Witnessing Katrina: Re/Cognizing Nature for Socially Responsible Science

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The events of August 29, 2005, have left a lasting impact on the citizens of the US. Seeing through the eye of a category four hurricane has resulted in multiple destabilizations. Levees have been breeched, a historic city devastated, climate change rendered not simply believable, but palpable[i], and the face of suffering given a complexion that revealed to a shocked nation the plight of the poor and the racism that is woven into our economic structures.

As I considered the news reports of the various impacts of Katrina and thought about the city of New Orleans, I knew that I was witnessing afresh the reasons I have for the last two decades been advocating that those concerned with doing science, including science studies responsibly embrace an interactionist ontology.[ii] The events unfolding in the wake of Katrina provided a trenchant illustration of the importance of embracing such an ontology and its concomitant epistemology. Witnessing Katrina renders apparent the urgency of embracing an ontology that *rematerializes the social and takes seriously the agency of the natural*.

Medicine, the natural sciences, and engineering are designed to provide us with knowledge about the natural world. The social sciences and humanities are designed to provide us with knowledge of the social world. While the actual workings of knowledge production in these areas is far from simple, given that various institutions that are linked to these disciplines are often committed to the maintenance of ignorance as well as to the acquisition of knowledge[iii], still even this realization ignores an important gap in knowledge. As the phenomena of Katrina's devastation has taught us all too well, the knowledge that is

too often missing and is often desperately needed is at the intersection between things and people, between feats of engineering and social structures, between experiences and bodies.

In part the problem arises from questionable ontological divisions separating the natural from the humanly constructed, the biological from the cultural, genes from their environments, the material from the semiotic.[iv] We can make divisions between the biological and the social, as we feminists did with sex and gender, but what we soon discovered is that the divisions are both permeable and shifting, while at the same time deeply entrenched in bodies and practices. In "Re-Fusing Nature/Nurture" and "Fleshing Gender, Sexing the Body" I urged feminists to abandon the sex/gender dichotomy, arguing both that the nature/culture dualism that it rested on was flawed and that its use—though perhaps liberatory at a particular historical moment—was perpetuating the conceptual framework out of which sexist as well as racist practices have emerged. I argued that bodies, and sexes, are neither fixed nor inert, but fluid and emergent.

Seeing through the eyes of a category four hurricane impressed upon me the porosity of the categories "natural," "human-made," "social," "biological." In this essay I will argue that we must attend to this porosity and to the in-between of the complex interrelations from which phenomena emerge. As I have in other publications, I will argue for an interactionist account that shifts the debates from "realism" vs. "social constructivism" to *emergent interplay,* which precludes a sharp divide between the biological and the cultural. Given an interactionist ontology, what exists are "not things made but things in the making" (James 1958, 263)[v], and differences are fluid, evolving, and contextual. Donna Haraway's invocation of "material-semiotic" is kin to this ontology as is Andrew Pickering's notion of a "dance of agency" (Haraway 1997, Pickering 1995).

On What Is: Interactionism

Realism is a prevalent philosophical as well as "common-sense" commitment. While there are numerous philosophically nuanced accounts of realism, common tenets include both existence and independence. A realist is one who accepts not only the existence of various objects and phenomena, but who sees those entities as independent of human beliefs, conceptual schemes, linguistic practices, and social structures. In the commonsense terms of John Searle's *The Construction of Social Reality*, external realism is the position that "the world (or alternatively, reality or the universe) exists independently of our representations of it" (1995, 150). Searle certainly allows for entities that exist *because of* human beliefs and practices; indeed he is known to wave about a dollar bill as a paradigmatic example. But he argues that a significant portion of what exists is mind-, culture-, language-, perception-independent entities and processes. Realism then is the belief that what exists is both *prior to* and *independent* of human interactions.

Versions of social constructivism have been central to many feminist analyses. Various phenomena—gender, sexuality, ability, cognitive authority—once taken to be "natural" phenomena have been studied by feminists and shown to be socially constructed. These phenomena are fully *real* in the sense that they impact lives and have economic, social, and psychological effects, but they are not *independent* of human interactions. Indeed, they are emergent from them.

I have argued that feminists must avoid the divide of realism vs. social constructivism for neither framework is adequate (Tuana 2001). Both are embedded in a problematic nature/culture schism that does not do justice to the complexity of interactions of phenomena. Interactionism enables us to dissolve the divisions between these two poles and transform the terms of the debate.

