Practicing GIS as mixed-method: affordances and limitations in an urban gardening study

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Abstract

Geographic information systems (GIS) represent more than a tool for spatial data handling. Qualitative and mixed-methods approaches with GIS value the suite of spatial methods and technologies, while typically showing a marked sensitivity toward issues of subjectivity, knowledge-production, exclusion, reflexivity, and power relations. And although recent research in the use of qualitative GIS demonstrates the ways in which spatial representations and analyses can be used as part of critical geographic inquiry, there remain significant opportunities to demonstrate and synthesize the particular affordances of these approaches. Alongside broader developments in public scholarship and the digital humanities, mixed-methods research with GIS is coming of age, as technological innovations are easing access to data and access to visualization and analytical tools for some. However, the implications of these developments at the level of knowledge construction within community-based, critical research have been underexplored. What are the specific affordances of mixed-methods research with GIS? How are mixed-methods knowledges made and worked through community-engagement? Here, we trace how qualitative GIS methods uniquely enable multiple narratives to change the ways in which GIS is practiced. To illustrate this process, we present findings from the use of qualitative GIS to study urban gardening in a postindustrial, Midwestern city.

Keywords: *critical GIS; qualitative GIS; urban gardening; urban geography*

> A regional study must be done by a geographer who calls the region home. It is impossible to understand the neighborhood without being a neighbor … [T]he geographer gets a piece of the neighborhood, but then the neighborhood gets a piece of the geographer. (Bunge 1971, xxx)

> The question was never to get *away* from facts but *closer* to them, not fighting empiricism but, on the contrary, renewing empiricism. (Latour 2004, 231, emphasis his)

Introduction

Practice has become a central concept in critical human geography, with an emphasis on the processes that make up the everyday. Both macro and micro practices and habits have been topics of exploration and have required new and renewed methods of engagement and involvement, further blurring the line between the researched and the researcher. Indeed, the rise of practice in Geography has demanded reconsiderations of relationality in research; as Bunge (1971, xxx) writes in the above epigraph, "it is impossible to understand the neighborhood without being a neighbor". Extended further, some in science studies have underlined this mode of engagement, as Latour writes, to reconfigure our practices of empiricism by getting "closer" to facts (see also the "mangle of practice" by Pickering 1995). In this sense, practice is both an object and a mode of study.

More specifically, geographers have also brought attention to the practices of mapping, to think the map as simultaneously method and practice (Kitchin 2008; Cope and Elwood 2009). By understanding GIS as a set of technologies that make up these mapping practices, geographers have better understood the social implications of its use and have actively imagined new utilizations toward critical research agendas. Practicing GIS, then, beyond treating geospatial technologies as merely tools, engages with the multiple contingencies that enact spatial knowledges. In other words, GIS are both a method and a methodology, a mangling of being and learning that is in as well as of the world. GIS, then, is not simply shorthand for a specific desktop computer software (produced by Esri), but, as we understand it in this research, is rapidly expanding, to include a range of techniques and technologies. Indeed, as we demonstrate below, this expansion is also conceptual, paralleling a take-up of GIS by the critical social sciences and humanities.

The practice of qualitative GIS for a quintessentially spatial and socially complex topic such as urban gardening engages with the social implications as well as historical contingencies of this spatial activity. A qualitative GIS can be used to visualize the spatial patterns and correlations between features, much like more traditional GIS, but can also include individual, perhaps marginalized, voices in the process of research. Such a set of research strategies allows many interpretations of several forms of knowledge and voices, embedded as both narratives and visualizations, official and vernacular. To pursue inquiry on these themes, more conventional GIS might have difficulty engaging with narratives and integrating participant insight, photographs and historical research with quantified phenomena and spatial analytic methods. However, a largely ethnographic-interpretative approach might not engage narrative "data" to create easily transmittable, and appropriately re-adaptable, spatial visualizations. Here, we enroll and reflect upon the use of qualitative GIS as a synthesis of these two approaches. We consider

urban gardening as a sort of synthesis as well: an embedded social practice sitting right at the intersection of our urban landscape, property system, social and class structure, and diets.

We argue that the multi-channeled, iterative character of qualitative GIS allows for more inclusive data collection and analyses. Diverse forms of knowledge are produced, yet the focus is less on a product – a map, an output, an answer to a spatial problem – and more on the process of the research itself. While we recognize that even the formations of subject positions (such as activists) are a potential "product" of this knowledge work (McLafferty 2002), we contend that qualitative GIS practice asks questions and pursues lines of inquiry that resist simple conclusions. We also employ an expanded understanding of GIS, to include a spectrum of geospatial technologies, like web-based mapping applications. More broadly, we consider GIS as the organizing principle of this research project itself. Admittedly, we are taking liberties with more conventional usages of the term, but we do so in order to draw attention to the increasing meaninglessness of considering GIS only as research tools when in fact the practice of GIS is a social process that includes an increasing array of methods and epistemological diversity.

We situate these claims within the context of research on urban gardening in a Midwestern city, elaborating the affordances[1] of engaging qualitative GIS as a practice as well as a practicable research approach. In the course of this discussion, we also briefly discuss the "products" of this inquiry by touching upon three emergent themes within the research itself: gardens as sites of inter-scalar relationships connecting everyday social practice (gardening) with broad military and economic forces, as places where gardeners and others enact their discourses about neighborhood revitalization, and as places where gardeners convey their personal narratives regarding family and neighborhood communal relations. We further discuss some limitations to this approach, sketching the pitfalls of such a flexible, exploratory, and open methodology.

