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The Need for the “New Health Geography” in Epidemiologic Studies of Environment and Health

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Introduction

This narrative has its basis in my experience as a health geographer who has led a large socio-epidemiological project for the last few years. That project has by necessity taken me to the large and impressive work of epidemiologists and others who are trying to unravel the degree and manner in which social and built environments affect health. The apparent divergence between the innovative work in “social epidemiology”¹ and the “new health geography” is, in my opinion, problematic and noteworthy. At the most basic level, the differences between the two disciplines that historically have shared concerns and approaches is troublesome because the two disciplines *should* be able to inform and enhance each other. The current state of affairs suggests to me that such potential is not being realized and that we are in need of efforts to bridge the gap between what are two lively and exciting research practices.

How can social epidemiology and health geography more fully join forces, and to what ends will that joint effort, if at all possible, lead? This paper intends to take some first steps toward addressing those questions. My bias is with health geography and how it can inform social epidemiology and public health. That is the view I offer here, therefore. But I also want to stress that this argument is not intended as a critique of social epidemiology as much as a plea for what could come from the incorporation of geographic thinking—particularly thought from the cultural and critical sides of health geography—into social epidemiology, and public health more broadly. My particular goal is to illustrate the utility of several concepts from the new health geography, and geography more broadly, for the analysis of environment and health problems. A secondary goal is to consider how these concepts can complement or reshape in a positive way the typical social epidemiology approach to such problems.

The argument will proceed as follows. I first provide a short introduction to the cultural turn in health geography and then offer a brief view of the development of social epidemiology. As a part of that background for the argument, I draw upon very recent literature about the connection between culture and epidemiology that helps provide contrast and clarity for what health geography has to offer to social epidemiology. With that backdrop, I provide the core of the argument with reference to a case study through which selected concepts from health

geography are used. I use the concepts of cultural ecology, discourse materialized, political ecology, and territoriality as analytical “levers” to pry open windows on the situation in which social inequalities, risk, and health disparities are complexly interwoven with place and time. I propose that those analytical levers offer valuable insights for epidemiological approaches to health and environment. I close the paper with some reflections on what the prospects for an epidemiology infused with this sort of analysis might be.

The situations of (cultural) health geography and social epidemiology

In order to understand why it is timely to consider health geography concepts in the context of social epidemiology, a brief synopsis of both fields is warranted. Kearns and Gesler (1998) and Kearns and Moon (2002) have provided excellent analyses and summaries of the changes in what was once called medical geography that gave rise to the new health geography. Their view, with which I concur, is that the new health geography was different from the old (and still existing) medical geography in three major ways. The first was a move from spatial analysis to an analysis of place and processes of place. This often entails a strong cultural component and conceives place as a “landscape”—a term and concept central to cultural geography. Thus “therapeutic landscapes” (Gesler, 1992; Williams, 1999), and “landscapes of consumption” (Gesler & Kearns, 2002) have become central concepts through which particular health and health care situations are investigated. I would add (and will draw on later), that Wil Gesler’s early incorporation of some traditional concepts from cultural geography, such as cultural ecology and territoriality, are important albeit underutilized concepts in this vein.

The second important dimension of the shift from medical geography to health geography was the more explicit utilization of theory to make sense of data from health and place. Theorization has been pluralistic, and it seems that the specific choice of theory has been based, as in other disciplines, on the theory’s relevance to the subject matter as well as personal inclinations and what is in vogue. Indeed, theoretical orientations continue to be widely divergent in what is a small cohort of researchers. The third outstanding dimension of health geography is a tendency toward a critical view of health disparities, systematic inequalities related to those disparities, and the forces that shape or cause them. Not unlike the move in public health toward population health and the concern for upstream factors that affect well-being (e.g., McKinlay, 1993), many health geographers have borrowed from critical theory to provide insights into the way people and places are negatively affected by larger scale forces, such as state apparatuses and global firms.²

Although there are medical geographers who still usefully employ more positivistic approaches to problems, health geography in this sense is predicated on place processes and does not focus on generalizability. It employs a wide range of theoretical frameworks and deals with nuanced concepts with which to approach and to interpret its subject matter. This often entails qualitative methods or mixed methods research designs. As such, health geographers have moved further away from their cousins in social epidemiology. This departure from mainstream health science research, while exciting to those of us practicing health geography, *may* also be dangerous. I say dangerous because we risk further detachment from, and irrelevance to, our larger and more well-funded and respected cousins and the rest of the health sciences. How might health

¹As Nancy Krieger (2001) has argued, all epidemiology is inherently social and used to be recognized as such. Her definition of the term “social epidemiology,” however, is “explicitly investigating social determinants of population distributions of health, disease and well-being.” I am using social epidemiology even more broadly here to include epidemiological research on environmental health problems that are also concerned, if only secondarily, with some form of social determinant, issue, measurement, or analysis. And although social epidemiology research often includes researchers of various backgrounds, it is my view that traditional perspectives and methods from public health still dominate the field.

geography maintain the cultural turn and yet connect with and contribute to epidemiology? A brief look at social epidemiology, and recent discourse in epidemiology more broadly, provide some early clues.