Interactionism acknowledges both the agency of materiality and the porosity of entities. What I have termed "interactionism" has been inspired by a Whiteheadean process metaphysic (Tuana 1983) where the basic units of existence are phenomena (rather than physical objects) that are emergent from interactions. Donna Haraway's concept of material-semiotic arose from the same Whiteheadean foundation (see Haraway 1997).[vi] Interactionism is a metaphysic that removes any hard and fast divide between nature/culture, while at the same time troubling the division between realism and social constructivism. "the world is neither 'fabricated' in the sense of created out of human cultural practices, nor is its existence independent of human interactions of a multitude of forms, including cultural." Interactionism posits "a world of complex phenomena in dynamic relationality" (2001, 238-9)

Interactionism begins with the recognition that our biological theories, not to mention other accounts of interactions between organisms and environments, too often retain a division between nature (sometimes translated as gene) and environments (be they natural or social). Despite acknowledging an interweaving of genetic and environmental factors, such accounts retain an additive model that maintains an ontological divide between the two. Such a move simply changes the question from "Which traits are due to innate factors and which are due to environmental factors?" to "To what extent is the trait in question due to innate factors and to what extent is it due to environmental factors?" But the nature/culture divide remains intact.

Interactionism acknowledges the robust porosity between phenomena that destabilizes any effort to finalize a nature/culture divide. We can, and often need to make distinctions between such poles, but it is crucial not to see these distinctions as "natural kinds" or to read them as reflecting a dualism. Adequate distinctions can be made, even

distinctions between "nature" and "culture," but they are made for a particular purpose and at a particular time. In other words, we do not simply "read" such distinctions from nature, *but take epistemic responsibility*[vii] *for the distinctions we employ.* As Lorraine Code as so persuasively argued, we cannot separate epistemic analysis from ethical analysis. To know well, we must be responsive to the differences articulating themselves in our experiences and practices, along with being attentive to how the distinctions we embrace, in part, construct our experiences, as well as how these distinctions are enacted in social practices, how they enable as well as limit possibilities and for whom, what they conceal as well as what they reveal, and so on. Knowledge practices themselves often involve articulations of differences, but with an interactionist understanding of these differences being fluid, unfolding, and situated, epistemic responsibility requires this enhanced responsiveness. "Knowing well is a matter both of moral-political and of epistemic concern" (Code 1991, 72).

On What Is: Katrina

Look at Katrina. Katrina is a natural phenomena that is what it is in part because of human social structures and practices. Seeing through the eye of Katrina reveals no hard and fast divide between natural/social; they are rather seamlessly swept together in its counter-clockwise rotation. Katrina came into being because of a concatenation of phenomena—low pressure areas, warm ocean waters, and perhaps swirling in that classic cyclone pattern are the phenomena of deforestation and industrialization. There is now general scientific consensus that some degree of climate change is inevitable and the vast majority of scientists argue that the signs of anthropogenic climate change are visible—melting glaciers, rising coastlines (Oreskes, 2005).

But what of Katrina? A hurricane pulls its strength from the heat of the ocean surface waters. Katrina swirled into a Category 5 hurricane thanks to surface waters in the Gulf of Mexico that were 2 degrees warmer than normal for the time of year.[viii] Does it make sense to say that the warmer water or Katrina's power were socially produced rendering Katrina a non-natural phenomena? No; but the problem is with the question. We cannot sift through and separate what is "natural" from what is "human-induced," and the problem here is not simply epistemic. There is scientific consensus that levels of carbon dioxide have been rising significantly over the last century and consensus that carbon dioxide and other greenhouse gases are raising the temperature of the Earth's atmosphere. These "natural phenomena" are the result of human activities such as fossil fuel combustion and deforestation. But these activities themselves are fueled by social beliefs and structures. In the US we have hammered home a solid belief that economic success and independence is determined in part by access to and consumption of goods. The average household sports two vehicles, with the number of minivans and SUVs significantly rising since 1990.[ix] Current projections indicate that without severe reduction in these emissions, warming will increase from 2.5°F to 10.4°F causing serious weather related changes that poses grave threats to biodiversity.

Katrina then is emblematic of the porosity between humans and our environment, between social practices and natural phenomena. My point is that there is no sharp ontological divide here but rather a complex interaction of phenomena. This does not mean that we cannot attempt to determine the extent to which human factors increased the intensity of a hurricane or some other weather related phenomena. Indeed issues of distributive justice may require that such a distinction be make in order to determine how to

apportion responsibility across nations for harm from human-induced climate change as may be done if we adopt a "polluter-pays" principle of responsibility.

To weave flesh onto these theoretical bones, let us turn to New Orleans.

On What Is: New Orleans

While it began with Katrina, attention quickly shifted to New Orleans. And if we do the same, the viability of interactionism will be further illustrated. Remember also that my intention in this essay is to argue for a return to an enriched commitment to interdisciplinary by feminists and all theorists, for we cannot understand nor live responsibly in the world we are of and in without doing so. A thesis that weaves through this essay is the importance of understanding material agency, namely the importance of both rematerializing the social as well as understanding material agency—the human as well as the more than human.