On mixing methods

GIScience methods are currently experiencing an uptake by those who practice critical human geographic research, with increasing relevance within communities of practice around participatory action research, public scholarship, and the digital, spatial humanities. And while the term "mixed-methods" does not necessarily represent new methodological grounds in geographic scholarship, the *application* of GIS to traditionally critical human geography arenas is relatively under-examined. No doubt, critical GIS scholars, and the GIS and Society agenda more generally, have deliberated over this possibility, as a rewiring of GIS (Sieber 2004) or as GIS2 (Sheppard et al. 1999), assuming a reworking of the software itself. GIScientists have, to a limited extent, designed new forms of Internet-based GIS (Nyerges et al. 2006) and GIS-based qualitative coding systems (Jung 2009). Additionally, the advent of web-based APIs (application programming interfaces), have enabled a wave of map mashups and Internet GIS that have furthered a range of digital mapping activities (Miller 2006; Crampton 2009; Elwood 2009). These developments have raised the profile of digital mapping technologies, enabling their use in participatory action research, in public scholarship more generally, and, more recently, in the digital humanities. These developments, as well as those in other related fields, have contributed to a rising interest in the methodology of mixed-methods.

Participatory action research (PAR) is a method that problematizes the conventional distinction between researchers and the researched as a way to create positive change for the community involved (Kindon et al. 2007). In PAR, the problem, issue, and/or research question emerges from the co-participants in the research. Within such an approach, the method engaged

in by the co-participants might be video production or performance (Garrett 2011), focus groups or interviews (Longhurst 1996), or GIS (Elwood 2006). Therefore, mixed-methods are a certain reality of the day-to-day engagements of PAR. PAR encourages the iteration of action and reflection, where each phase of interactivity produces new knowledge and addresses new challenges of applying scholarly research agendas to community concerns.

Relatedly, a growing emphasis on the importance of public scholarship has meant more opportunities for scholars to experiment with different modes of inquiry and a heightened attention to methodology, or the various ways in which methods do work for scholars as well as impacted communities. Mitchell (2008, 2) writes, "what creates a public scholar is related to a profound urge to participate and intervene in the political practices of the world," bringing about questions of what it means to participate and to intervene. Public scholarship is therefore not limited to the translation of scholarship into public discourse, but is about making scholarship do work for those impacted by the studies. Different disciplines constitute this sentiment in different ways: consider public sociology (Burawoy 2004) and public geography (Fuller 2008). Fuller notes that public-oriented geographies have been around since the "so-called revolutions of 'social responsibility' and 'relevance'" in the early 1970s (2008, 4; see also Staeheli and Mitchell 2005). Contemporary public geographies are a change in direction in both form and substance – recognizing, as Fuller notes, that "how to do" geography is as important as what those geographies are about. Indeed, there is a general attitude that Geography needs to continue to engage issues that affect the public in an accessible discourse (for instance, see the Syracuse Community Geography program).

Digital technologies have provided one way in which the humanities have more recently sought to bring about this kind of engagement. Recognizing that the traditional products of the humanities are limited by their mode of delivery, humanities computing sought to digitize the artifacts and objects of humanistic inquiry to render them more accessible. Enabling questions about the affordances of these transformations towards digital objects, the digital humanities have sought to elevate the contemporary importance of "the digital" around issues of standardization, collaboration, and materiality (Rieger 2010; Bono et al. 2012). These issues highlight the making of digital objects as opportunities to broaden notions of authorship and intervention. Furthermore, the spatial humanities considers the use of geographic information technologies in digital humanistic inquiry (Bodenhamer et al. 2010).

The qualitative GIS approach that we exercise is a mixed-methods approach, rather than a multi-methods approach. The distinction lays in the relationship between data collection channels. Here we follow closely Elwood's and Cope's (2009) differentiation between *mixed*- and *multi*-methods projects. Mixed approaches "weave together diverse research techniques to fill gaps, add context, envision multiples truths, play different sources of data off each other, and provide a sense of both the general and the particular" (5), while a multi-methods approach employs parallel, operationally independent research strategies. In our mixed approach, data "interact" during the process of research, guiding the multiple pathways toward addressing the research priorities. The urban gardening research project discussed in this article provides a way to illustrate this mixed-methods, qualitative GIS approach, though our intent is not to present it as a reproducible model even if such a reproduction were possible. Rather, our contribution here serves as a grounded way to explain the affordances and limitations of a mixed-methods, qualitative GIS approach as well as a stage to discuss more broadly the role of mixed-methods approaches in spatial research, to reflect upon what it means to engage with mapping technologies in critical inquiry.

A Brief History of Qualitative GIS

The subfield of qualitative GIS has emerged out of a series of responses and reactions to the increased importance of GIS in academic geography and society at large, in a tradition of critique since the late 1980s. Responding to Openshaw's unrestrained fervor for GIS as the "glue" to unite all of the fractures within geography because of its "explicitly naked geographicalness" (1991, 622), early critics of GIS saw it as a weapon of Empire and a powerful tool for corporate power (Smith 1992; Rundstrom 1995; Goss 1995). Rundstrom (1995) considered that GIS is "potentially toxic to human diversity, notably the diversity of systems for knowing about the world" (45). Goss (1995) saw geodemographic applications of GIS as employing a troubling "instrumental rationality" (171) that constitutes the infrastructure for state and private panoptic surveillance of the citizenry. Neil Smith (1992) criticized GIS as a battlefield technology, and dismissively chided the GIS community that the "time is ripe for a critical and contextual history of GIS beyond existing internalist treatments" (258).

Indeed, just behind the increased sophistication of GIS technologies in the geospatial sciences in the 1990s emerged a critical scholarship on GIS. This approach considers GIS as not simply a data management and spatial visualization tool, but focuses on the social implications of GIS, reflecting on how and why researchers and planners employ GIS (Pickles 1995; also see Sheppard 1995; Pickles 1997). From GIS and Society writing informed by social theory grew the project of "critical GIS," which specifically examines the role that GIS plays in creating geographic knowledge and the ways in which broader social structures enroll this knowledge (Schuurman 2000). To GIS and Society and critical GIS scholars, the conventional treatments of GIS research within public life as well as within the academy has tilted the use of GIS toward positivist epistemologies (Miller 1995), an "instrumental logic" (Sheppard 1995, 5), and internalist ethical frameworks (Crampton 1995), thereby lending support to the dominant power structure.