Social epidemiology emerged as a distinct field during the last few decades. Major motivators were stress research, a return to ecological thinking in epidemiology, and the emergence of the “population health” movement of the 1990s (Berkman & Kawachi, 2000). The concerns of social epidemiology, as its name and background suggest, are social phenomena that influence health inequalities in populations. The social phenomena of interest vary, but socioeconomic stratification, social capital, social networks, discrimination, and segregation are commonly investigated; but the conceptual and methodological approaches remain those of epidemiology. As Berkman and Kawachi (2000) suggest, the boundaries between social epidemiology and other types, such as environmental epidemiology, are often fuzzy, as the case study that follows helps to illustrate. Social epidemiologists have drawn on concepts and techniques that implicate the geographic concepts of space and place, and they have begun to use geographic information systems (GIS) in earnest. Moreover, the increasing importance of the concept of neighborhoods in social epidemiology (Kawachi & Berkman, 2002) implies that its subject matter is thoroughly geographic in nature even if it is not overtly conceptualized as such.

The findings in the now burgeoning literature of social epidemiology are unsurprisingly mixed. Yet the weight of the evidence is that places, and so-called neighborhoods in particular, do matter in the health outcomes of a broad array of populations (Sampson, Morenoff, & Gannon-Rowley, 2002). The increasing sophistication of designs, methods, and analytical strategies are leading to refinements of understanding, but the corresponding incremental outputs appear to be relatively small. Whether it is simply too early in the life social epidemiology or the case of diminishing returns under the current regime, there are several aspects of this social epidemiological research that are problematic from a health geography perspective. One is that while social epidemiology provides support for the role of place in health, and thereby the role of health geography as a discipline, social epidemiology does not typically conceptualize or theorize place with any rigor.³ There is too little engagement on the part of epidemiologists with the geography literature on place and health. Second, and related to the first problem, social epidemiology researchers still believe that generalizability of findings can be developed through proper research design; in contrast, geographers emphasize the place-dependent nature of their findings. Third, the issue of culture and *its manifestation on the ground* is still a mostly alien notion for epidemiology. This final point needs additional elaboration.

A recent article and series of responses in the *International Journal of Epidemiology* provides a vista both into the state of social epidemiology vis-à-vis culture and into the potential linkage between health geography and social epidemiology. The central argument in the series (Eckersley, 2006) concludes that epidemiology has neglected culture in the sense of how culture shapes values in a society that in turn define relationships, meaning, and well-being. Instead, Eckersley suggests, epidemiology has been content to view culture primarily in terms of ethnic or racial differences that indicate a dimension of socioeconomic status. Commenting on Eckersley and largely sympathetic to his argument, Glass (2006) offers a plausible explanation for the lack of cultural analysis in epidemiology. Glass suggests that culture and cultural analysis are incommensurable with cause and effect models in epidemiology. He notes one reason is that culture is like software because it exists symbolically in the heads of people and influences cognition and behavior. Glass also contends that culture is a process at the

²For good overviews and examples of this literature, see Jones and Moon (1987), Kearns and Gesler (1998), and Curtis (2004).

societal level that also affects individuals differentially as they have different cultural experiences; this notion creates great problems for traditional epidemiological thinking: “The counter-factual model of causation poses insurmountable obstacles for thinking of culture in any causal sense” (2006, p. 260). And Glass adds an important conclusion at the end of his paper:

More importantly, social epidemiologists will be required to abandon either/or explanatory frameworks when considering the role of cultural factors relative to material deprivation. Envisioning how culture and material conditions interact synergistically will prove difficult for epidemiology, but may yield significant improvements in our ability to account for population patterns of health (Glass, 2006, p. 261).

This very recent acknowledgement in epidemiology has significance for health geography and for improved understanding of environment (writ broadly) and health. First, the move toward culture in epidemiology narrows the gap between health geography and epidemiology. A new common language may be forming through which geographers, with their more developed understanding of culture and health, can contribute to the epidemiological discourse. Second, geographers know well that culture is not just software operating in the heads of individuals but that the cultural is written on the landscape and that the landscape reflexively affects people. The cultural geography embedded in the new health geography and in the larger discipline has much to offer to the epidemiological view of culture as it relates to health and well-being. Third, health geography is already using modes of analysis beyond the either/or explanatory frameworks. Analysis in health geography could be a model for a new type of epidemiological analysis that wants to take culture and its material manifestation in places seriously. I now turn to a case study in which to suggest how the epidemiological can become the geographical, and visa-versa.

A case study of how the new health geography can enhance epidemiology

The Texas City Study

Texas City, Texas is distinct for its multi-ethnic community (of approximately 50,000) and its large complex of petrochemical plants (see Figures 1 and 2). The broad goal of a study undertaken by colleagues and myself was to discover how a stress response—created by the petrochemical industry and other stressors—worked its way through the neighborhoods, lives, and bodies of citizens in Texas City to affect health. The project uses a social epidemiology design that pays close attention to status, social ecology, and social relationships as potential health determinants. In addition, the environment, particularly the petrochemical production that posed risks to those living in the city, was a central component of the analysis. The study was planned to build on the approach to technological hazards developed by geographers at McMaster University (e.g., Elliott et al., 1993; Luginaah et al., 2000).