New Orleans is a city surrounded by water: the Gulf of Mexico, the Mississippi, and Lake Pontchartrain. It is a city built on land that is below sea level, an average of six feet below sea level, though there are points at which the land is a staggering ten feet below sea level. New Orleans is a city that emerged out of complex interactions. Much of the city lies below the level of the river that helped to create it. The Mississippi and its coursing into the gulf was the transit by which wealth in the form of cotton, sugar, grain, and other goods was naturally carried from the North to the South, to the city that became New Orleans. This water carried wealth, but given the particulars of the land, it also carried death. Flooding has been a commonplace of the city of New Orleans, not to mention the illnesses the swampy land bred, and efforts to control the water were equally commonplace.

A city is a complex material-semiotic interaction, and New Orleans rests at the heart of multiple interactions. Consider the levees, which have emerged from the interaction of

social and material forces. The city sits on the banks of the Mississippi, where sediment from the river had created areas of elevated land called "natural levees." New Orleans' earliest buildings sat on top of these levees, but as the population grew, houses were built farther inland at lower elevations. To create usable land, water had to be pumped out of the area, which in turn caused the ground to sink even lower. *The levees transform the local geology and hydrology, and are in turn shaped by them. But the local geology and hydrology also emerge from complex social vectors.* Without the US Army Corp of Engineers which has been building levees along the Mississippi River for two centuries, neither New Orleans nor the Mississippi would be what they are today.

But before turning to the extensive levee system that makes New Orleans what it is today, it is important to understand that not all the reclaimed land of the area was crafted through engineering technologies. I pick this complex interaction as a reminder, a caution to avoid positing an Edenic time before colonialization and industrialization and against the persistent myth of passive indigenous peoples who simply lived in but did not transform "nature." The peoples who lived in the area that was to become New Orleans actively shaped its land. The land was rich in resources, including shellfish. Shellfish was such a prevalent food source that shell middens or debris mounds accumulated. From these emerged a new ecozone in the marsh, a clear material-semiotic interaction. The middens contributed to the emergence of significantly different plants and distributions of plants in the marshes, as well as providing the dry land needed for human habitation (see Kidder 2000). Indeed the cypress trees that are the hallmark of the eastern marshes took root because of the middens as did the oak trees that lent their name to the islands. And it was the economic promise of these oak stands that, in the eighteenth century, attracted colonialists. These same middens would be the literal foundation of building in New Orleans

as the contents of middens were used to create the material of houses or the lime that plastered the walls of the buildings of the emerging city. As is often the case, human agency, though not always intention, is knit together with more-than-human agency. Human consumption and refuse practices resulted in material-semiotic interactions that altered flora habitats which in turn, altered human interests. Material-semiotic. The point is that material agency in its heterogeneous forms, including irreducibly diverse forms of distinctively human agency, interact in complex ways. Agency in all these instances emerges out of such interactions; it is not antecedent to them. Our epistemic practices must thus be attuned to this manifold agency and emergent interplay, which means we cannot be epistemically responsible and divide the humanities from the sciences, or the study of culture from that of nature.

We often view nature as subdued through technology, the story of human agency impacting the natural order. But we often forget to reverse the interaction for the Mississippi, and Katrina, and those shell middens have agency too, an agency that impacts the so-called natural and social order. And as we make pragmatic divisions between what is natural and what is social, as I have here, it behooves us to remember the viscous porosity between these phenomena, a porosity that undermines any effort to make an ontological division into kinds—natural and cultural—where the edges are clean and the interactions at best additive.

Go back to the levees. The levee system has been shaped by numerous forces—technology, economics, weather, sedimentation patterns, the Mississippi River, to name a few. A 1947 hurricane which caused 100 million dollars in damage gave rise to hurricane protection levees along Lake Pontchartrain's south shore. Another deadly hurricane in 1965 caused the Orleans Levee Board to raise existing levees to a height of 12 feet. We knew

that those levees and floodwalls were not designed to provide protection from a Category 4 or 5 hurricane storm damage. Numerous studies had been conducted which concluded that a hurricane of this force could result in levee breaches that would put the city underwater. Even a 2001 FEMA report (the Federal Emergency Management Agency at the Department of Homeland Security) warned that a hurricane flood of New Orleans was one of three most likely disasters to strike the US in the near future.[x]

But levees and floodwalls are expensive. *New Orleans CityBusiness* reported in June of 2005 that Federal funding for the US Army Corp of Engineers projects in New Orleans would be reduced by $71.2 million dollars, shelving a study to determine ways to protect the region from a Category 5 hurricane. State Senator Mary Landriew was quoted as saying that the Bush administration was not making the Corps of Engineers funding a priority. Katrina is shifting those priorities in unpredictable ways.