According to Wilson (2009), the emergence of qualitative GIS is indicative of a problematic in the GIS and Society debates regarding how best to approach critique and reformulation of conventional GIS practice. Earlier articulations of critical GIS raised the importance of critique from an "insider" perspective, mastering the conventions and developing critical and methodological innovations all within the language of the system (Schuurman 2000). Socio-behavioral studies of GIS use might fit well within such an insider's perspective (for example, Nyerges et al. 2002) as might the use of GIS for critical human geographic research (Pavlovskaya 2004). However, science and technology studies and ethno(carto)graphies of GIS are couched in social theory and discussions regarding the role of GIS in "broader narratives of global capital, institutional networks, and information sciences" (Wilson 2009, 161) and therefore move in literatures beyond those that take up the specific language of the system itself.

From this insider/outsider binary emerged qualitative GIS as a kind of synthesis. Qualitative GIS grew from the "reconstructed" (Harvey et al. 2005), critically-informed engagements with GIS to address the earlier critiques of the technology. While attuned to social theory and informed by feminist geographers' notions of embodiment, situated practice, and positionality (Kwan 2002), qualitative GIS preserves much of the language and repositions many of the practices of conventional GIS methodology.

Generally, we recognize two directions in qualitative GIS approaches: (1) the technical integration of qualitative materials and (2) the conceptual reworking of different epistemologies. The first approach, exemplified best by Jung (2007, 2009), envisions qualitative GIS as a

solution to the technical problem of how to embed qualitative media such as pictures, audio and video into a familiar GIS software framework. Jung has forged CAQ-GIS (computer-aided qualitative GIS) to address the needs of multimedia integration into geovisual data. Relatedly Kwan and Ding (2008) developed an approach to conduct narrative analysis within a GIS, what they have termed "geo-narrative."

The other direction of qualitative GIS research forces an epistemological examination of GIS or spatial research more broadly (see Elwood and Cope 2009; Wilson 2009; Pavlovskaya 2009; McLafferty 2002 and Kwan 2007 among others). This approach situates qualitative GIS, like any other methodology, as a site of a particular kind of knowledge production. Therefore, the knowledge production that happens through qualitative GIS enables a kind of messiness in exploratory research as well as potentially activates more-than-representational affects. Indeed Kwan (2007) even uses GIS software as a platform to create visual art, images that express emotion, while withholding any discernible spatial representation. Our concern is less with reworking geospatial technologies in order to accommodate qualitative methods and more with resituating qualitative GIS practice increasingly broadly: as a conceptual configuration of research strategies.

Garden (Variety) Geographies and GIS

The transdisciplinary, yet balkanized, garden studies literature has identified the multivariate roles that gardens play in human experience: as producers of important aspects of national identity (Helphand 2003), reproducers of important cultural practices in immigrant communities (Airriess and Clawson 1994), contested neighborhood spaces (Schmelzkopf 1995), places where grassroots and state-run service bureaucracies conflict (Jamison 1985), and spaces that foster civic participation (Baker 2004; Shinew et al. 2004) and urban ecological restoration (Irvine 1999). Crouch (2009) considers community gardening as an example of a "quietly emergent" practice of "mundane" creativity (140), while Milbourne (2009) argues that such ordinary creativities can contribute to the "regeneration" of economically depressed neighborhoods (141). By contrast, Guthman (2008a) argues that alternative food networks in the United States, including urban gardening projects, often enhance or create spaces of white privilege that "reflect a delimited politics of the possible" (437).

Smith and Kurtz (2003) consider New York's community gardens as sites of resistance to the neoliberalization pressures of the Giuliani administration, while others argue that in other cases neoliberal forces can enlist organized urban gardening projects to promote individualistic notions of food procurement, protect property values and business concerns (Pudup 2008; Guthman 2008b). Recent research on community gardening in Berlin contends that city leaders enact and reinforce a neoliberal discourse while promoting community gardening projects (Rosol 2012).

Knigge (2006) diagrams the political economy of community gardening as a functional element in the cycle of urban neighborhood development and disinvestment. Community gardens not only help groom a neighborhood for capital reinvestment through beautification, but they also transfer responsibilities of abandoned property maintenance from the municipal government to neighborhood volunteers (23). But, like Smith and Kurtz (2003), Knigge also points out that community gardens can also be sites of socialization and organization against neoliberal urban renewal/decay (37). Similarly, for Blomley (2004) public gardening projects are not necessarily just reproducers of or resistances against neoliberal practices, but are excellent sites through which to critically examine the slippery notions of property and the neoliberalization of public

space. With important exceptions, there are few studies that incorporate GIS work into such investigations of urban gardening.

Knigge and Cope (2006) provide a cogent example of a qualitative GIS approach that employs both quantitative and qualitative data, with a case study focused on the topic of the community gardens of Buffalo, New York. Integrating city spatial data on neighborhoods and community gardening with personal interviews, participant observation, field notes, photographs, and mapping, their work provides an example of a field study that aims to eliminate the boundaries between quantitative and qualitative GIS. The broad mixed-methods approach, which included GIS, practiced by Knigge (2006) in her dissertation drew out diverse forms of knowledge at multiple scales, which allowed examination of the contradictory roles of community gardens in the political economic context of Buffalo. A mixed-methods approach was crucial to arriving at such findings. A similar set of questions answered using primarily one or another investigative method would have yielded little understanding of the contradictions of community gardening practice. While the foundations of GIS centered around quantitative data and spatial analytic functions, qualitative GIS methodologies represent a turn toward more inclusive types of data and knowledge, an embedded reflexivity, greater attention toward power structures and processes of exclusion, and perhaps less tidy conclusions. And, while beyond the scope of this manuscript, new spatial media, such as location-based services and web-based map mashups, enable further integration and juxtaposition of qualitative materials.