What I will discuss below is a selected set of health geography approaches that could be applied to Texas City (and similar cases). Because of the desire to provide some scope to what a health geography approach can add to epidemiology and public/population health studies, I must paint each view with broad strokes. Hopefully enough of an image will appear to allow one to begin to understand what and how these conceptually-driven descriptions and analyses can complement and enhance more positivistic, public health approaches. Although I will have more to say in the conclusion about the meaning and role of these conceptual views of the Texas City stress and health situation, I suggest that at the very least we consider the health

³The work of Macintyre and colleagues (Mcintyre & Ellaway, 2000; McIntyre & Ellaway, 2003; McIntyre, Ellaway, & Cummins, 2002) is an exception to this rule. It should be noted, however, that their analysis of place is distinct from that presented here because it does not consider critical, landscape dimensions.

geography conceptualization as providing a much needed context for interpreting epidemiologic data and findings.

Cultural ecology and discourse materialized

The new health geography, that which is informed by cultural geography concepts, owes more to Wil Gesler than any other scholar. It was in his important book *The Cultural Geography of Health Care* (Gesler, 1991) that he suggested the use of cultural ecology as one of several frameworks for thinking anew about health and health care problems. To explain the utility of cultural ecology, Gesler drew on traditional cultural geography's notions of culture and environment interaction. He stressed that the interaction was bidirectional in that humans shaped their environments in order to survive and flourish, but they also needed to adapt and adjust to environmental changes in order to try and establish a balance in the relationship. Although Gesler was writing about health care, his ideas may be applied to environmental health and well-being.

It is also important to add another dimension to Gesler's approach. Cultural geography has evolved since Gesler's initial efforts, and additional understandings of the manifestation of cultural ecology—the *cultural landscape*—have emerged, and I believe Richard Schein's (1997) work is particularly important. In brief, Schein argues that while the traditional view of how culture becomes material through the landscape—that the landscape can be read as an empirical source of information about a local or broader culture in a positivist sense—is useful but problematic. The landscape provides evidence for understanding place and culture, but it does so by providing a materialized discourse between varying interests, groups, agents, and other sources of power that have written and over-written the landscape like a palimpsest. This idea of cultural landscape as *discourse materialized* is important because it combines dynamism of the culture and place relationship with a critical view of power within it. And as we shall see, power becomes important to the story of Texas City and well-being.

Several dimensions of the Texas City landscape are revealing about the environment and health relationship. The first dimension reveals the legacy of tragedy, resilience, and ongoing vulnerability of a community that abuts a large petrochemical complex and its port. On April 16, 1947, a ship loaded with ammonium nitrate fertilizer caught fire and exploded in the Texas City harbor, setting off fires and explosions throughout the refineries, and the city. Approximately 600 people perished and more than 3000 were injured, and a large portion of the city was damaged or destroyed. The memory of that terrible event is inscribed on the landscape in various parks and monuments in town (Figure 3). While the petrochemical plants were not the cause of the accident itself, the explosion, subsequent fires and toxic releases from the plants associated the petrochemical industries with the disaster. Even though the city rebuilt and encouraged the reconstruction of the port and petrochemical plants, the memory is written on the landscape.

The interpretation of the various monuments and memorials must be a diverse one.⁴ Naturally, part of the discourse is overtly one of honor for those who died in the tragic accident. Noticeable on the monuments are the names of many Mexican-Americans who were killed, but African-Americans also died as did non-Hispanic whites. Every year on the anniversary of the explosion, a remembrance event is held in the memorial park. But in addition to the role of honoring the dead, the monuments scattered around town, such as an anchor that was blown over a mile by the blast, serve to state the resilience of the town's population in the face of the

⁴ Foote (2003) provides an excellent analysis of the variety, meanings, and uses of such sites with a particular focus on American places that memorialize (or obliterate the memory) of tragedy and violence on the landscape.

horror and destruction. The monuments also suggest how enterprising the town was to come back from such a setback. Although the health aspects of Texas City's cultural ecology can be questioned, the ability to rebound and re-establish equilibrium after such a tragedy is notable. Yet another interpretation is plausible: "those who remain here are still at risk." This interpretation is plausible because periodic "upsets" (unintentional releases of toxic emissions) and explosions have occurred many times since 1947. This more sinister aspect of the discourse also is echoed in the following sections on political ecology and territoriality.

The symbolism inherent in the monuments to historical events also is present in different form and with different meaning in a more mundane yet interesting dimension of the Texas City cultural landscape. The dimension of what I will term "pride and denial" is evident in different contexts. On a city water tank, we read of the two reasons to be proud of Texas City: its All-American City status and the High School football championship. This form of boosterism is often used to sell a place to outsiders, but it also serves to lift up local spirits and build support of local initiatives. In a Texas municipality of approximately 50,000, high school football is an important source of local pride and esteem. At the same time, however, these positive statements appear to encourage residents to ignore, or deny, the blight and danger of the petrochemical plants. They selectively state the positive, but they also reflect the status of their mostly non-Hispanic white and less-exposed neighborhoods. These statements on the landscape are repeated in various forms, such as the welcome sign placed in front of a refinery as you drive into town from the south (Figure 4). One way to read this euphemistic discourse in this example, particularly the "by the bay" statement and the image of a sailboat on blue water at sunset, is: "even though the landscape you see around you at this point looks dangerous and ugly, our city has a lot to offer, including recreation and nature." One cannot help but be initially overwhelmed by the petrochemical sights, sounds, and smells as you pass the sign on that route into the city.