Part of the psychology of living in New Orleans, a city in which there are points at which cargo boats on the river are sailing on water levels significantly *higher* than street level, is believing that human agency will win out over other forms of material agency. That belief was not warranted, but it made living below sea level palatable. (The orange are those areas of New Orleans that are below sea level, and yellow is at sea level) One had only to read the numerous scientific studies produced by the Army Corps of Engineers that provided computer simulations predicting the devastation. But denial is a powerful force. Even President Bush and Michael Chertoff, Secretary of the US Department of Homeland Security, practiced it. Bush in an interview with Diane Sawyers on *Good Morning America* on September 1, 2005 claimed that he did not think that anyone could have anticipated the breach of the levees. And Chertoff justified the slow disaster response rate as being due to what he called the "second catastrophe," namely the breech of the levees "really [catching]

everybody by surprise."[xi] Denial indeed functions in complex ways. *And now that the tapes have been released, we know that this was a high level of denial even for Bush, the master of denial.* X 4

One need not practice this type of denial to live below sea level. Approximately 27 percent of the Netherlands is below sea level, an area that supports over 60 percent of the country's population of almost sixteen million people. After a serious flood in 1953, the Netherlands inaugurated the Delta commission to set up a system of dykes, dams, and other structures that are built to provide flood safety at a far higher storm level than the New Orleans' system. While no technology is fool-proof, the confidence of New Orleaneans prior to Katrina had to be based either on denial or on ignorance, while the confidence of Netherlanders has a more solid foundation. Not that there is no denial at work even in the Netherlands. For to wall off major sea arms means destroying ecosystems and losing coastline (almost 400 miles of coastline). Living below sea-level can be done, but it requires what Andrew Pickering calls a "dance of agency" between the human agents—the engineers—and the nonhuman agents—the sea.[xii]

On What Is: Plastic Flesh

The dance of agency between human and nonhuman agents also happens at a more intimate level. The boundaries between our flesh and the flesh of the world we are of and in is porous. While that porosity is what allows us to flourish—as we breathe in the oxygen we need to survive and metabolize the nutrients out of which our flesh emerges—this porosity often does not discriminate against that which can kill us. We cannot survive without water and food but their viscous porosity often binds itself to strange and toxic bedfellows.

Katrina's wake left New Orleans flooded with what headlines called a "toxic soup." There are five superfund toxic waste sites in and around New Orleans, all of which were

compromised by Katrina's flooding. There are even more superfund sites in Louisiana and Mississippi that were in the path of Katrina's wake. These sites contain a range of contaminants, but the most common are barium, which can damage the heart, liver, and kidney; polycyclic aromatic hydrocarbons, which are carcinogens and can impair immune systems, and benzene, which causes cancer and damage to bone marrow. As I wrote this paper weeks after the levees broke, most official reports were that the sites have not been damaged, but there were unofficial reports of disturbed caps at some sites and general worries that floodwaters seeping into contaminated soil may be spreading toxic chemicals or leaching them into groundwater.

While Katrina may have compounded the problem, any effort to witness Katrina cannot ignore the fact that toxic wastes have been a longstanding concern in New Orleans. There are over 130 petroleum and chemical plants along with over a hundred other industries that dot the Mississippi River from Baton Rouge to New Orleans. According to Barbara Allen "the chemical industry in Louisiana annually reports the equivalent of sixteen thousand pounds of hazardous waste for every citizen in the state" the equivalent of "12.5% of all hazardous waste reported nationally" (2003, 1). While there are many types of industries clustered along this corridor, a region which has come to be known as "cancer alley," I will focus on the plastics industries to provide an illustration of a complex material-semiotic interaction, an interaction that permeates flesh.

Gerald Markowitz and David Rosner in *Deceit and Denial: The Deadly Politics of Industrial Pollution* trace material-semiotic factors that led to the US plastics industry relocating many of its plants to the South, and in particular to the region that would come to be known as cancer alley. Markowitz and Rosner argue that understanding the reasons for these moves requires numerous perspectives—from the geography of Louisiana to the

psychology of Louisiana's legislature—again the importance of addressing questions through an interdisciplinary lens. The Mississippi and the port in New Orleans provided transportation options. Louisiana's salt deposits provided a resource needed for plastics production. Louisiana's governmental structure promised fewer environmental regulations and its seeming acceptance of corruption suggested a "flexibility" the industries found attractive.[xiii] The plastics factories settled in as did the pollution of their products.

Polyvinyl chloride (PVC) is an inexpensive and, when combined with plasticizers, a highly malleable material that has a manifold of uses. Medical equipment, coke bottles, children's toys, food wraps, siding for houses, credit cards, water pipes, even the chairs we sit on and floors we walk on came to be made of it. Look around you at home and at work; you are likely to be surrounded by it. (location of concentrations) The complex material-semiotic interactions that resulted from PVC replacing materials like glass, wood, and metal are a complex and interesting story, but not the one that interests me here. For this commonly found substance has not only transformed our lives, it has transformed our flesh. That is the interaction that interests me here.

There is a viscous porosity of flesh—my flesh and the flesh of the world. This porosity is a hinge through which we are of and in the world. I refer to it as viscous for there are membranes that effect the interactions. These membranes are of various types—skin and flesh, prejudgements and symbolic imaginaries, habits and embodiments. They serve as one of the mediators of interaction. My interest in the story of PVC has to do with skin and flesh.

