Visualising and analyzing diverse economies with GIS: A resource for performative research

Luke Drake
California State University, Northridge

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Abstract:

This chapter explores how geographic information systems (GIS) can be used in diverse economies research by first tracing how debates about GIS methods and associated epistemologies have changed since the 1980s. Although initially seen as a tool limited to quantitative spatial analysis, GIS has since expanded in scope to support and extend a variety of interpretivist modes of knowledge. Participatory, qualitative, and critical GIS emerged as some diverse ways to use GIS and spatial data. Scholars using a diverse economies approach participated in this expansion of the scope of GIS. Increasingly, the potential for GIS in diverse economies research is becoming more evident. This chapter discusses three ways that GIS can align with this framework. Previous literature is reviewed on how GIS has been used to visualize and analyze economic diversity and the commons. Original research is then presented to show how GIS can reveal historical layers of economic diversity.

Keywords: urban diverse economies, commoning, spatial data, spatial analysis

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Introduction

Geographic Information Systems (GIS) are computer-based systems for storing, processing, analyzing, and visualizing data that are linked to locations on or near Earth's surface. GIS evolved through the emerging computer technologies of the 1960s. It grew from the far slower technique of spatial analysis that had until then been done by manually overlaying translucent hardcopy maps as layers on top of one another in order to combine variables such as land ownership, soil type, and population. GIS offered advantages in speed, automation, and the ability to handle large datasets in a way that was not previously possible. As such, it became a key tool of scientific geographical research that was part of the larger "quantitative revolution" sweeping through the discipline of geography in the mid-20th century. By the time GIS became more prevalent at major universities in the 1980s, it was mainly aligned with a positivist approach to knowledge that privileges quantification and scientific verification via logical or mathematical proof along the methodological

lines followed by much natural scientific inquiry. However, recently scholars engaged with more interpretive modes of knowledge production have found ways to use GIS in a variety of settings. Today, it is used across fields as diverse as engineering, natural and social sciences, and humanities. This chapter examines how GIS can be used for diverse economies research by tracing how critical GIS scholars experimented with applications and with new links between GIS methods and interpretivist epistemologies.

A Brief History of Debates about GIS, Methodology, and Epistemology

Deploying GIS in research has a contentious history within the discipline of geography and the social sciences more generally (Pickles 1995; Schuurman 2000; Crampton 2010). A first wave of debate from the 1980s to 1990s was characterized by opposition between advocates and critics of GIS, who both saw it as essentially positivist, which was a problematic view because it conflated epistemology with method. Advocates viewed GIS as progressive yet neutral, with the strength to analyze and inter-relate detailed data concerning both physical and social systems covering very large spatial extents (Openshaw 1991). Early advocates provided examples of what they saw as successful GIS projects, including the optimal siting of coal mines or missile systems (Dobson 1983). Unsurprisingly, critiques appeared, framing GIS as a step backward to the fraught history of geographers aiding and facilitating imperialist expansion around the world (Pickles 1993). For critics, GIS was risky in many ways. It was a danger to society as an expensive and elite technology to be used by large and powerful institutions for surveillance and other ends. Epistemologically, they saw GIS as limited to treating humans as atomistic objects and reduced to data points, thus eliminating human agency and subjective experience from spatial analysis, and limited to representing space as a discrete surface separate from political and economic processes (Curry 1995). Whether coming to the debate from a techno-positivist or critical social theory perspective, the interlocutors of this first

wave promoted a polarized and simplistic view of GIS—it was either essentially neutral or inherently flawed.

A second wave of debate emerged when scholars trained in both GIS and social theory worked to see past such binary divisions to use GIS for critical social science. Since the 1990s, GIS has been used in a variety of interpretivist approaches (Crampton 2010). Participatory GIS has involved community members in GIS research and decision-making by contributing local, non-official data (Craig, Harris, and Weiner 2002). Feminist scholars have depicted multiple subjective representations of space through GIS data structures (Kwan 2002; Pavlovskaya 2002, 2004). Qualitative applications of GIS have used photographs and metadata to store contextual data, and analytical possibilities have expanded to using GIS within focus groups (Cope and Elwood 2009; Aitken and Kwan 2010). These applications have revealed the co-existence of multiple spatial rationalities. They have disrupted the narrative of a uniformly positivist GIS. Importantly the argument has been made that GIS is not tied to any particular knowledge system (Pavlovskaya 2006).