State and national symbolism also is prevalent throughout the city particularly in the form of flags. There is a strong strain of conservatism in Texas City that helps to explain this part of the cultural landscape. Part of that conservatism is an active and vocal support of the petrochemical industry, particularly among the non-Hispanic white population. A more critical reading, however, could be used to suggest that the petrochemical infrastructure that accompanies many views in Texas City is one that citizens are meant to feel pride about because the town is playing a vital role in the U.S. economy. By keeping the country supplied with petrochemical products, the city is aligned with the federal and state values of the status quo.

The discourse materialized in Texas City also speaks to minority populations and their relationship to the environmental hazards of the oil industry. While the positive symbols of local esteem, boosterism, and identity are located in more predominantly non-Hispanic white parts of town, the sections of Texas City with more African-American and Hispanic residents display a notably different cultural landscape; indeed, there are multiple cultural ecologies in this place. Texas City is a southern city and African-Americans once faced segregation into neighborhoods south of Texas Avenue and near the petrochemical plants (personal communication with city official and residents). The pattern of residential segregation is still apparent in the landscape of neighborhoods bordering the northern fence-line of the industrial complex. Here, there is less power to inscribe the landscape with meaning. Nonetheless, one can find symbols representing African-American heroes that children at this school can admire and be inspired by (Figure 5). But other views of the landscape from these neighborhoods in the shadows of the refineries (Figure 6) bring the poverty and proximity to the plants into stark contrast with both the symbols of African-American success on the school and with the symbols of denial and relative affluence in the neighborhoods in the northern part of the city. My visits to the southernmost part of Texas City, near the plants, offered observational evidence that

African-Americans suffer the burden of poverty more than other racial/ethnic groups. In comparison to the mode of typical social epidemiological assessment of poverty (e.g., census data), landscape analysis offers a more tangible, material understanding of daily life and the experience of poverty and human suffering.

The strong Hispanic presence in Texas City (approximately 25% of the population is Hispanic) also is apparent on the landscape but is less geographically circumscribed than that of African-Americans. There are two reasons why the Hispanic cultural landscape is not as well associated with a zone in the city. First, the old Hispanic barrio in Texas City that bordered the petrochemical plants in the southeast corner of town was destroyed in the 1947 disaster (Aulds, 2006). This segregated but cohesive neighborhood once created a distinct Hispanic cultural zone replete with ethnic food, cultural activities, and Spanish-language religious services. After the disaster, Hispanic residents moved into other parts of the city. Second, Hispanics in Texas City are less segregated because their average income is higher than that of African-Americans. Hispanics can afford to buy or rent in different areas of the city.

Yet the Hispanic cultural landscape, especially that tied to the more recently immigrated population, exists in churches as well as food stores, taquerias (informal Mexican eatery), and night clubs. These symbols of Hispanic culture tend to be clustered in the lower rent areas closer to the plants because the immigrant population is poorer than more established Hispanic families. In more integrated neighborhoods, the distinct Hispanic presence is inscribed on the landscape through more personal additions to the landscape such as statues of the Virgin Mary, Mexican art, and other symbols of Latino culture on homes and lawns. The Hispanic cultural landscape can be viewed, therefore, as somewhat bifurcated between the less integrated and poorer immigrant group of Hispanics, and the more established and integrated Hispanics with several generations of history in Texas City. This means that the risk exposure of Hispanics, and their resources to contend with it, will vary more than that of African-Americans.

Based solely on the context as understood through the cultural ecology perspective and augmented by the viewpoint of discourse materialized, we can begin to more clearly understand why and how differences in health or well-being would exist among these three racial/ethnic groups. Our survey evidence on differences in living environments, perceptions of neighborhood quality, concern about health risks associated with the petrochemical plants, and perceived stress align with the story revealed through a cultural ecology and discourse materialized approach. Processes of cultural ecology and power exemplified in discourse materialized in the landscape have led to a remarkable patterning of the three ethnic groups into distinct environments. Non-Hispanic whites live in areas which were objectively rated by project staff as higher quality. Hispanics ("Latino" in US Census parlance) live in worse neighborhoods but ones that are better in quality than those in which African-Americans tend to live. The resident perceptions of those environmental qualities correspond with the objective data. Concern about health risks associated with the plants and overall perceived stress scores show a similar gradient across the three groups where non-Hispanic whites have less concern and stress, Hispanics more, and African-Americans the most. The differences in the cultural landscapes associated with each group and the gradients of objective and subjective environmental ratings lead me to conclude that the processes of cultural ecology and discourse materialized provide additional, important layers of understanding about how the health of Texas City residents is shaped beyond that of statistical and textual inferences. As mentioned above, they extend our understanding of human experience by adding a material understanding of the role of place—and place dynamics—in health and illness processes.