PVCs are produced by running an electrical current through salty brine in the presence of a catalyst, which is sometimes mercury. A series of interactions occur at the molecular level from which chlorine, sodium hydroxide, and hydrogen are produced. And

when the catalyst is mercury, there is mercury released, perhaps as emissions. But that is another story of interactions. The chlorine is then mixed with carbon to form ethylene dichloride, from which vinyl chloride monomer is synthesized. This is polymerized to create PVC, which is often made softer and more flexible by additions of plasticizers, typically phthalates.

There are numerous studies linking cancer threats to PVC production. Studies of workers in industries that produce PVC have shown significantly increased mortality from cancer deaths including lung cancer, angioscarcoma (liver cancer), and leukemia. One source of the problem may be the plasticizers. Phthalates have been shown to be endocrine disruptors, mimicking hormonal action in animal studies. Studies of the effects of vinyl chloride, polyvinyl chloride, and phthalates have documented damage to liver (Wong 2002), kidneys (Maltoni 1975), lungs (Mastrangelo 2003, Suzuki 1981)) and brain (Tabershaw 1974, Wong 1991). They are both genotoxic and carcinogenic, causing a wide spectrum of tumors in various animal species. The plastics industry continues to insist that humans are exposed to such small amounts of phthalates that they pose no significant risk.

The viscous porosity of entities and the interactions out of which phenomena emerge are well illustrated by this example. Beginning at the molecular level, we know that phthalates and vinyl chloride affects in the human and also in nonhuman animal bodies a complex interaction that can result in cancer. Workers inhale PVC dust and those who live by incinerators inhale it as plastics are burned.[xiv] The viscous porosity of our bodies and that of PVC allows for an exchange of molecules, where PVC and phthalates pass through the porosity of skin and flesh, particularly the mucosal linings of our intestines and our lungs. Plastic becomes flesh. (food TEQ=toxic equivalents)

The molecules that mix with our flesh are endocrine disrupters which mimic, enhance, or inhibit a hormonal action. They function as chemical messengers, traveling through our blood until they hit an appropriate target—a lung, our liver. When such a molecule hits such an organ they interact with a receptor, which "recognizes" the molecule as a hormonal component. It then either passes through the membrane into the cell to interact with the DNA or RNA of the cell to either turn on or turn off a genetic process, or it releases a molecule that is part of the receptor which does the same thing. That interaction can lead to cancer.

Young children are at greater risk. Their organs and nervous system are still developing during the first year of life. Their ability to metabolize, detoxify, and excrete toxins is often less developed than that of adults and their nervous system is less capable of repairing damage. The viscous porosity of breast milk has been the subject of attention of the ecologist Sandra Steingraber. "When it comes to the production, use, and disposal of PVC, the breasts of breast-feeding mothers are the tailpipe" (1999 363), for of all human foods, breast milk is the most contaminated. Burning PVC creates dioxin, a known human carcinogen. It is lipophilic, concentrated in fat, so breast milk concentrates the levels of dioxin, and other toxic residues. As Steingraber explains:

> This is why a breast-fed infant receives its so-called "safe" lifetime limit of dioxin in the first six months of drinking breast milk. Study after study also shows that the concentration of carcinogens in human breast milk declines steadily as nursing continues. Thus the protective effect of breast feeding on the mother appears to be a direct result of downloading a lifelong burden of carcinogens from her breasts into the tiny body of her infant (1999 363).

Plastic flesh.

The viscous porosity of bodies belies any effort to identify a "natural" divide between nature/culture. When I drink coke out of a plastic bottle I have been taught to think of myself as a natural being and the bottle as a cultural artifact, a product of technology. The bottle is made of naturally occurring materials, but is constructed by humans to be a different material or structure than what occurs in nature. Now incinerate that bottle and breathe deeply. The components of the bottle have an agency that transforms that naturally occurring flesh of my body into a different material or structure that what occurs in nature. The parts of the plastic become as much a part of my flesh as parts of the coke that I drank. Once the molecular interaction occurs, there is no divide between nature/culture, natural/artificial. These distinctions, while at times useful, are metaphysically problematic for there are important migrations between and across these divides that can be occluded by efforts to posit a dualism.

