Gustave Flaubert took a story of a certain woman, a woman the elements of whose story were no different from the stories of a thousand other fallen women, and when Flaubert transformed that story into a great novel – ever since then it was clear that the subject matter of a narrative was fundamentally unimportant.

I'm not sure what set that minor tirade off, but the critic's peeved reaction made me think about the role of the subject within the narrative tradition. In science the subject is pretty well-defined. The phenomena under study – a new turquoise-colored molecule, or the AIDS virus – are surely not quite as real and unyielding of construction as scientists speak and think of them. But they are much further removed still, I think, from the evanescent and ephemeral guises assigned them by the "social construction of science" gang. The truth lurks somewhere in-between; I am reminded how after I and

Shira Leibowitz wrote a clever article about how the military metaphors of drug design are damaging to our psyche and culture, and even to the logic of drug design – how after we wrote this we got a letter from a friend who was struggling with cancer (and who soon passed away), who gently said that it was difficult for her to think of a "love not war" alternative metaphor when she was dying of the disease.

My opinion is that we live in a mansion of realism and fiction, that in it are real things and an infinity of mirrors. Modern science is a successful social invention for acquiring not truth, but reliable knowledge. An essential part of the structure of science is a built-in alternation of flights of wild theoretical and narrative fancy with experimental probing of some underlying reality. The fancy is not unfettered. In the pursuit of the art, craft, science, and business of chemistry there are numerous checks with reality. To be sure, each is individually deconstructible, but their totality shapes a pretty reliable network of knowledge.

Which in no way precludes tall, fancy, and mythical stories, fitting into absolutely every category of folktale you have. For it is human beings that seek the reliable knowledge. So they clothe the oral and written reports of their curious exploration with the fabric of narrative. Even as the ritual and ossified format in which scientists' metier requires that you report the new (the scientific article) tries to repress the human quality of science... Narrative is absolutely indestructible; it looms just under the surface in the driest chemical article. And I am so happy that I am privy to the codes, so that I may see the myth (and the approach to reliable knowledge) underneath.

Some trends in literary studies have aimed to remove the purported subject of the text. First it's the author and his intentional fallacy who are banished. Then the subject; it is easy to subvert it. Even the reader, that ever-flexible vagrant can be done away with. But, strangely enough, these fictionalizable characters in the drama of modern literary theory – author, subject, reader, even critics – just keep reappearing, persistent ghosts that they are.

I suspect that we will see the resurgence of the subject, be it an emotion or a human being. It, she may not be as "real" as the subjects of the limited world of the scientist, who deals with the important subset of problems in this world that have solutions (rather than inexhaustible alternative resolutions; I value those too). But the subjects of literature – yes, Madame Bovary, my favorite stones (which are Archie Ammons' stones) – will be central to what I see in the future of literary studies. This is what M. H. Abrams has called a humanistic literary criticism, "one that deals with a work of literature as composed by a human being, for human beings, and about human beings and matters of human concern."

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