Political ecology and territoriality

The political ecology of health is not a new idea in the social sciences. Medical anthropologists developed the concept (Turshen, 1977), and health geography followed medical anthropology, but social epidemiology has been more of a laggard in its use. The most recognized view of political ecology in health geography argues that it takes the traditional concerns of an ecological view and extends them with a political economy perspective to search for structures, agendas, or agents that shape environments and health risk for populations (Mayer, 1996). A medical anthropologist, Harper (2004), argues that a political ecology perspective should also include a bottom-up understanding of how human health and culture in turn shape interactions with the environment. Harper adds that biomedical, epidemiological, and public health approaches to environmental health problems will fail if they do not confront the perpetuation of structural inequalities and power relations that lie at the root of cultural practices and health processes.

This additional infusion of a concern for power into the place and health equation brings another dimension to understanding the risk and health context of Texas City. Indeed, some of the dynamics of the political ecology of our case have been alluded to above. Racial segregation and injustice is one example of how the white community dominated (and still dominates) the local society and economy. The fact that inexpensive housing exists (and always existed) in close proximity to the plants (and to associated risks) put plant operators' concerns for a proximate labor pool above the health concerns of those workers.

Because the petrochemical industry is the largest economic and political agent in Texas City, the top-down, structural forces are more readily apparent to the health situation of residents. A series of political maneuvers and non-actions have helped the oil industry in Texas City and elsewhere in Texas and the US retain power vis-à-vis environmental health policies and activists. At the federal level, the United States Environmental Protection Agency (USEPA) oversight and state-level enforcement of the Clean Air Act is very poor (Coequyt, Wiles, & Campbell, 1999). The Bush administration has been particularly protective of the oil industry's opposition to regulation, but not of the environmental health of those exposed to petrochemical risks. In addition to industry representation and influence at key levels of the federal government and regulatory agencies (Coequyt, Wiles, & Campbell, 1999), industry representatives exert power on and through important Texas regulatory commissions (Harper, 2004). The most important consequence for our concern here, environmental health, is lack of incentive for the petrochemical industry to reduce emissions, and similarly, small penalties for excessive emissions or accidents (Galveston-Houston Association for Smog Prevention, 2005). The largest polluters in the state are refineries, and among the top 10 Texas polluters are three refineries in Texas City (U.S. Environmental Protection Agency, 2002). Larger releases of toxic chemicals happen during "accidental" events called "upsets", and few of the violations are investigated and fewer still result in fines (Cappiello, 2004). A Texas City resident said that such accidents occur mostly at night (as if to conceal the event) and when he has contacted the refineries about the situation "...they give you the runaround. They will tell you it's under control or blame another plant" (Cappiello, 2004).

One way to extend the understanding of political ecology is to use Cox's (1997) conceptualization of the politics of spaces and scales. Cox distinguishes between "spaces of dependence" and "spaces of engagement" in local politics. The former denotes the mostly localized social relations that "define place-specific conditions for our material well being and our sense of significance" (Cox, 1997, p. 2). Spaces of engagement are those "in which the politics of securing a space of dependence unfolds" (Cox, 1997, p. 2). The spaces at which a local political ecology (or space of dependence) unfolds is the local scale, and larger jurisdictional areas affected by political institutions are regional, state, or national scales. When

political action “jumps scales” to include entities at geographic scales larger than the local, spaces of engagement become defined by networks formed by the spatial distribution of entities involved. The space through and over which political action occurs—for example, actions intended to create healthier ecologies—is a network space that brings political actors at the different scales (and jurisdictions) together. Using the example of petrochemical regulation above, the oil companies can be seen as wielding superior power through spaces of engagement that have potentially deleterious health outcomes for the local scale (space of dependence) that is Texas City. The companies have leverage at various scales and can coordinate that leverage across scales through the spaces of engagement on the issue of petrochemical production and health. This conceptualization becomes useful for the remaining analysis as well.

At the local scale, the prominence of the oil companies means income for Texas City and for its residents. One sees unambiguous symbols of the intricate relationship between the petrochemical firms and the city in forms such as the British Petroleum (BP) emblem on the high school marquis or recognition of the petrochemical companies’ donations at parks and memorials. These signs and symbols tend to build goodwill in that they promote a sense of partnership between community and the multinational firms. Texas City residents also are aware of the fact that their property taxes are low because the petrochemical firms pay \$75 million a year in local taxes (Bloomberg News, 2006). The development of goodwill through such actions can be interpreted in a number of ways. When refiners pay local taxes it helps to counter negative opinions of their plants in Texas City. That goodwill seems to work in two ways to the companies’ benefit. One is the way in which enough citizens forgive the transgressions of plants by recognizing the benefits that come with them. I have no evidence for this cost-benefit calculus other than from casual conversation with residents, but the Chamber of Commerce and others try to influence residents’ views with statements such as, “The petrochemical industry has been very kind to Texas City” (Bloomberg News, 2006). The other mechanism at work is the generation of support of the industry from local government through financial contributions to the community. Tax funds contributed by local petrochemical producers appear to eliminate the burden of funding city operations from local politicians and administrators. Moreover, the relationship can work to reduce any potential pressure for safety and health concerns and at the same time protect the companies’ from related expenses. This arrangement is a classic example of political and economic power overtaking the concerns of public health and well-being. Petrochemical producers use a complex space of engagement for political and economic gain, but efforts at the local scale appears critically important to understanding related health risks.