I pointed to Haraway's figure of OncoMouse in my earlier work as emblematic of a culturally constructed natural being, a site where the nature/culture divide dissolves (Haraway 1997, Tuana 2001). But the bodies of the plastics industry workers, indeed my body, your body, are similarly emblematic of a divide that is richly porous, and one that we ignore only at our own peril. OncoMouse is a transgenic research mouse, which has been materially refigured by technology to contain an oncogene, a transplanted, human tumor-producing gene, the gene that produces breast cancer. While her material reconfiguration was intentional, it reflects the flesh of workers in the plastic factories along that stretch of the Mississippi dubbed cancer alley. The cancers that emerged from their flesh were also the results of material-semiotic interactions: industries choosing Louisiana because of corrupt politicians (Markowitz and Rosner 2002); the complex interactions of endocrine disruptors; industries like Dow and B. F. Goodrich suppressing and misrepresenting data (Sass 2005);

the complex ways the products used to create plastics leach into groundwater, contaminate soil, and become part of the flesh of the food that we eat; the process by which chemical industry employees and consultants serve as external peer reviewers of EPA assessments of the risks of vinyl chloride (Sass 2005); the practices we use to "dispose" of PVC, including incineration which releases toxins to air and soil, to name a few. We do not need a transgenic animal to make us aware of the porosity of distinctions we make between nature and culture, nor to remind us of the robust interrelationality of material agency.

This example also illuminates the significance, the urgency, of rematerializing the social in all its meanings. The plastics industries have the material resources to lobby Congress and ensure that their representatives serve as reviewers of EPA studies. And we can trace the interaction of poverty as we map the location of industries and the neighborhoods of the poor and recognize that health disparities are not due only to inequitable access to healthcare but to environmental racism and classism. Political failures to address the environmental hazards of plastics have left their signature on the flesh of many bodies, but the bodies of industry workers who toil in the plastics factories or the garbage incinerators and the bodies of those who live in the path of their pollutants have disproportionately suffered the negative effects of this material-semiotic interaction.

Witnessing Katrina: Materializing Ignorance

Before I end, let me gesture at one more genre of interaction—poverty and ignorance. Poverty leaves its effect in the bodies and psyches of those it touches. This material-semiotic interaction should come as no surprise to anyone. Grow up without

proper nutrition and physiological development will be affected. Grow up without educational resources and cognitive development will be affected. Grow up living the effects of institutionalized racism and trust in those institutions will be affected.

But the poverty Katrina forced us to witness came as a "shock" to the nation as it watched news coverage of Katrina's wake. This serves as an interesting lens for considering some of the ways that ignorance is materialized and the various institutions and motives that have a stake in the production and maintenance of ignorance. Consider just a few representative headlines and news reports:

> "In the last twenty years, nothing has put grinding American poverty on display like Hurricane Katrina. The powerful Gulf Coast storm ripped the lid off an issue many Americans liked to think was behind us.
>
> The stark images from New Orleans and the Gulf proved it isn't. Two weeks after Katrina hit--and under the glare of world shock dismay--President Bush stood in the French Quarter, acknowledged "deep, persistent poverty" with "a history in racial discrimination", and promised "bold action"

This ignorance and the wrenching out of ignorance caused by the news coverage of Katrina were discussed in *Newsweek*'s September 19th issue.

> It takes a hurricane. It takes a catastrophe like Katrina to strip away the old evasions, hypocrisies and not-so-benign neglect. It takes the sight of the United States with a big black eye—visible around the world—to help the rest of us begin to see again. For the moment, at least, Americans are ready to fix their restless gaze on enduring problems of poverty, race and class that have escaped their attention. Does this mean a new war on poverty? No, especially with Katrina's gargantuan price tag. But

> this disaster may offer a chance to start a skirmish, or at least make Washington think harder about why part of the richest country on earth looks like the Third World (Alter 2005).

That some US citizens were shocked by the poverty that they witnessed provides additional support for what Charles Mills called an epistemology of ignorance[xv]. "On matters related to race, the Racial Contract prescribes for its signatories an inverted epistemology, an epistemology of ignorance, a particular pattern of localized and global cognitive dysfunctions (which are psychologically and socially functional), producing the ironic outcome that whites will in general be unable to understand the world they themselves have made" (1997, 18). If we are to fully understand the complex practices of knowledge production and the variety of factors that account for why something is known, we must also understand the practices that account for *not* knowing, that is, for our *lack* of knowledge about a phenomenon. Epistemic responsibility requires that we attempt to understand the interactions that result in the poverty that is woven into the lives of so many in New Orleans, or any major US city, *being well-known, but ignored or rationalized.*

In New Orleans, as with other US cities, poverty and racism interact. Sixty-seven percent of New Orleans' residents are black, and about half of them are poor. According to the 1999 Census, 27.9% of people in New Orleans live below the poverty line. In New Orleans, 38% of children live in poverty compared to 17% average in the U.S. And those children are likely to be black. In Louisiana, 44% of black children live in poor families, while 9% of white children live in poor families. Just to get a sense of what it means, materially, to be poor, the federal poverty level is $16,090 for a family of three and $19,350 for a family of four.