The first and second waves of debate differed in their assumptions about the relationship between methodology and epistemology. The first wave framed GIS as a unified and coherent method and epistemology. The second wave rejected a deterministic relationship between method and epistemology to instead see GIS as being compatible with a range of theoretical approaches. This move was enabled, I suggest, by broader debates in geography about methodology and epistemology that argued, for example, that feminist theory can be applied through quantitative methods (Lawson 1995), and that even positivism itself can be used critically (Wyly 2009). What has become known as *critical GIS* has nurtured experimentation on how existing tools and data structures of GIS could be used with non-positivist epistemologies, and how GIS could be changed to better fit those epistemologies. Reflection on what should be done next, and an openness to experiment without knowing where the path may lead, characterizes critical GIS. This is quite

different from the first wave of debate, when critics found shortcomings in GIS and then closed off conversations. This open and inquisitive stance of critical GIS is also deliberately foregrounded in diverse economies theory, where just because an economic alternative might have negative impacts or face the chance of cooptation does not bring just cause to stop thinking through it. These similarities are one way that GIS and diverse economies are compatible. GIS can be a means of revealing economic diversity, resisting capitalocentric discourse and reading for difference.

Using GIS to Visualize and Analyze Economic Diversity

GIS databases can be used to visualize a range of labour practices, types of enterprise, transactions, property or finance. Further analysis of such data could include a range of techniques, from using maps within focus groups, to spatial statistics or modeling. By mapping where diverse economic practices take place, GIS extends other visualization techniques such as the iceberg image to show that not only can we have a vocabulary of economic diversity but also that it exists in real places.

Researchers and activists have used maps in this way to create counter-narratives that show spatial patterns of the growth and expansion of non-capitalist enterprises. Projects in North and South America as well as Europe have mapped the solidarity economy by drawing on secondary data, field observations, interviews, and participatory approaches (Borowiak 2015; Safri et al. 2017). Outputs from this work include online interactive maps. They allow users to see point locations of solidarity economy enterprises on web-based maps, which are hosted on a variety of platforms such as OpenStreetMap, Google Maps, or custom-built applications, many of which are maintained by grassroots organizations. Second, advanced techniques are used to dynamically cluster points at regional and national map scales on other web maps. For example, the U.S. Solidarity Map (solidarityeconomy.us) shows individual locations and types of enterprises at local scales, and it clusters points when zoomed out so that users can easily see broader spatial patterns (Safri et al. 2017). These maps allow users to find solidarity economy sites and also serve a performative role in

showing the geographical ubiquity of economic diversity. This cataloging and visualization leverages the power of maps to make the invisible visible (Pavlovskaya 2018). As Safri et al. note "being on the map requires articulation in theory, policy, and practice" (2017, 72). Such work provides a different discourse than one in which alternatives are understood as piecemeal or anecdotal and disrupts a narrative of an all-encompassing capitalism.

Spatial analysis of urban diverse economies shows how GIS can help explain the complexity of diverse economic processes. Pavlovskaya (2002, 2004) examined daily household experiences in Moscow to understand women's lives in light of the expected improvements after the fall of the Soviet Union. To reveal urban change at a neighborhood scale, she constructed datasets with the following materials: phone books of urban establishments, maps of building footprints that showed the spatial area of individual buildings, and household interviews. Through the combination of interviews and GIS, a diverse economy comprising household labour, informal exchange, and formal markets were traced in a way that was not possible through official state data. Likewise, the automation and speed of GIS allowed her to process a large amount of data that otherwise would have been unfeasible. While the project drew on the ontological power of mapping to reveal the invisible as in the visualization examples above, it also used the analytical capacity of GIS to explore the processes that accompany diverse economies.