The community’s health risk and that risk’s connections to global firms and the global economy were brought into focus when a large and fatal explosion occurred at the BP refinery in Texas City in March 2005. Fifteen workers were killed and another 170 injured in the blast. Moreover, tens of thousands of pounds of hazardous chemicals were released into the atmosphere subsequent to the blast, including benzene, heptane, and hexane (Texas Natural Resources Conservation Commission, 2006). While BP blamed plant staff for the accident, later investigations revealed that a number of accidents, including the fatal one, were due to inadequate maintenance and inadequate attention to safety (Neal R. Gross & Co., 2005). Indeed, BP was cited after the blast for approximately 300 willful violations of Occupational Safety and Health Administration (OSHA) standards (Belli, 2006). During the same period, the BP refinery in Texas City was among the largest producers of gasoline in the US, and in 2004 it earned the distinction of being the worst polluting refinery in the country (Cappiello, 2006). Although BP faced \$21 million in fines related to the 2005 tragedy, the fine is small for a massive global firm. In addition to lax safety and health standards and underreporting of emissions, BP has joined with other oil companies to fund a multi-million dollar study to counter claims that benzene is a carcinogen (Cappiello, 2005).

In a public meeting to discuss the findings of the US Chemical Safety and Hazard Investigation Board (CSB) report on the 2005 explosion, the political ecology of Texas City's risk, including the spaces of engagement in petrochemical politics, were apparent.⁵ Texas City mayor Matthew Doyle commented positively on how BP had responded so quickly to the tragedy although one wonders what else the company would do. He also noted that it was important that James Baker (the former US Secretary of State with close ties to the oil industry) would head a blue ribbon committee to investigate the matter. While no one at the meeting questioned the appropriateness of Baker's role, brief connections to the power and global leverage of BP were made. Mike Wright, a Steelworkers Union representative criticized the BP management for blaming six low-level BP employees for the blast and then firing them. Wright stated, "If those six individuals deserved to be fired, then so do the several thousand other people in the corporation, beginning at the very top in London." The global web of power that is created by global firms and tacitly or overtly protected by political agents puts residents who live in the shadow of the economic activity at risk, and it also makes them feel relatively powerless to do much about it. A long-time resident who spoke at the CSB meeting, Harry Phillip, shared his frustration and explains the ongoing burden that those living in Texas City undergo.

They [refiners] say their flares [large towers that burn off excess combustibles from petrochemical processing]...can prevent accidents. Well, they sure do make a lot of noise, and I call the police and say they are disturbing the peace by having those flares rumbling and all that noise. And I can't even understand why BP...why they're not even listed in the phone book. Can you answer that? ...my cyclone fence is all rusted from the chemical pollution. A lot of times the pollution is so bad, I have to turn the air conditioner off because of the smell that comes from the refineries. Maybe it's BP, maybe it's Marathon, maybe it's Texas City refinery [referring to the multiple refineries].

Phillip's comments suggest real stress and health issues from the petrochemical plants that he recognizes as such. Yet his obvious frustration is associated with his perceived powerlessness to do much about the situation. Indeed, our epidemiological survey findings show that residents feel they have little control over the risks posed by the plants. Individual citizens—particularly those who are poorer and less educated—have much fewer resources to enter spaces of engagement beyond their local community to contest petrochemical companies' actions. And as far as I know, there is no active group in Texas City that is working in those spaces to diminish health risks. The oil companies control the relationship with residents, and they thereby dominate the shaping of the health landscape. The firms use power generated in economic operations, and in political spaces of engagement, at different geographic scales—state, national, global—to minimize operation restrictions and maximize output in locations such as Texas City.

This landscape of power that the political ecology of health reveals can also be viewed somewhat distinctly thru the concept of territoriality. Territoriality refers to "a spatial strategy to affect, influence and control resources and people, by controlling area" (Sack, 1986: 1). More specifically, territoriality is "a strategy to establish different degrees of access to people, things, and relationships" and is a "primary geographical expression of social power" (Sack, 1986: 5, 20). Gesler (1991) suggested that the concept had currency for health geography, but to date, there has been little use of it (for one exception, see Cutchin, 2002). I propose that it has utility for understanding the risk and health of populations in Texas City beyond that of what I have already mentioned. It plays an intriguing role in the shaping of risk for both citizens and the petrochemical corporations that operate in Texas City.

⁵A transcript of the meeting was produced by Neal R. Gross & Co. (2005).