Katrina interacted with poverty in relatively predictable ways. The poor are less likely to be able to evacuate. they are less likely to have the cash needed to leave and to live elsewhere. And when displaced, as thousands of New Orleaneans have been, they have fewer options—skills that are marketable, financial resources to cushion them, etc. The interactions we saw on the news were mainly material—people dying in nursing homes or crowded into a dark, hot stadium with few resources. But Katrina also stirred up psychic interactions. For example, many Lower Ninth Ward residents who were interviewed by *The NewStandard* (October 17, 2005) said "they believed the levees had been intentionally destroyed – either by dynamite, barges or neglect – in order to divert flood waters from richer neighborhoods" (Azulay 2005) and attributed this belief to the memory that the government blew up a levee in 1927 to save parts of New Orleans at the expense of poorer areas.

The dance of agency to which Pickering urges us to attend can only be seen and understood if we understand the rich interactions between organisms and environments in all their complexities. Katrina, herself an interaction between what we have labeled the "social" and the "natural," flooded us with thousands of interactions—just a few of which I've attempted to document here. What caught our attention on the nightly news, those of us who were not in New Orleans, that is, was the heartrending impact of being poor and being in the middle of a disaster. Witnessing children and adults, the firm and the infirm, struggling to stay afloat, at first literally, and later regarding finding adequate food, water, shelter, we watched a complex interaction between social structures—class, governmental emergency reactions, etc.—and thousands of humans and nonhuman animals.

The US poverty rate of about 13% is the highest in the developed world and twice as high as the rate in other industrialized countries. Feminists and other theorists have

developed careful investigations of the complex of interactions—material, social, psychic—that keep these figures so high.[xvi] But what was equally surprising about Katrina is that while it "blew the roof off" of efforts to ignore poverty, it had no comparable impact on our social understanding of the material interactions of disability. Materializing ignorance.

CNN's *Death and Despair* showed graphic pictures of New Orleans after the storm. Despite pictures of victims of nursing homes and the numerous pictures of dead people in wheelchairs making the face of disability painfully visible, *it was not seen* amidst the storm. While headlines screamed the impact of poverty and of race on those who could not evacuate New Orleans, no headlines decried the plight of those with a disability, a far greater number of whom live below poverty than any other group of individuals, and whose ability to evacuate is limited not only by financial materiality, but may also be impacted by their embodied materiality. As hard as it is for someone with limited financial resources to evacuate, that difficulty increases exponentially if the individual with limited financial resources has limited physical mobility.

Poverty and disability are strongly linked, and in both directions. Disability can link to poverty if the disabled individual is denied access to economic opportunities and appropriate accommodations are not made. The US Census Survey of Income and Program Participation showed that 28 percent of adults ages 25 to 64 with a severe disability lived in poverty, compared with 8.3 percent for the general population of adults aged 25 to 64. Poverty can also be a cause of disability. Inequitable access to health care, dangerous living conditions, environmental racism and classism, and malnutrition can all lead to disability. Data derived from the National Health Interview Survey, which was conducted by the National Center for Health Statistics, indicated a 1% increase in the rate of childhood disability between 1983 to 1996, with the increase due to children living in poverty.

The 2000 Census reported 23% of New Orleaneans as having a disability. That is 23% of 484,000 people. Add to this the number of individuals who were seriously ill when the hurricane struck or who needed medications to stay well, medications that were made inaccessible by the storm, and you have a clearer answer to why so many people did not, no, could not, evacuate New Orleans. Some people were not physically able to move or be moved. Materiality.

But while the US news reports responded to Katrina by decrying the impact of poverty on the lives of US citizens, few even noted the impact of disability despite is "visibility" all around them. As politicians decried individuals who "refused" to evacuate New Orleans, they rendered invisible the large number of people who could not leave.

In this section I have tried to gesture at just a few of the forms of ignorance that circulated in the eye of Katrina. Its devastation gave witness to poverty and lingering racism, and to the power of ignorance

Viscous Porosity: What Might Yet Be

So what is at stake? The separation of nature and culture has impoverished our knowledge practices. We posit a reasonably predictable natural world and a far less law-governed social realm. The natural sciences emerged from this model of the natural, divorced from the social. The humanities and the social sciences have focused on the social divorced from the natural—representations, meanings, and institutions. But the world in which we live cannot be divided in this way into two neat and tidy piles. In the words of Andrew Pickering, we live "in the thick of things" (nd). Witnessing the world through the eyes of Katrina reveals that the social and the natural, nature and culture, the real and the constructed are not dualisms we can responsibly embrace. In more ways than I can

demarcate in this essay, it is the *interaction* between them that is the world that we know and are of.

Interactionism. It is easier to posit an ontology than to practice it. It is easy to point out that dividing up the academy between the natural sciences oriented toward studying the natural apart from the social, and the humanities and social sciences oriented toward studying the social apart from the natural is a stultifying idea. But despite years of efforts geared at cultivating and practicing interdisciplinarity, we seem at a loss of how to proceed. There are various reasons for this. The academy, granting agencies, publishing houses all contribute to this separation. But effective interdisciplinary research is difficult and time-consuming. As those of us who are women's studies scholars have battled to be taken seriously in institutions that do not value interdisciplinary work, perhaps it is no surprise that our scholarship has become increasingly disciplinary.

