

VIEWPOINTS

## *Mapping Women's Worlds: knowledge, power and the bounds of GIS*

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Feminist geography and geographic information systems (GIS) have been two of the most dynamic research areas in geography over the past decade. They have opened up new methodologies and epistemologies, challenged fundamental research categories, and charted new areas of geographical inquiry. For the most part, however, these two fields have remained stubbornly apart—unconnected, uncommunicative, and directing geography in divergent directions. This article, like the others in this collection, explores the connections between feminist geography and GIS, identifying how each can enrich and inform the other. The discussion reflects my background as a feminist with expertise in GIS and quantitative methodologies and several years' experience in using GIS in the health arena. To set the stage for the discussion, I begin with a brief 'story' (case study) describing the role of GIS in women's activism concerning breast cancer in Long Island, New York. Subsequent sections review the key elements of feminist and GIS epistemologies and then discuss the challenges of integrating the reflexive methodologies of feminism with the more static, layer-based approaches of GIS. Key issues of knowledge, context and power are examined.

### **A Story**

The story begins in the late 1980s in suburban Long Island, New York, where concern was emerging about high rates of breast cancer. Women saw breast cancer in themselves, friends and family, and sensed a breast cancer 'problem' in their communities. They were worried about environmental causes—agricultural chemicals that might have contaminated soil or drinking water, electromagnetic fields from overhead power lines, and hazardous wastes from industrial sites. Small groups of women began meeting to discuss what to do. Their first step was to contact the State Health Department, but the response was unsatisfactory. Drawing upon county-level breast cancer statistics, the state cited genetic factors, high-fat diet and socio-economic characteristics as the primary risk factors for breast cancer on Long Island (Long Island Breast Cancer Action Coalition, 2001).

At this point, the women began to take matters into their own hands. Community-based breast cancer coalitions were formed. In some communities, women prepared door-to-door surveys asking residents if they or other household members had been diagnosed with breast cancer and about potential risk factors, length of residence, and

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socio-demographic characteristics. The women created 'pin maps' to depict detailed geographic variation and examine spatial clustering. Recognizing the limitations of pin maps, one community coalition asked my research group at Hunter College to put the survey information into a GIS for mapping and analysis. We used the GIS to address women's queries about breast cancer in the community; for example, are cases clustered near a hazardous industrial site (Timander & McLafferty 1998)? Do women who live at the ends of water mains have a higher risk of breast cancer? Is breast cancer prevalence higher in neighborhoods along the shore? These were not 'scientific' queries; they came from community residents, based on their own fears, experiences and concerns.

These local initiatives became part of a larger, area-wide effort to raise public awareness and stimulate scientific inquiry into the causes of high breast cancer rates. The coalitions lobbied for more federal funding for breast cancer research, and specifically for research on environmental exposures. They asked that a GIS be created for Long Island to explore the association between elevated breast cancer risk and a wide range of environmental and social hazards. Their calls were heard by Al d'Amato, the powerful Senator from New York, who spearheaded legislation calling for 'a multi-study research initiative examining the possible role of environmental factors in breast cancer in Suffolk, Nassau and Schoharie counties in New York and Tolland county in Connecticut, where breast cancer rates are elevated' (National Cancer Institute, 2000). Enacted in 1993, as Public Law 103-43, the legislation directed the National Cancer Institute to establish a research initiative, termed the Long Island Breast Cancer Study Project (LIBCSP), with funding of more than \$27 million for the 1993-2000 fiscal years.

A key element of PL 103-43 was the use of a 'geographic system to evaluate the current and past exposures of individuals, including direct monitoring and cumulative estimates of exposure' (PL 103-43, sec. 1911) to a wide range of environmental contaminants. The legislation was unusual in its specificity. Not only did it stipulate the topic of research inquiry (the roles of environmental and other risk factors in breast cancer), but also the geographic area of inquiry, down to four counties in New York and Connecticut, and the research methodology (a 'geographic system'). In 1999, a \$5 million contract was awarded to a private firm for developing and implementing the GIS for breast cancer studies on Long Island. The GIS will be web-based and will comprise 400+ data layers, primarily from government and private sources, although residents are also being asked to contribute descriptive historical and environmental information which may ultimately be incorporated in the GIS. A skeletal GIS is already on the Web at: <http://www.healthgis-li.com/>.