We have sought a more focused interrogation of the affordances and limitations of qualitative GIS, as method and practice. Here, we argue that qualitative GIS enable an iterative, intermingling of data collection and analysis, in which the concept of "data" is exploded to include the narrative, the visual, and the quantitative. In what follows we are lead by the following two questions: (1) How does one actually practice qualitative GIS, given the emerging "game-changing," map 2.0 technologies of recent fascination captured by neogeography, volunteered geographic information, and the geoweb more generally? and (2) How might qualitative GIS productively extend the technical integration of qualitative materials (Jung 2007, 2009; Kwan and Ding 2008) toward a discussion of the possible reconfiguration of conceptual frameworks? As a mixed-methods approach, we look to examine the epistemological affordances of the integration of qualitative materials (such as videos, images, and interviews) as they cause a reconceptualization of the underlying frameworks that typically guide conventional GIScience. Observation, analysis, and representation are configured into channels as part of a broadened research strategy.

Mapping Middletown

To draw out the affordances and limitations of qualitative GIS as an approach, we begin by situating the places and spaces to be mapped. The well-documented history of Muncie, Indiana has followed the familiar pattern of development of many other mid-sized Midwestern cities. White Euro-American settlement began in the 1820s, displacing an Algonquin community previously displaced from New York. The land was divided into townships and sections via the Public Land Survey System (Ellis 1898). As a result of uncovered natural gas reserves, the late 1800s saw the region quickly transform from a collection of homesteads to a regional industrial center. Most historical accounts portray the gas reserves as completely squandered by the turn of the century, but the foundation for heavy production in the area was set (Glass and Kohrman 2005). The gas boom lured the Ball Brothers Glass Manufacturing Company to build a factory

and corporate headquarters in Muncie in the late 1880s, a move that would in large part direct the future economic and political development of Muncie (Lynd and Lynd 1937; Carlson 2000).

By the time Helen and Robert Lynd began what would become their classic sociological study of Muncie in the 1920s, heavy industrial concerns had transformed the economic and social fabric of the town (Lynd and Lynd 1929). It was the character of this transformation of everyday life that they sought to chronicle in *Middletown* (1929). Major employers such as BorgWarner, Chevy, General Motors, in addition to the Ball Corporation, provided the basis for employment in Muncie for most of the 20th century. The Ball Corporation and its founding family initiated a legacy that has had incalculable influence on the development of Muncie into the present day by establishing or directing many of the major institutions of the city. The Ball presence is manifest today in Ball State University and Ball Memorial Hospital, currently the two largest employers in the county by a wide margin. The 2010 census puts Muncie's population at 70,085, but the population has generally declined since 1980. Such an industrial past and present day demographics place Muncie squarely within the "rust belt" of the public imagination (e.g. Stern and Smith 2009).

A comparison between the Lynds' class-based map of "Middletown" (Figure 1[2]) and a current census map of income (Figure 2) and race (Figure 3) show the persistence of the spatial inequalities in Muncie. The White River marks the boundary of the strongest disparities in town in terms of employment and educational attainment as well as the socioeconomic measures. On the north side: Ball State University and the neighborhoods of its middle and upper income employees, student housing, a local cultural center (Minnetrista), and the major mall and chain store sprawl district. South of the river: downtown Muncie occupied by local businesses, law offices, social service agencies, and municipal government buildings, while beyond downtown lies middle-to-lower income households formerly dependent on manufacturing jobs and abandoned housing and factory spaces. Railroad tracks act as secondary borders, drawing neighborhood boundaries, separating the historic neighborhoods and downtown Muncie from the more traditionally blue collar neighborhoods to the south. It is in these latter neighborhoods, literally "south of the tracks," that constitutes the study area (Figure 4) where qualitative GIS was used to better understand gardening activity.

We practiced qualitative GIS as a series of research *channels*, some of which are more easily represented and analyzed using the traditional tools associated with GIS, while others triangulate and assist in interpreting the mapping of Middletown. And while the broader methodological question that we explore in this article is around the affordances and limitations of studying urban gardening with qualitative GIS, the actual use of qualitative GIS in Muncie was motivated by the following research questions: Where do people have gardens? How do they articulate why they garden? What do they do with the products of their gardens? What roles have gardens played in Muncie historically? In what ways have gardens been implicated in broader political-economic forces at play from the local to global scales? In what follows we outline the five channels of data collection: ground survey of the study area, interviews, visual materials, historical/archival materials, and participant observation (Figure 5). In sum, we argue, these research strategies compose a qualitative GIS approach. Implemented iteratively and in concert, the work from the ground survey influences the kinds of discussions held in interviews, while the production of visual materials draws upon and rubs against materials from the archive. This mixed-method approach provides a front-row seat to these channels as they unfold and reveal new forms of knowledge.

Ground Survey: The study area was surveyed on bicycle by conducting a visual inspection of yards. For the purposes of this survey an edible garden was defined in context on the basis of the researcher's emphasis on *practice* over Euclidean spatial configurations. Does the space appear to show that there is garden*ing* occurring here? Field maps were condensed into a Google mashup that showed the distribution of gardens in the study area (Figure 6). Some versions of these in-progress maps were printed out at the appropriate neighborhood resolution and shared with interviewees in order to stimulate reflections about the maps. The final Google mashup result was shared on an online forum of Muncie residents to generate additional discussion (see "Historical/Archival Materials"). Here, again, products are less-fixed and seen as snapshots of an unfolding process that connects surveys to interviews to spatial media.

Interviews with gardeners: Semi-structured interviews were also conducted with twelve gardeners who live in the study area. Interview participants were questioned about their gardening practices, if their gardening practices have changed, and the reasons they garden at all. In some cases, the annotated field maps from the ground survey were used to help explore themes and discuss aspects of property and place with interviewees. Further, Preston's insight as a participant-observer in the local gardening community greatly informed the conversations. These interviews were audio recorded and later transcribed.