In a project on solidarity economies GIS has supported the analysis of demographic and diverse economy data for Philadelphia and New York (Pavlovskaya and Eletto 2018; Borowiak et al. 2018). These projects examined whether the growth of enterprises such as cooperatives and people-focused financial institutions such as credit unions had uneven race and class impacts. This was done by comparing enterprise locations to socio-economic census data in GIS. In both cities, there was spatial fragmentation in terms of both race and class, which showed that diverse economic enterprises and institution are not evenly accessible or experienced. Credit unions in New York, for instance, were spatially clustered according to whether they were simply member-owned or also

had explicit aims to serve racial minority and working-class populations (Pavlovskaya and Eletto 2018). In Philadelphia, GIS was used to integrate analysis of multiple types of enterprises, including cooperatives, community gardens, community land trusts, time banks, and credit unions, rather than record only individual types of enterprises (Borowiak et al. 2018). This meant that the solidarity economy as a whole was visualized. One aim was to perform economic diversity by visualizing a coherent whole--the resulting maps showed that solidarity enterprises were a part of larger interconnected local and regional economies not isolated or fragmented practices.

Commons and commoning processes are also visualized through GIS analysis through both primary and secondary data. As the following examples show, this includes using data specifically created about commons, and also turning secondary data on capitalist activity into a source of diverse economies data. Drake and Lawson (2015) have used GIS to reveal the spatial extent of an actually existing commons. They conducted a survey of community gardening organizations in the U.S. and Canada to complement a literature characterized by detailed qualitative case studies of individual gardens. Statistical analysis of the survey data revealed shared challenges and benefits of the process of sustaining commons, and GIS was used to visualize the locations of the survey respondents. With this, the ontological power of mapping showed a spatial pattern of community gardens that stretched across nearly all the populated areas of North America. This form of commoning thus appeared as an expansive presence.

Second, commons can be revealed by reading spatial data for difference. *Reading for difference* within the diverse economies framework is a technique to resist reading landscapes, ideas, and practices as dominated by capitalism and to instead look for hidden but potentially ubiquitous non-capitalist ones. I suggest here that spatial data can also be read for difference, as shown in the following example of fisheries. Spatial data used in GIS often originates as state-produced datasets about populations, especially in the U.S. where secondary data is publicly available. The process of producing data and maps about populations and territories has been

theorized not as a neutral reflection of space but as a process through which knowledge and power are co-produced (Foucault 2007). As such, official government statistics are not neutral reflections of a place and its people but actively work to discipline how people think and behave. Economic indicators such as gross domestic product, for instance, normalize capitalist practices as legitimate, bring formal market-based exchange into being, and render economic diversity invisible (Mitchell 2008). Fisheries data likewise are constructed in a way that privileges the individual commercial fisherman as discussed below. From a critical interpretivist approach, state-produced datasets could be read for the dominance of capitalism. However, datasets can also be read in ways that do not reproduce the discourse of capitalist dominance to instead find emergent economic diversity.

The case of community fisheries management in New England illustrates how to read spatial data for difference (St. Martin 2005; St. Martin and Hall-Arber 2008). Marine spatial planning is largely based on the assumption that fishermen are utility-maximizing individuals and thus apt to overharvest. This assumption has pushed policy towards privatization of the marine commons. St. Martin's research with others used secondary GIS data to reveal another reality—that certain areas of the Atlantic Ocean have been collectively managed by communities of New England fishermen. Data on commercial fishing trips from the National Marine Fisheries Service, which was originally encoded in a way that represented fishing as an individualistic pursuit, was instead processed to show territories at sea. Point data on the locations that individual boats traveled to were categorized by each boat's home port. Kernel density surfaces were then made from these points. This resulted in color-coded regions in the ocean that corresponded to ports. The project revealed that the ocean was not a site of hyper-competitive individualistic fishing but a commons that was negotiated and shared by communities for responsible fisheries management.

Revealing Past Layers of Economic Diversity

GIS can also uncover historical economic diversity, which matters because alterity is not just a contemporary phenomenon (McKinnon 2010). Historical approaches to diverse economies have included discourse analysis of parks and urban agriculture, showing how narratives of monolithic capitalist urban space are the outcomes of historically contingent and fragile processes rather than unstoppable forces (Gabriel 2011; Drake and Lawson 2014). In terms of GIS, the following example of my research draws on historical census data and maps in order to create a spatial narrative of urban space as something other than dominated by capitalist processes.