Part of the evidence provided above also has territorial dimensions. The fact that minorities, particularly African-American residents, are clustered in a zone closest to the complex of refineries and other chemical processing plants in Texas City is based in more than historical segregation patterns of the 20th century. The land near the plants has always been less desirable because of the noise, smells, and perceptions of risk. When public housing was developed in communities with refineries in decades past, they were frequently constructed on property in those zones near the factory fence lines (Timms, 2000). Not only are property values cheaper there, but such housing has always maintained a stigma that creates a NIMBY (not in my back yard) reaction by more affluent populations (Dear, 1992). Consequently, territorial control of existing neighborhoods relatively distant from the factories had the effect of exclusion of public housing and their eventual location in zones of higher risk and stress. More affluent (typically non-Hispanic white) residents' power to say "mine, not yours" about their neighborhoods is an important element in the story of who becomes more exposed to local health threats and who does not.

A curious dynamic becomes apparent, however, when one examines the territorial behavior of the petrochemical companies in Texas City. Closer examination of the aerial image of the city shows various areas of green space directly north of the petrochemical complex (Figure 7). The green spaces are vestiges of neighborhoods and commercial property that have been abandoned or purchased by the oil companies. From ground level, one can see the evidence as well (Figure 8). The cause of this somewhat eerie landscape is a decades-long effort by the companies to control the space around them and create a buffer zone (personal communication with a city official). For many years, they have been buying residential and commercial property in the neighborhoods that border the plant, ostensibly to create a safer distance between residents and the chemical plants. The symbolism of power and control is apparent when the companies' purchase of a home is made (Figure 9). Typically the property is marked, potential trespassers warned, and the home is razed (Figure 10). The territory reverts to green space with the ghostly trace of streets once populated. This territorial control and depopulation protects citizens who once lived there, and it also reduces the risk to petrochemical producers by lawsuits from those claiming harm from emissions or accidents. This form of territoriality in Texas City appears to be a behavior that would be welcomed by all.

This part of the story is not so straightforward, however. Residents in public housing are not involved in this process and are for all intents and purposes trapped in place. Landlords are unlikely to sell valuable income property in this risky zone. Some residents do not have the resources to leave the area even though they would like to. A woman who lives in public housing near the plants in Texas City told a reporter, "I pray I can give this up. I want to move out of Texas City" (Timms, 2000). Other residents, particularly older adults, seem to be too attached to their place to leave.⁶ Others deny that risk exists, and they suggest they are habituated to the plants.⁷ The conclusion I see worthy of noting about these situations is that a continual and often conflicting dynamic of territorial power between the petrochemical companies and residents takes place in Texas City, and the outcomes of the process appear to affect the risk and health of residents who have fewer resources and options.

As a final note on political ecology and territoriality, the plants have heightened their surveillance of people and activity in the blocks bordering the petrochemical complex. While I was taking photographs recently in Texas City, I was observed and then followed by a civilian

⁶Rowles' (1983) research on older adults in an Appalachian community is suggestive of how and why this process of attachment outweighs other rational reasons to move.

plant security guard. As I moved by car out of the zone near the plants to take other photographs, the plant agent followed me and communicated to his base via radio. He shadowed me for about 15 minutes until I drove toward the north side of the city. The petrochemical companies most certainly fear terrorism and the loss of assets that terrorism threatens, and as a result they seek extended control of the public space beyond their land. Such behavior must invoke fear in some residents; this form of power may have stress and health consequences for residents, as well as affects on their political resistance to petrochemical plants, that we do not yet understand.

Conclusions

As I proposed earlier, a potential way of thinking about how the new health geography can inform epidemiological approaches to social and environmental health problems is to consider how it develops an understanding of context so often lacking epidemiology. Although I have not relied on the concept of “therapeutic landscape” that has been implemented to assess place and environmental health (e.g., Wakefield and McMullen, 2005), I have suggested other concepts that have been much less often employed in such research. Moreover, I have attempted to articulate and provide examples for how the processes described by those concepts play an important role in the place and health experience in a multi-ethnic community in the shadow of one of the largest collection of petrochemical industries in North America. The concepts from health geography enable a good view of context because they bring a more holistic perspective of place and process on the question of patterns of health. Their use also illustrates a way to collect information about place and landscape and then interpret how the processes that create and re-create them create the situation that an epidemiologist typically investigates. Although the concepts require an epistemological shift for epidemiologists, the processes they illustrate provide a *better explanation of underlying causes* for the patterns and associations discovered in epidemiological analyses. Indeed, these types of health geography analyses provide the backdrop upon which the statistical results of epidemiological work can be most fully understood. Moreover, the techniques of data collection and analysis are efficient and inexpensive. Without the insights created through the use of such geographic concepts and approaches, statistical associations derived from social epidemiological inquiry cannot be properly connected with the daily, material life of people and place. The geographic perspective can produce an enhanced view that leads to policies with greater health impact.

To be fair, I note that public health has a long tradition of analysis that includes the political as well as social injustice and inequality, and that tradition appears to be in revival (Hofrichter, 2003). Moreover, public health research attention to the physical and mental health consequences of built environments has grown tremendously of late (Frumkin, 2005; Galea et al., 2005). Now, as epidemiology begins a more serious discussion of how it might incorporate a more sophisticated view of context via culture, it should also begin to consider the material (vs. “software”) expression of culture— cultural landscapes. What the new health geography offers is a set of concepts and analytical approaches that unite the concerns for the political, economic, built environment and cultural dimensions of health. Cultural landscapes are created and evolve in the ongoing transactions among cultures and places that tell us about significances, values, and changes in people’s relationship with place. *Landscapes are not only a reflection of the qualities of life in a particular geographical setting, but they provide evidence of the interplay of values and power from various geographic scales in that setting as a discourse materialized.*

⁷Risk perception is a complex subject that cannot be addressed here. See Slovic (2000) for an excellent collection of papers on the different explanations for variation in risk perception among different population subgroups.