Visual Materials: In one case, Preston video-recorded two family members as they talked and gardened. This recording of these individuals' unique and efficient front and back yard garden spaces, were compiled into a short film displaying their practices and narratives associated with their garden spaces, becoming an important visual-spatial component within this study. Notably, one historical theme they highlighted in their discussion of their gardening and canning practices – the role of the Ball canning jar in Muncie's industrial history – triggered deeper research on this theme in the other data channels. In addition to the short film, other types of visual material representing gardening in Muncie were pursued. Historical photographs from the Center for Middletown Studies, the Lost Muncie Facebook group[3], and other sources were collected.

Historical/Archival Materials: In addition to the collection of new visual materials, this mixed-methods approach also incorporates historical and archival materials that situate the contemporary mappings of Middletown gardening practices. The Lynds' *Middletown* inspired subsequent generations of social researchers to visit Muncie and perform research to "update" the Middletown project, in the form of books (Caplow 1982; Caccamo 2000; Lassiter 2004), films (Davis 2010 [1982]; Carlson 2000; Jones 2010), and university archives (Center for Middletown Studies). Along with these conventional source materials, the Lost Muncie Facebook group provided an active forum and vernacular historical archive of images and commentary. Preston participated in this forum, sharing findings from the ground survey and querying others about their gardening practices. Most archival information highlighted the prominence of urban gardening practices during periods of national economic and historical crisis, namely World War I, the Great Depression, and World War II. Once again, the research along this channel of inquiry was guided by, and, in turn, informed research among other channels. For example, Preston shared documentation about the storied history of urban gardening in Muncie with the local gardening community. This documentation helped to provide context to support our activism, for example as potential fodder for grant proposals.

Participant Observation: As integral to this qualitative GIS approach, Preston carried out community gardening work as a co-coordinator of a community garden located down the street from his home. This role positioned him within a group of gardeners and led to his involvement

in a citywide network of community garden activists referred to as the Urban Gardening Initiative (UGI). Preston's experiences and observations constituted another set of insider fieldnotes and also provided critical insights about the many intersecting nonprofit and governmental organizations that participate in various functions of urban gardening in Muncie. As a member of this network, he contributed a modest amount of work and ideas to the growth of community gardens in the community, creating a particular, active variety of knowledge from which to draw out further insight within other data channels.

In what follows, we discuss how these channels work together as a qualitative GIS approach, recognizing the likely incommensurability of data. Therefore, we argue for a qualitative GIS approach that does not rely upon integration into a single technology, an approach that does not necessitate the reduction of rich contextual materials into a Euclidean space of latitude and longitude coordinates. Instead, we argue that a qualitative GIS approach assumes certain irreducibilities in knowledge artifacts (e.g. videos capture space from an embedded perspective, while conventional GIS use organizes space using a view from nowhere and everywhere) and yet integrates these artifacts as part of a multi-channel research endeavor. As a system of qualitative geographic information, this approach actualizes the messiness of exploratory research while recognizing the limits of such a wide range of inquiry. The research channels themselves produce types of inquiry that will likely not be captured entirely by the representational technologies of conventional GIS, thereby requiring a more modest approach that tacks between and across channels in order to accommodate the remainders of research that are not assembled within the mapping machine. As such an approach, this work highlights the viability of conducting spatial research in smaller urban environments, while exemplifying an embedded approach to spatial analysis of urban gardening practice. We posit five affordances of this approach to qualitative GIS inquiry – breadth, depth, iterativeness and flexibility, visualizations, and process – and then sketch the limitations to this method.

Affordances of an actualized qualitative GIS

Breadth

Quite simply, the rigor of socially-embedded qualitative GIS lies in the *breadth* of the data collection regime rather than the quantitative/statistical notion of reliability. Data collection here refers to the process of conceptualizing several seemingly unrelated channels of data as a single interrogative strategy. Interactions between data channels, including contradictions and resonances, become nodes for discussion.

Simultaneously, several analytical perspectives can be subsumed under the qualitative GIS framework. The ground survey component of urban gardening research in Muncie, for example, is best associated with spatial analyst tendencies in GIScience. The ground survey along with overlaid census data provided an overview of the spatial patterns and distributions of urban gardening practice in the study area. These "hard" data intermingle with the more vernacular spatial knowledge accrued from interviews and participant observation as well as with historical texts. That is, this research regime accommodates a broad range of sociospatial data. Simply put, this breadth of information contributes to a more nuanced understanding of the topic.

We also argue that this breadth of information may tend to encourage ethical research practice. For example, the breadth of data pursued in this sort of study acted as a buffer against possible privacy concerns. The ground survey design was limited to a visual inspection of where

gardening took place, with no additional information mapped. The garden locations were aggregated by city block. The breadth of other available qualitative data, like interviews, made unnecessary any photos or further extraction of information from particular garden spaces in our survey. That is to say, the breadth of the data collection regime, crucial to the qualitative GIS approach, provided a built-in response to privacy concerns and precluded any justification for collecting any more than this nominal non-volunteered data.

The question of knowledge production in a broad-based research regime is not simply about collecting many sorts of data, but also how the different data collection strategies effect one another and interactively guide the pursuit (or avoidance) of particular questions. In partial alignment with visual methodologies more generally (Rose 2007), we seek to take visual products and the processes that underlie their creation seriously, to understand the social and technical conditions of their production and the significance and implications of their use.

Depth

Second, multiple representations and voices are allowed some *depth* within these data. Here, interviews did not function as a representative survey, but were moments at which participants could speak freely and creatively about their individual experiences. Likewise, Preston approached photography and historical data less as tools to present a chronological, reconstructed view of gardening in Muncie's past, but more as images that generate additional voices and interpretations in relation to the other channels of data. Further, such an approach provides vital contextual meaning, an approach contributed by feminist geographers to inform qualitative GIS (Kwan 2002, 2007).

During interviews, participants volunteered their knowledge and associations with considerable depth. One community gardener, Meg[4], drew a possible garden space on a map and spoke of future scenarios for the garden and her involvement. Additionally, she noted the vacant lots near the community garden, where she already spends much of her spring and summer, and imagined a greenhouse or cornfield or fruit trees in these spaces. Pointing at a map of the neighborhood seemed to make her imaginings more concrete:

> There's space over there. We wouldn't even have to squat, we'd have permission.