Chavez Ravine, two kilometers north of downtown Los Angeles, has been the location of the Los Angeles Dodgers baseball stadium since 1962 but was home to semi-rural, primarily Mexican-American neighborhoods from the late 1800s until the 1950s. Popular and scholarly narratives focus on the eviction and razing of three neighborhoods through an urban renewal program (López 2005; Laslett 2015). While the case exposes institutional racism, it also typically employs a capitalocentric narrative of urbanization. The community is thus defined and identified by its displacement. Rarely told is how the community persisted for decades so close to the center of a rapidly growing city, or the spatial dimensions of residents' lives (cf. Normark 1999).

A spatial data binary was evident in the dominant narrative--displacement and enclosure were easy to recognize and made even more real through the use of quantitative data, yet everyday life was moved to the background and had little evidence except for anecdotes. Although displacement occurred, it is reified as the only possible story through systematic, structured data, while stories of livelihoods are tangential sidenotes. Indeed, state documents in the 1950s represented the area as a slum and wasteland instead of as a place filled with social life, and critical scholarship in recent years quantified the number of people forcibly removed but provided few statistics on the socio-economic livelihoods preceding the removals (Laslett 2015). I aimed to bring

those livelihoods into the center by assembling systematic, structured data in a way that rendered those livelihoods visible once more.

I used data from the 1940 U.S. Census and archival maps to make demographic maps of pre-displacement Chavez Ravine and overlaid these data onto current maps. Such mapping is routine work for current or recent data, but for Chavez Ravine it meant taking streets and houses that no longer exist and returning them to maps, and then using census data to describe variations in neighborhood social geography. First, scanned original enumeration documents were accessed from the 1940 census. These records showed individuals' responses to census questions, which were made public in 2012. They also provided the street addresses of each person who was surveyed. Archival maps were then used to identify street names and locations within Chavez Ravine. These maps were necessary because nearly all streets in the study area from 1940 no longer exist—they have been replaced with the stadium's parking lots. Historical street intersections (i.e. not found on current maps) were used as search criteria to download census data. A random sample of 62 individuals were selected and digitized as GIS point data based on the home address shown in the census enumeration data; these individuals were marked as the head-of-household, meaning they were the primary breadwinner. The locations of the points corresponded to home addresses, and the attribute data were selected from census variables such as place of birth, housing, and employment. Address locations were determined by consulting archival Sanborn Fire Insurance atlases, which were highly detailed maps showing the addresses of individual parcels.

This data unsettles historical discourses that the area was a slum or wasteland, and also gives vibrancy that is missing from dominant accounts (figure 1). First, there was more spatial variety in Chavez Ravine than previously discussed. I identified two more neighborhoods in addition to the three that are the focus of existing accounts. Two of these neighborhoods overlaid spatially with current-day neighborhoods. Additional homes were scattered throughout Chavez Ravine but did not appear to be clustered into neighborhoods. Next, the 62-person sample's socio-economic geography

was diverse: 42% were born in Mexico, 32% in the U.S., and 26% in Europe. Across the five neighborhoods, the sampled heads-of-household were spatially dispersed by place of birth; there was no clustering of people according to where they were born. Last, in terms of cash economy, there was an uneven spatial pattern in annual income: The 1939 average annual income of the five neighborhoods, based on the sample, ranged from $153 to $925 (the average U.S. income in 1939 was $956). Census respondents from neighborhoods with lower average incomes reported a less diverse range of occupations, such as labourers and gardeners, while higher-earning neighborhoods also reported skilled trades, merchants, and truck drivers. Two brick-making factories had also been located in the area.