While some processes of cultural landscape production in Texas City may be generalizable, others will not. How each landscape can be more critically evaluated as a discourse of power is an important element of such analysis. In Texas City, the lines of power work in a variety of ways to continually shape the ongoing risk residents (differentially) face. As I have tried to illustrate, elements of cultural ecology, landscape, and discourse are key parts of the risk and health story, but ones that a social epidemiologist would likely omit. Likewise, the political ecology of health in Texas City is a case of how economic power can have direct and indirect influence on environments and environmental exposure. Territoriality is a more clearly geographical manifestation of how that power is used for political and economic ends—as well as an influence on others' health. The patterns of environmental change and risk can be understood more clearly through the implementation of these views.

It is more difficult to assess whether social epidemiologists will implement such concepts in their research projects. Susan DiGiacomo (1999) was less than enthusiastic about the potential to fuse cultural anthropology and epidemiology. She argues that without joint research design that fully involves medical anthropologists, the research questions and epistemologies of the two disciplines would remain too far apart. In her view, epidemiologists have to be willing to meet half-way and take social science perspectives seriously. I suggest that the funding agencies' preference for quantitative data and traditional epidemiological methods provide an additional difficulty but one that may be lessening.

Nonetheless, I prefer to be optimistic about a social or environmental epidemiology infused with the greater depth that health geographic concepts offer. Besides the advantage of a more fully developed context for the interpretation of statistical results, what would be the benefits? First, the use of geographic concepts like the ones I have used here lessens the reliance on reductionism in traditional epidemiologic approaches to health disparities. Instead of a risk factor approach where effects are to be isolated, epidemiology could begin to view risk factors as part and parcel of larger, more complex place processes, and that is a maneuver that goes beyond establishing context. As Glass (2006) contends, escaping the reductionist science of epidemiologic orthodoxy will be difficult. If epidemiologists could be persuaded that health geography produces a more holistic account of environment and health processes that is essential, then we might be able to test, beyond Texas City, whether Glass' hope "to yield significant improvements in our ability to account for population patterns of health" can be realized through the use of different, non-reductionist approaches similar to those produced here. The epistemological differences suggest a gulf, however, over which epidemiologists must be willing to help build a bridge.

A related implication of an epidemiology integrated with health geography is better theory that can be generated about how and why people in particular places experience particular environmental health issues. The lack of theory in public health research has been an issue of concern for over a decade (Krieger, 1994), but I believe it fair to say that it remains missing for the most part in epidemiological work. This is not really surprising, for epidemiology's roots are empiricist. As social epidemiology begins to more fully encounter the complex world of human lives, cultures, and places, it must develop relevant theory about associated patterns and relationships. A good way to begin theorizing is through the conceptual bases (and their underlying literatures) offered here.

As I allude to above, a third potential consequence of a health geography-infused social epidemiology would be more appropriate and context-dependent interventions. By creating a more thorough understanding of local cultures and the organizations (local and global) which exert power through those cultures and shape environmental health, epidemiologists and health geographers could more effectively target locally-relevant "upstream" interventions that might

be more effective than current ones. The implications for Texas City are that environmental risk and health interventions should begin with institutional and corporate changes and concomitant changes in power relationships among groups in the city. This would mean, in part, understanding the spaces of political engagement that affect the health risk of residents. This is of course a significant challenge, but the reductionism of traditional epidemiological approaches leads to reductionist interventions that do not affect root causes.

The side of the Texas City study that I have presented here speaks loudly for the importance of pluralism in studies of environment and health. That pluralism means the opening of the dominant approach of epidemiology to other perspectives. As I remarked at the beginning, social epidemiologists have added much to the current state of knowledge. My central point has been that we need to create a pluralism of perspective, concepts, and methods for investigating the complexity of human-place transactions where a “risk factor” approach does not do justice to that complexity. Health geography is only one part of that pluralistic vision, but it could be an important one.

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Figure 1.
Texas City study area

Figure 2.
View of Texas City study area (north) and petrochemical complex (grey area to the south).

Figure 3.
Memorial Park in Texas City where the 1947 disaster is remembered.

Figure 4.
An attempt to counter the industrial landscape that greets those entering Texas City.

Figure 5.
Mural on an old school in a predominantly African-American neighborhood near the petrochemical plants.

Figure 6.
It is not an exaggeration to say that some live in the shadow of the petrochemical plants.

Figure 7.
Some areas adjacent to the industrial complex have been purchased by the petrochemical firms in an effort to create a buffer zone.

Figure 8.
Once occupied but now vacant land near the refineries.

Figure 9.
Property purchased and territorially marked by BP.

Figure 10. Former property of a survey respondent; the house was razed sometime after the interview was conducted.