It is significant to note that the "vacant" lots are sites where houses were recently demolished. The apparent high home vacancy rate in the area, observed during the fieldwork for the ground survey (Figure 7), can be linked back to unemployment, and the decline of industrial base in the immediate area. The historically relevant site of the former Ball jar canning factory is located just one mile southwest of Meg's neighborhood. Such data and images were drawn from other channels within the qualitative GIS structure.

Meg, a prolific canner and preserver of her garden produce, concluded, however, that her time is limited, that her additional gardening scenarios will not come to fruition:

> I'm just one person [...] It's a cool idea, there just needs to be a more focused leader. I just like growing things.

Such insights, which scale from everyday practice ("I just like growing things") to the macroeconomic (abandoned neighborhood lots as an the effects of the neoliberal reordering of the manufacturing economy), spring from the points of intersection between the strands of

qualitative inquiry, in part bolstered by the interviewee's interactions with maps produced from the ground survey. Here, the local and global understandings of place are constructed alongside specific responses, as the intermingling of inquiry and intervention produce knowledge as well as activist subject positions (compare McLafferty 2002).

Iterativeness and Flexibility

The third affordance of an embedded qualitative GIS approach is its iterative, flexible character. As with any inquiry, the researcher must decide how to grapple with new questions that arise during the course of the study. The embedded qualitative GIS approach leaves open pathways that call for corollary lines of inquiry. While not oriented toward problem-solving or hypothesis-testing research questions, this approach can thereby exercise greater flexibility in revising methods and accommodating new questions as they arise. Again, this flexibility of design results in an inclusive, open structure to GIS, resulting in a greater emphasis on otherwise marginalized narratives. In this sense, the messiness of multiple strands of research is actually a strength, not a weakness, of research design.

For example, in the Muncie urban gardening study the conceptual layering of historical narratives with contemporary interviews highlights the points at which these types of texts intersect. This is the iterative nature of qualitative GIS, where, as Knigge and Cope (2006) show, such "research practices […] constantly informed, contradicted, complemented, and enriched each other" (104). A publication released by the Delaware County Defense Council just after World War I, *Delaware County in the World War, 1917-1918* (McPhetridge 1919), reported the following startling evaluation of Muncie's war garden organization efforts: "The county with Muncie as a center stood first in all the United States in war garden activities and in canning and preserving fruits and vegetables to be used as substitute foods for the staples that were being saved and sent abroad to supply our fighting forces" (34).

While many historical accounts of Muncie emphasize the enormous impact that the Ball Corporation, manufacturer of Ball canning jars, has had on the development of Muncie throughout the last century (Lynd and Lynd 1937; Caplow 1982; Carlson 2000; Lassiter 2004), these sources contain little mention of gardening, the domestic practice that drove the canning jar industry. Only one comment on gardening appears in the Lynds' *Middletown* (1929), in a footnote:

> The large back-yard garden has either disappeared altogether or is considerably more limited in size and content. Among working class families, smaller yards, less home canning, lack of winter storage space for food, time spent riding and tinkering on the car, movies, and similar factors have been responsible for the decline of back-yard gardening, while among the business class families the high cost of labor, increased preoccupation of the camp, the tendency of a few families to move in summer to a cottage at the Lakes ninety miles distant, are additional factors operating in the same direction. (95n)

It is not clear whether we should consider the Lynds' mini-analysis of gardens at face-value since their methods for drawing these conclusions are not transparent. However, their negative correlation of the rise of the industrial working class with the prominence of backyard gardens resonates with present-day interview participants noting the reverse: the increase in prominence of gardening after the decline of the industrial working class of Muncie. In addition, several

interview participants practiced canning (Figure 8) and discussed the pronounced influence of the Ball Corp. in Muncie.

The open iterativeness of the qualitative GIS methodology allowed what was initially a digression from the research topic – the role of the Ball canning jar in Muncie – to take on a greater importance in the study. As Ball Corp. and the practice of canning continually cropped up in the research, research priorities *at each channel of the methodology* could be, and were, shifted accordingly. That is, our broad data collection regime included what at first glance seemed to be a curious connection between the history of urban gardening in Muncie and the practice and production of home canning, but the flexibility and iterativeness of the qualitative GIS approach incorporated this avenue of inquiry into the other channels of data collection. Here we intend to show that the practice of GIS can accommodate the more open, exploratory mode of an ethnographic or historical project. Considering the varied channels of data collection as if they were spatial data layers, such an approach allows leads to be followed and developed while maintaining a spatial research focus.

Visualizations

Fourth, as with conventional GIS, qualitative GIS research can also involve an emphasis on geographic visualizations of the data. However, maps were used as objects for consideration, knowledge-sharing, and editing during interviews and semi-public queries, as well as for visual inspection. Pavlovskaya (2009) sees the essential character of qualitative GIS and all GIS as visual. We suggest that the qualitative GIS practice of including on-the-ground photography, archival photos, and moving images may de-center the "god's-eye" perspective (Haraway 1991, 89), provide additional layers of meaning, and add contextual information to the other channels of inquiry. Here, qualitative GIS help to draw research participants closer to the methods of the research itself and thereby encourage more in-depth participation and interplay among the spatial data.

Figure 9 neatly expresses the link between gardening and the global priorities of Ball Corp., the business typically linked with Muncie's growth. From Figure 10 we get a look at an urban garden in progress in Muncie. The film "'This Little Square of Dirt'" (Figure 11) created by Preston, gives life to themes, namely family, sharing, and neighborhood communal relations, concurrent in the different, but accompanying channels of inquiry. The film is less a set of results as it is a summary of an encounter between the audience, filmmaker, and film subjects. As discussed by Garrett (2011), humanistic-oriented videographic inquiry is itself a social practice. Interpretations of this inquiry are ceaselessly negotiated between those involved. For example, in the final scene, entitled "Neighborhood," the gardener articulates her vision of a neighborhood community gardening practice that utilizes what she calls the "wasted spaces" of the parkway strips (i.e. the strip of grass located between the sidewalk and the roadway in many residential neighborhoods). The film briefly portrays her vision, juxtaposing the typical grassy parkway strips with the growing mini-cornfield in front of her home.