My witnessing of Katrina is a call to transform theory and practice by abandoning all traces of ontological divides between nature and culture. It is a plea to better understand our being in the world. The porosity I have asked you to attend to involves recognizing the interaction of nature-culture, genes-environment in all phenomena, not just the phenomena of sex or of race. Nature/culture is a problematic ontology—not just for the human world, but for what is, as well as what might yet be.

Attention to the porosity of phenomena provides a Copernican revolution that will serve to protect our work against the too limited choice of realism vs. social constructivism. Interactionism not only allows but compels us to speak of the biological aspects of phenomena without importing the mistaken notion that this biological component exists somehow independent of or prior to cultures and environments. It serves as witness to the materiality of the social and the agency of the natural.

Notes

* My work on this paper has been greatly enriched by very helpful comments from Stacy Alaimo, Vincent Colapietro, and Susan Hekman.

[i] The *Time* October 3, 2005 issue's cover story was "Are We Making Hurricanes Worse? The Impact of Global Warming; The Cost of Costal Development" (Kluger, 2005)

[ii] My first foray into developing this ontology concerned the sex/gender distinction, which I first attempted to trouble from an ontological perspective in 1983 in my essay "Re-Fusing Nature/Nurture." More recent versions of this ontology have been the subject of "Fleshing Gender, Sexing the Body" (1996) and of "Material Locations" (2001).

[iii] For an overview of aspects of epistemologies see my "Speculum of Ignorance" (forthcoming).

[iv] Each of these divisions, and others, have significance in different domains and in different disciplines. While a longer study would be needed to trace the similarities and divisions of these divides, at this point I can only urge the reader to consider how such divisions have functioned in different historical periods and in different contexts.

[v] In using the term "interaction" I also hope to create a bridge to the pragmatist tradition of John Dewey, for the notion of interaction was a central tenet of his thesis that logic is naturalistic, not in the sense of being *reducible* to natural objects, but as emergent from the interactions of intra-organic and extra-organic energies, where no sharp divide is created between the biological and the cultural.

[vi] Karen Barad's attention to phenomena as material-discursive is another iteration of this thesis, although she traces the genesis of her position to the work of Neils Bohr, a genealogy that helps to account for her attention to measurement in the context of scientific practice. She argues for a form of realism she labels agential realism.

[vii] Code coined this phrase in her book of the same name, *Epistemic Responsibility*, but has over the years refined and developed this concept significantly. See in particular Code 1991 and forthcoming.

[viii] NOAA reported in 2000 that ocean waters had warmed to a depth of two miles in five years. These findings were reported in *Science* (Levitus, et al. 2000). The scientists who reported these findings argued that the world ocean warming is probably caused by a combination of natural variability and human-induced effects.

[ix] Energy Information Administration, "Household Vehicles Energy Use: Latest Data and Trends" http://www.eia.doe.gov/

[x] The other two disasters were a earthquake in California and a terrorist strike in Manhattan.

[xi] "Well, I think if you look at what actually happened, I remember on Tuesday morning picking up newspapers and I saw headlines, "New Orleans Dodged The Bullet," because if you recall the storm moved to the east and then continued on and appeared to pass with considerable damage but nothing worse. It was on Tuesday that the levee--may have been overnight Monday to Tuesday--that the levee started to break. And it was midday Tuesday that I became aware of the fact that there was no possibility of plugging the gap and that essentially the lake was going to start to drain into the city. I think that second catastrophe really caught everybody by surprise. In fact, I think that's one of the reasons people didn't continue to leave after the hurricane had passed initially. So this was clearly an unprecedented catastrophe. And I think it caused a tremendous dislocation in the response effort and, in fact, in our ability to get materials to people." *Meet the Press* interview with Tim Russert, September 4, 2005. http://www.msnbc.msn.com/id/9179790/

[xii] Pickering's *The Mangle of Practice* provides a helpful model of the dance of material agency, in which agency is often, but not always human agency. His more recent work (see, for example "Asian Eels and Global Warming") extends this work to develop what he calls a posthumanist alternative to realism/social constructivism that emphasizes the coupled becomings of humanity and the environment, arguing that traditional disciplines necessarily obscure such "heterogeneous assemblages" (2005 34).

[xiii] Markowitz and Rosner point to the corruption of Louisiana's governor Huey Long as well as a series of elected officials who were convicted of felonies and a general lack of governmental oversight and potential for bribery.

[xiv] There are other potential sources of this interaction: leaching from plastics into foods when foods are stored in plastic or food is microwaved in plastic containers, groundwater contamination, eating the flesh of animals who have been exposed through their food or water, etc.

[xv] Epistemologies of ignorance are extensively developed in Tuana and Sullivan (2006) and Sullivan and Tuana (2006).

[xvi] See, for example, Amott 1993; Rank 2004; Ward 1990