The breast cancer example—a grass-roots effort transformed into a multimillion dollar GIS; an effort with its roots in women's activism—illustrates several important points about the roles of mapping and GIS in women's attempts to understand their 'worlds'. It reveals women's desire to *know* about significant health and environmental issues in their community and regional context. It shows how activists embraced mapping and GIS as intuitive means for exploring spatial and environmental associations; and it depicts the shifting matrices of empowerment and disempowerment, as a health-GIS project takes on a life of its own. The example brings up key notions of knowledge, context and power—concepts that are central to feminist inquiries—and as such points to a common ground between GIS and feminist geography.

## **Divergent Paths: feminist geography and geographic information science**

For the most part, feminist geography and GIS have emphasized different ways of knowing. Feminism highlights several important aspects of research methodology, including: reflexivity, the lived connections among the researcher, the research topic and the subjects of research (see Kwan, this issue); the importance of giving voice to the subjects of research (Gilbert, 1994; Moss, 1995); positionality, the non-neutrality of the researcher in relation to the subjects of research and the situatedness of all knowledge (Haraway, 1991); and importance of diversity and difference (Kobayashi, 1994). Although feminist geography is by no means monolithic, and feminist geographers have embraced diverse methodologies (Lawson, 1995), feminist geographers have typically advocated qualitative methodologies, such as in-depth interviews, narratives and participant observation, that promote subject-centered research.

In contrast, the hallmarks of GIS include: the reliance on Cartesian, Euclidean conceptions of space—a characteristic that in some senses defines a GIS (Sheppard *et al.*, 1999); the representation of research subjects as spatial entities such as points, lines and polygons, or as ‘objects’ that belong to a particular class (DeMers, 2000); and the reliance on data layers at a single geographical scale, with little attention to multiscale relations (Goodchild, 1995). Many of these issues are attracting attention from researchers concerned with critical GIS and GIS and society (Sheppard *et al.*, 1999); however, for the most part GIS science, and GIS technologies, continue to emphasize visualization, mapping, and quantitative, positivist research methodologies.

In summary, on the surface, feminist geography and GIS appear to have little in common and are moving in different directions. The literature in feminist geography shows a preponderance of qualitative, subject-centered methodologies, and an absence of GIS (exceptions include the articles by Pavlovskaya and Kwan in this issue). GIS research, with a few notable exceptions, is quantitative and technical in orientation and detached from its research subjects, with little attention to gender. This division, echoing the much-discussed quantitative/qualitative division in human geography (Mattingly & Falconer-Al-Hindi, 1995; Flowerdew, 1998), reflects fundamental differences in epistemology and ontology—in ways of knowing and in the nature and definition of knowledge. Yet the fields intersect in their concerns with the grounded contexts of everyday life and in dealing, either implicitly or explicitly, with conceptions of power and empowerment. This begs the questions: how can GIS contribute to feminist geography, and how can feminist geographies and methodologies enrich GIS? These issues are discussed with reference to the Long Island breast cancer example.

## **Common Grounds/Points of Intersection**

### *Data and Knowledge*

Integrating feminist geography and GIS challenges us to think about geographic data and the creation of new knowledge in innovative ways. Much feminist geographical research is based on experiential knowledge—information acquired through interviews and field observations that represents people’s lived experiences. Such information offers unique insights, but it is, by definition, limited by experience. GIS provides a tool for representing and visualizing environments beyond the scope of daily experience. In the breast cancer example, women in Long Island quickly realized that while breast cancer incidence ‘seemed’ high among their friends and neighbors, they needed to know more. Were rates of disease elevated within the local community, in neighboring communities,

and across the entire region? Were there localized areas of high or low incidence? For these women, mapping and GIS became important tools for acquiring knowledge outside the realm of daily experience and for connecting their personal experiences of health and illness to a wider social and political agenda.