The activity of making this film, as with any research method, did not just digest and present information, but was a social practice itself with effects beyond the realm of this research project. During the interaction Preston had with the film participants, they learned more about community gardening projects in town. They subsequently became involved with the community garden project coordinated by Preston and are becoming increasingly involved with assisting this project and other gardeners. That is, our mixed-methods approach conveyed visualizations that provided a perspective from the ground not just to augment more conventional cartographic

formulations, but to create an active dialogue among these forms of spatial inquiry as well as the world beyond the research.

Process

Fifth and finally, there is a distinct focus on the *process* of research in qualitative GIS, as opposed to a *product* – a problem solved, a location identified, a map produced. This focus frees the channels of data to diverge, rather than chart a trajectory toward a comparatively narrow set of conclusions or an isolated problem. Qualitative GIS addresses research questions by making associations and drawing insight from several types of sources. In this context, the enrollment of GIS may not function as a problem-solving regime, as in conventional GIS practice, but manifests as a process of exploration.

As Kwan (2007) has contended, transformations in subjectivities should also be considered as the products of geospatial research. Emotion, affect, the body, and art in large part remain unexamined, yet unavoidably implicit, in geospatial research. To illustrate this interest, Kwan created a "3D GIS videography" based on the personal narrative of a typical day of a Muslim woman in Columbus, Ohio not long after 11 September 2001 (27). The result was not a scientific portrayal of how she moves through space, but an expressionistic account of how she *feels* as she made her way through the day. Such an experiment highlights the subjectivities typically ignored in GIScience projects and opens the door to greater interpretative use of geospatial technologies in social research.

Another way that subjectivities can be articulated in the course of a mixed-methods qualitative GIS approach is through the emphasis on positionality and social context necessitated by a research process informed by participant observation. Since qualitative GIS is typically exercised as a process, typically less driven by output, contradictions engendered by participant observation can play a constructive, rather than a destructive role, in the research. Indeed, the emphasis on the exploratory characteristic of this qualitative research was abetted by the inclusion of the researcher's activities within the methodology, allowing such a positionality (as a gardener, member of a local gardening organization [UGI], "townie," student, and researcher) to further clarify the ways in which the research terrain is navigated.

As an example of this productive tension among the overlaid data channels negotiated by the multiple roles of the researcher, a critical look at community gardens arises: as greenwashing (Rogers 2005), neoliberal roll-out (Pudup 2008; Guthman 2008b), or as elements of nationalistic programs during U.S. military activity. (It is also significant to note that Ball Corp. formed an aerospace and national defense production division in the 1950s [Neff 2010].) Such a perspective has seemed askew to much of the discussion engaged in during UGI meetings, where discussions center on how to expand urban gardening to improve the health, economy and social divisions at the neighborhood level in Muncie. Obviously, these motives have little to do with attracting foreign investment or supporting U.S. military activities. Here, researcher participation in these efforts coupled with other channels of data generates a possible critique of some uses of urban gardening. As a mixed-methods approach, this research examines the interplay and messiness of the discourses and materialities that give rise to and make up community gardening practices. This approach can heighten process over product. In this case, the practice of research has informed the researcher's own community gardening practices and has fomented lasting relationships with other community members.

As a process then, a mixed-methods qualitative GIS approach enables this mingling of research channels, not to emphasize a finalized research product (this manuscript not

withstanding), but to enact forms of inquiry that both impact and draw energy from the communities that participate in this research. Indeed, this research practice is transformative, enabling new subject formations, not fixed as externalities or "products," but as subjectivations continually in the process of formation, of becoming (Butler 1997, 83).

Limitations

As with many methods, the affordances of practicing embedded qualitative GIS can also be its limitations. As a grounded approach, driven through participatory or collaborative interactions, research can seem to continue ad infinitum as the relationships forged exceed the neat boundaries of the research program. The messiness of exploratory research in qualitative GIS, the hyperattentiveness of such mixed-method engagement, can enact an undoing. As such, an actualization of qualitative GIS requires a vigilant reflection on the objectives of the engagement, to continually iterate and adjust the channels of research within the scope of the project. Less than vigilant attention toward project scope can lead to difficulties defining the practical day-to-day tasks for the researcher. At worst, this open structure methodology can lead to dissolution of the method itself.

Nor does this iterativeness and flexibility necessarily lend itself readily to success within the bounds of the academic institution, which, perhaps due to funding and evaluative structures, leans toward short-term engagements that regard participatory and collaborative research as barriers to completion. Exploratory qualitative methodologies driven by embedded researchers may lack short-term, tangible, and predictable benefits that fit within the rhythms of institutional funding cycles and student research deadlines.

Further, in recognizing qualitative GIS as a research strategy that engages the positionality of the researcher(s) and highlights the reflexivity within the research process, there exists the danger of tending too far toward the autobiographical. Consider Haraway's appeal to de-purify methodological strategies such as reflexivity: "The point is to make a difference in the world" (1997, 36). That is, mistaking autobiographical narrative for transparency with social research may make it difficult to extend the impact of the project, to realize change within the communities engaged by the research.

Conclusions

> Maps are powerful, not only because of what they represent but also because the process of mapping forces communities to come together and think about how they share the spaces in which they live. (Young and Gilmore 2013, 820)

Qualitative GIS is coming-of-age, and yet few examples within this emerging, interdisciplinary literature explicate the actual mixing of methods in an engaged research project. Fairly recently, the words "qualitative GIS" sounded like a contradiction in terms (Kwan and Knigge 2006). But lately the terms, the attitudes, and the technologies have shifted to accommodate multiple pathways of inquiry. Furthermore, Pavlovskaya (2009) argues that the quantitative vs. qualitative methodological divide has always been a false dichotomy since GIS is an inherently a visual, qualitative medium. She goes on to contend that "only a modest share of GIS functionality involves quantitative spatial analysis" (19).