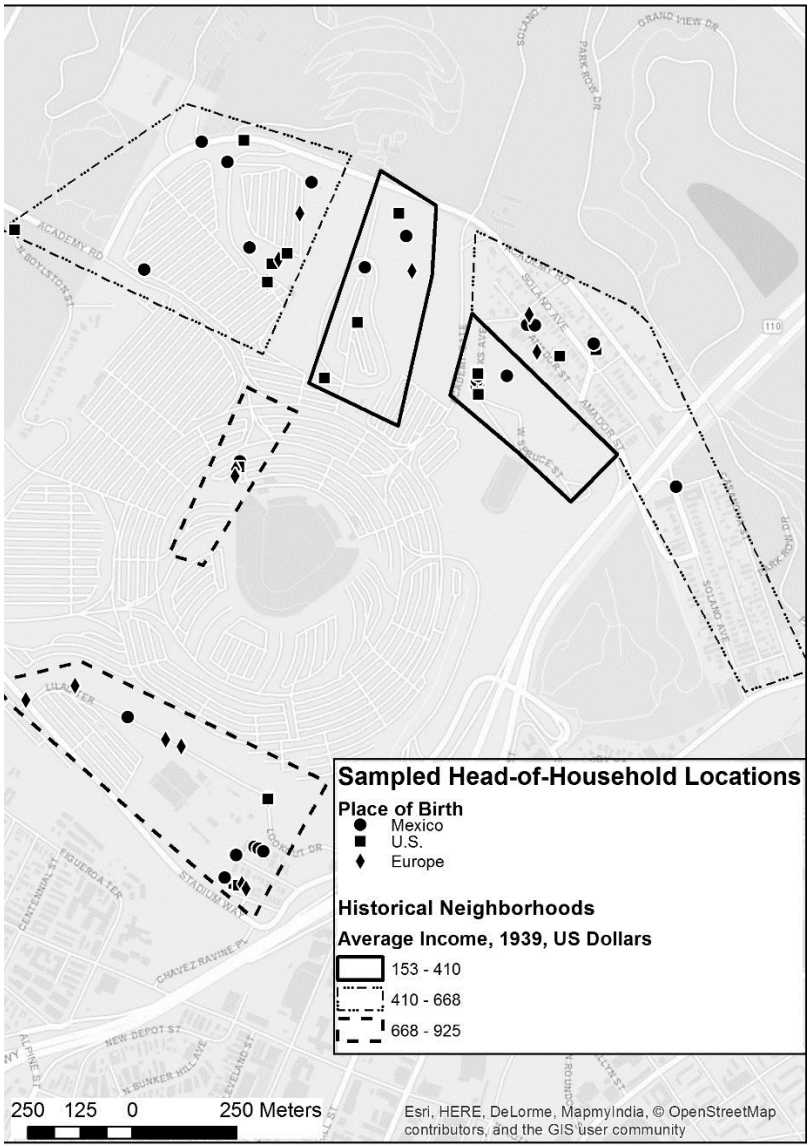

Figure 1. Overlay of 1940 neighborhood data with a basemap of current locations of stadium, parking lots, streets and residential areas

This snapshot of Chavez Ravine shows how GIS and historical maps can be used for historical diverse economies work. The methodology required conscious effort to resist slipping into a strong theory of historical change. This was challenging; indeed, it would have been easier to use the data to affirm the timeline of displacement and destruction. To do so would have performed a discourse of dominance, and the neighborhoods would have remained erased. Instead, I aimed to make those livelihoods real through the mapping and measurement of historical data, and to bring those spaces out of tangential anecdotes into a formal map discourse that lends a sense of truth to what had been located there.

Conclusions

The use of GIS to research and perform diverse economies follows critical reflection on the multiple ways that methodology and epistemology are related. Critical GIS emerged through a shift in views on GIS from inherently problematic to having transformative possibilities. Diverse economies emerged from critical economic geographers' efforts to theorize post-capitalist possibilities. Both involve an open stance toward experimentation with method and theory. When negative social impacts of GIS were identified, critical GIS scholars did not summarily dismiss the technology but instead sought creative ways to work through these issues (see Elwood 2006). Diverse economies scholars take a similar approach to critique, in that their aim is not to find ways that economic alternatives are doomed to fail or cooptation, but to "seek pathways, connections and surprising alignments" (Gibson-Graham 2016, 360). Critical GIS and diverse economies share a resistance to "I told you so-ism" (ibid.), and they show how critical research does not have to be driven by a strong theory of dominance. Indeed, scholars working from a diverse economies perspective contributed to the development of critical GIS. However, the use of GIS for diverse economies research has been limited. There is much opportunity to expand and extend the brief examples provided here.

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