The intersections of GIS and feminist geography also promote a broader and more critical view of geographic data. In the LIBCSP GIS, geographic data are being defined in narrow, spatial terms. The GIS relies primarily on secondary data from governmental sources, describing point, line and area geographic entities such as highways, watersheds, power lines and census tracts. Despite their obvious utility in exploring environmental causes of breast cancer, these data layers tell only part of the story. They represent visible or measurable features, but do not capture people's experiences of those features. Feminists, on the other hand, highlight the importance of qualitative data, such as narratives, photographs, sketch maps, videos and oral histories, to provide meaning about geographic entities. For example, oral histories could shed light on the conditions in homes and factories in Long Island decades ago, when environmental regulations were weaker. Increasingly, these diverse types of data can and are being incorporated in GIS (Harris & Weiner, 1998). Matthews *et al.* (2001) link ethnographic data for welfare recipients by residential address to traditional GIS data layers. Others have brought in sketch maps, video clips and historical photographs. Thus, with current technology, GIS can readily integrate qualitative and quantitative geographic information.

Although most technical barriers to data integration have fallen, the analysis of mixed data types—quantitative and qualitative—in GIS remains a challenge. How can these diverse types of information be fused to generate new knowledge? In a GIS, data are linked by location; yet little is known about whether and how such linkage enhances understanding. The visual map interface may be a useful vehicle for data integration, permitting users to browse among diverse data types and explore geographical associations. On the other hand, the well-known limits of map representations may impede understanding (Monmonier, 1991). Better cognitive models that consider how women and men acquire knowledge in GIS are needed for the integration of qualitative and quantitative information in GIS to be truly effective (Mark *et al.*, 1999).

### *Context*

Both GIS and feminist geography highlight the importance of geographical context—the grounding of human experiences and interactions in space and place. GIS provides a tool for representing and visualizing the geographical contexts of women's lives. The women in Long Island saw GIS as a way of analyzing the localized connections between environmental hazards and the incidence of disease. They understood intuitively that geographical associations between health and environment, analyzed via GIS, could provide clues about the underlying causes of ill health, a view that is slowly gaining acceptance in the public health community (Croner *et al.*, 1996). A small, but growing, number of feminist geographers are using GIS to explore the geographical accessibility of jobs, services and resources for women and to examine how these are changing in response to economic restructuring, globalization and welfare/health care reform (Kwan, 1999; Pavlovskaya, this issue).

Feminist geography draws attention to a different kind of 'context': the socio-political contexts of GIS use and implementation, and the social construction of GIS. Feminist epistemology emphasizes the situatedness of all knowledge, including knowledge acquired through GIS. GIS is a social practice (Sieber, 2000). Each GIS is socially constructed in

terms of data, scale, queries and access. The LIBCSP GIS, and its evolution over time, illustrates well the social construction of GIS. The GIS began as a community-based activity in which women collected information, directed how that information would be incorporated in GIS and represented on maps, and identified geographical and environmental queries for investigation. Admittedly, the GIS was narrowly circumscribed, addressing the concerns of breast cancer activists in a particular place; but that group had a great deal of control over GIS development and use. In 1993, federal legislation shifted the nexus of control to the state and to private industry. Although the state has solicited community input through a series of town meetings, it firmly controls the design of the GIS by spelling out the kinds and scale of data to be incorporated and the analytic tools that will be made available to users.

The evolution of the LIBCSP GIS also reveals a subtle shift in orientation away from community advocacy towards an emphasis on scientific research endeavors, including case control studies and environmental exposure modeling. A 'masculinist' GIS is being created to support well-defined scientific investigations. This echoes Clark's (1998) point that GIS often supports a division between the social and the scientific which in turn creates a technocratic elite.