But then what is the difference between this method, practiced here as qualitative GIS, and what we might call a mixed-methods, spatially-oriented ethnography? Geography has a long history of problematizing not just political borders, but disciplinary borders as well. The practice

of qualitative GIS methodologies erodes the walls erected around GIScience as a specific disciplinary entity defined by technological expertise, particular software implementations, and problem-oriented spatial analytical questions. Such practice therefore constitutes a specific intervention, serving to challenge disciplinary thinking, and its history as an interruption is important (Wilson 2009). And while it is not trapped by its (limited) history, its history as an intervention nonetheless shapes its contemporary practice.

Can geographers engage GIS without digital integration? Can we even imagine GIS beyond maps? If we are to agree with critical GIS scholars' contention that GIS is more than a tool (see Schuurman 2000; Harvey, et al. 2005), and that conventional GIS embeds a particular epistemology (see Wilson 2009), then we must make room for practices of GIS that refuse, or ignore, technological integration as an unavoidable presupposition of conceptual integration. As web GIS proliferates along with its social and economic architecture, and with the study thereof (see Crampton 2009; Haklay, et al. 2008), the dangers of epistemological uniformity grow. How is the expanding dominion of Google Maps/Earth affecting our spatial imaginations? A diffused, conceptually-focused re-envisioning of qualitative GIS reminds us that spatial processes can be mapped with words and pictures and that spatial analysis does not necessarily require digital information. We recognize, therefore, that questions such as "is this really a GIS?" are indications of a somewhat radical reworking of what *is* an information system or science, and what it means for that system or science to be geographic. We welcome these kinds of unsettling questions as part of a reconfiguration of GIS practice.

Here, we have drawn attention to the specific affordances and limitations of qualitative GIS as mixed-methods research. The results of the urban gardening study are beyond the scope of this article (see Preston 2012), however, we have suggested that the "where" of the research process matters to the qualitative GIS approach. Therefore, the distillation of this research practice into bounded techniques, which might be applied with regularity in a diverse set of research settings, is made more complex by the contingent and emergent characteristics of qualitative GIS and its situational perspective. In other words, the practice of this kind of mixed-method work is inextricably linked to the space-times of the research and the particularities of the topics of exploration. For instance, an urban gardening qualitative GIS project will be necessarily engaged differently in a suburban sense-of-place qualitative GIS project.

And while the multivocality of qualitative GIS lends itself to a diversity of research agendas and settings, its history as a political intervention in GIScience underlines its significance. At the same time, the position of qualitative GIS within GIScience may lend qualitative GIS methodologies the attendant legitimacy of GIScience. That is, the framing of this research as qualitative GIS has the potential to shape the way the project is considered in the local community (as well as in academia). Especially in a community like Muncie, Indiana, which has been scrutinized by sociologists since the 1920s, social research framed as qualitative GIS may have higher local buy-in compared to research framed as ethnography, a sociological survey or an anthropology project.

But we still ought to keep in mind that this discursive space of the contestation prompted by qualitative GIS is constantly shifting. Sui and DeLyser (2012) have recently begun a review of, coupled with a renewed call for, hybrid methodological practices "in an effort to bury the qualitative-quantitative divide in our discipline" (116). Expanding the boundaries of this call are three initiatives taking place more broadly within the academy: PAR, public scholarship, and the digital humanities. These project agendas directly situate the researcher as part of the study. As Latour's "renew[ed] empiricism" positions the researcher-subject at eye-level with the "data"

amongst Pickering's "mangle of practice," the social commitments to place implicit in Bunge's neighborliness take on central importance *as research*. (Human geographers may realize that their most thoughtful work occurs when their own socio-spatial existences occur within their "study area.") The affordances of practicing qualitative GIS, which offer a broad, flexible, and open structure to socio-spatial research, proceed along these priorities.

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Notes

[1] Here we are re-appropriate the term "affordance" from the field of environmental psychology, described by Kyttä (2004) as perceived "physical opportunities and dangers" at the interface between the individual and the environment, further noting that "[t]he concept has the potential to be extended to comprise even emotional, social, and cultural opportunities that the individual perceives in the environment" (181). In our context, the affordances of the "environment" of a mixed methods qualitative GIS research regime are perceived by the researcher and others involved in the project.

[2] Map from *Middletown in Transition* by Robert S. Lynd and Helen Merrell Lynd.

[3] With over 5000 members, this Facebook group describes itself as "Dedicated to what made Muncie great back in the day!"

[4] Pseudonym.

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Figure captions

Figure 1. Map of class in Muncie/Middletown, from Lynd and Lynd (1937).
Figure 2. Percentage of low income (< 120 percent federal poverty rate) households in Muncie, 2010 American Community Survey estimate at the tract level. The 120 percent poverty rate is based on average 2.5 persons household size and equals $19,999 annually. Two census tracts were excluded due to skew of student population.
Figure 3. Percent African-American population of Muncie, Indiana at the census (2010) block level.
Figure 4. Study area for urban gardening practices.
Figure 5. Conceptual layering of five data channels of qualitative GIS methodology.
Figure 6. Use of Google Maps to collect and represent urban gardening practices. Blue tags signify the 512 home gardens, green tags are the four communal gardens in the study area.
Figure 7. One of dozens of abandoned homes within the study area.
Figure 8. T-shirt sold at Minnetrista, a cultural center founded by the Ball family.
Figure 9. Ad, circa 1933-1937. Retrieved from Lost Muncie Facebook Group.
Figure 10. North Street Urban Garden, Muncie. Photo from 2010.
Figure 11. Screenshot from "'This Little Square of Dirt'", accessible at cardinalscholar.bsu.edu/handle/123456789/195945.