The evolving social construction of the LIBCSP GIS is beginning to raise concerns among the activists who originally embraced it. Residents have questioned the data layers included in the GIS, noting the lack of historical information on environmental hazards. Furthermore, because of privacy concerns, the state decided to restrict access to cancer data by address or by small geographic area. Access will be granted only to certain researchers who will be given a password, and the criteria for deciding who will be granted access have not been specified. As one local activist commented, 'What if someone in China has a theory? Will he get caught up in the politics of trying to get the password?'; (Sokoloff, 2000).

The recognition that GIS is a social practice embedded in shifting webs of political and social activities that operate at varying geographical scales suggests several areas of feminist GIS inquiry. As GIS becomes more widespread in community and governmental organizations, we need to examine how GIS is used and by whom. Just as metadata establish the parameters of spatial data layers, 'GIS metadata' could identify who has access to GIS data at what scale; and who uses GIS, for what purposes. The contribution of GIS in women's activism also requires attention. Although researchers are beginning to examine varying community capacities for GIS adoption and use (Leitner *et al.*, 1998), the role of gender has not been addressed. What would a 'feminist' GIS look like, and how and for whom might it be used? Finally, researchers need to look critically at the politics of geographic information. How is access to the vast quantities of personal geographic information collected on a daily basis controlled? How do such controls balance the right to privacy with the need to provide access to important geographic information at a detailed spatial scale?

### *Power/Empowerment*

The final area of commonality between GIS and feminist geography concerns issues of power and empowerment. GIS clearly has potential as a tool for women's empowerment, a point highlighted in the recent literature on public participation in GIS (Sheppard *et al.*, 1999). In Long Island, GIS helped to enable and empower activists by documenting the breast cancer problem in their communities and by providing a means for exploring environmental associations. The community activists went so far as to advocate that GIS

be written into federal legislation, and they remain deeply interested in GIS development.

The LIBCSP also supports a more nuanced analysis of power, however. Feminists see power as situated and gendered. Interlocking webs of power permeate the social relations that underpin GIS and that guide GIS development. The breast cancer GIS initiative was successful in capturing public attention and gaining federal funding largely because it took place in an affluent, well-organized community with strong connections to a politically powerful senator. Marginalized communities are unlikely to achieve such political success. As Sieber writes, 'The ability to shape GIS practice to community needs presumes technical knowledge and the power to influence' (2000, p. 779).

The gendered nature of power and the shifting boundaries of empowerment and disempowerment are also apparent in the LIBCSP GIS. Women's empowerment at the community scale was transformed into political and economic power at the national scale, as a set of grass-roots, community-based GISs evolved into a multimillion dollar GIS. Currently, public agencies, researchers and a private corporation are directing GIS development. Although women activists sit on the GIS advisory board, they no longer have a strong voice. Thus, what began as an empowering tool is emerging as potentially disempowering for the women who advocated it. Understanding the changing geometries of power that underlie GIS development, women's places in such geometries, and the implications for progressive social change present important opportunities for feminist GIS inquiry.

## **Conclusion**

GIS and feminist geography have followed divergent paths; yet a closer examination suggests many areas of potential collaboration and common ground. GIS can enrich feminist geography and feminist activism by creating new kinds of knowledge, by describing the socio-spatial contexts of women's lives, and by serving as a vehicle for women's empowerment. Feminist geography can enrich GIS by advocating the incorporation of qualitative information to give meaning to spatial data; by drawing attention to the social construction and contexts of GIS; and by highlighting the gendered geometries of power that shape particular GIS applications and establish the bounds of GIS. Case studies are needed to illustrate how GIS can inform feminist geographic studies and how feminist geography can enhance GIS research and practice. GIS is more than a computer-based technology or a spatial analysis tool kit. It encompasses the people who create, utilize and interact with the technology and whose lives are affected by it. Using GIS to map women's worlds involves not only addressing technical and data challenges, but also understanding how GIS practices impact and are transformed by wider social and political relations. Tapping the strengths of GIS and feminist methodologies and molding them to create new forms of knowledge and empowerment offers exciting prospects for geographical inquiry.

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