

ORIGINAL RESEARCH ARTICLE

Leveraging Geographic Information in Organization Studies: Beginning the Conversation

Rebecca A. Costantini^{1*}, and Courtney M. Thompson²

¹Department of Communication, William Paterson University, Wayne, NJ, USA

²Department of Geography, Texas A&M University, College Station, TX, USA

Abstract

We propose geographic information systems (GIS) as a framework in organization studies, particularly for scholars who consider the nuances of space and geography in various organizational contexts. GIS are computer-based systems that manage, store, analyze, and distribute spatial data. While more and more scholars recognize the theoretical significance of organizational space, suggestions for conducting empirical research around organizational space using alternative frameworks – such as GIS – are seldom made. We present an introduction to GIS and various spatial analyses through a case study of organizations in the reproductive healthcare field and offer future directions related to the geographic implications of understanding organizations and organizing through GIS.

Keywords: GIS; Organization studies; Geospatial inquiry; Spatiality; Organizations

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Understandings of *space* in the field of organization studies have long drawn inspiration from critical geography. With roots in scholarly conversations from the 1960s to 1970s, conceptualizations of space as a discursive, material, and political formation have been taken up by many scholars across paradigms and schools of thought. These interpretations of space were derived from scholarship put forth by critical geographers and scholars of the spatial turn, including Henri Lefebvre, Bruno Latour, David Harvey, Yi-Fu Tuan, and Doreen Massey (to name a few). According to the spatial turn, 'geography matters not for the simplistic and overly used reason that everything happens in space, but because *where* things happen is critical to knowing *how* and *why* they happen' (Warf & Arias, 2008, p. 1). The spatial turn represented a paradigm shift that acknowledged the socially constructed, contradictory, and dynamic nature of space and the literal and metaphoric roles it serves in our daily lives. In this way, space effectually shapes and affects all social processes.

Many significant publications have contributed to advancing the ontological status of space within organizations and organizational life (see, e.g., Ashcraft et al., 2009; Beyes & Steyaert, 2012; Fairhurst & Cooren, 2009; Vásquez & Cooren, 2013).

Studies on organizational space have predominantly worked with qualitative methods but have not comprehensively mapped space visually, which is why we propose geographic information systems (GIS) to do precisely that. GIS are computer-based systems that facilitate the maintenance, storing, analysis, production, and distribution of spatial data (Bolstad, 2016). GIS process data related to the location of physical entities, events, and activities on the Earth's surface (Maliene et al., 2011). While more scholars recognize the theoretical significance of organizational space, suggestions about how to conduct empirical research around organizational space using alternative methodological processes – such as GIS – are seldom made.

The organization studies literature often alludes to the geographic potential of organizations by framing organizations as conduits and channels (Owen-Smith & Powell, 2004), ecologies (Carroll, 1984), and knowledge clusters and networks (Gambardella & Giarratana, 2010). A large body of organization studies scholarship also draws inspiration from critical geography, applying notions of 'mapping' and 'space' when theorizing about organizations and organizational effects. Within this spatial theorizing of what organizations are lies the possibility of understanding organizations geographically,

*Corresponding author: Rebecca A. Costantini, Email: costantinir@wpunj.edu

beyond the highly conceptual nature of space. However, these geographic possibilities are often not materialized into mapping efforts and spatial analyses. Similar to how other disciplines have adopted GIS, so, too, can organization studies as a framework to answer questions that include – but are not limited to – issues around the material aspects of organizing and organizational space, proximities, spatial configurations of organizational life, the communicative dynamics of social and community relationships, economic opportunity, and the built environment (e.g., rural and urban spaces).

This paper reflects on the possibilities of adopting GIS as an information system within organization studies to answer these questions from a different spatial lens. We believe that GIS can aid in the understanding of *where*, *why*, and *how* things happen. Therefore, this paper proposes GIS as a framework in organization studies, particularly for scholars who consider the nuances of space and geography in various organizational contexts. To further demonstrate how GIS might be leveraged in organization studies, we also present an empirical case study using organizations from the reproductive healthcare sector.

A note on the case study and this paper

We specifically chose reproductive healthcare-related organizations as the focus of the case due to their dynamic, conflict-driven nature and shifting geographic presences. Furthermore, GIS are a frequently used technology in public health research, including reproductive healthcare, so we draw from existing scholarship that has implemented GIS in reproductive healthcare and organizational contexts. As such, we demonstrate that GIS can be used in organization studies. Firstly, we outline what GIS are and how GIS have been applied when understanding organizations and issues related to reproductive healthcare. Secondly, we present a case study that investigates various spatial considerations of organizations in the reproductive healthcare sector. Finally, we discuss how GIS and geospatial practices can address organizational problems and advance empirical methods in organization studies.

We also acknowledge that this paper is an interdisciplinary effort. The styles we approach the paper from are very different, even when comparing how we understand and conceptualize space in qualitative to quantitative research. By training, Rebecca is a critical qualitative organizational communication scholar, and Courtney is a human-environment geographer who uses quantitative spatial methods. As you read our paper, be mindful that it is vastly different from a typical article. To bridge similar scholarly conversations and ideas, we truly attempted to write interdisciplinarily for several fields, including organization studies, geography, communication, and public health.

Geographic information systems and the spatial possibilities of organizations

GIS are computer-based systems that facilitate the maintenance, storing, analysis, production, and distribution of spatial data (Bolstad, 2016). More specifically, GIS are automated mapping and analysis systems that process copious amounts of data related to the location of physical entities, events, and activities to describe and locate places on the Earth's surface (Maliene et al., 2011). Depending on the context, GIS can refer to a toolbox of functionalities, a form of scientific inquiry, or an information system (Star & Estes, 1990). For this paper, we situate GIS as an information system composed of five primary components: people, data, methods/analysis, hardware, software (see Figure 1). Bolstad (2016) defines each GIS component as follows – *People* are the researchers, analysts, and technicians who ask questions and choose, collect, and analyze the data. *Spatial data* are representative of a specific geographic location on the surface of the Earth, such as longitudinal and latitudinal coordinates, and are critical for creating maps or running spatial analyses. *Methods* are the guidelines, specifications, procedures, and standards for analyzing and applying GIS. *Hardware* is the physical machinery that supports GIS, such as computers and additional equipment. Lastly, *software* are different programs, such as ArcGIS or R, that can facilitate and conduct spatial analysis. Together, these components form a GIS, an umbrella term covering multiple research modes of inquiry, techniques, and sets of methodological tools.

GIS rely on spatial data or information about the geographic positioning of events on the Earth's surface. The relationships and interactions present in spatial data are communicated through various methodological approaches and models offered through spatial analysis (Haining, 2003). What makes GIS particularly unique is its ability to take information about the real world and tie it to a spatial location. As Bodenhamer (2008) stated, the power of GIS 'lies in its ability to integrate data from a common space, regardless of its format, and to visualize the results in combinations of transparent layers on a map of the geography shared by the data' (p. 100).

Originally developed by geographer Roger Tomlinson in the 1960s, the earliest function of GIS focused specifically on punch-card data entry, which summarized and measured geographic regions and their characteristics (Maliene et al., 2011). GIS has since evolved to consider a wide variety of capabilities and geographic phenomena, including geoprocessing (1960s), geographic information management (1970s), and spatial support systems (1980s). Over time, GIS-related technologies and tools have become more affordable and accessible for its users through enhanced database management systems, graphics, server accessibility, and storage capabilities, and internet map environments.

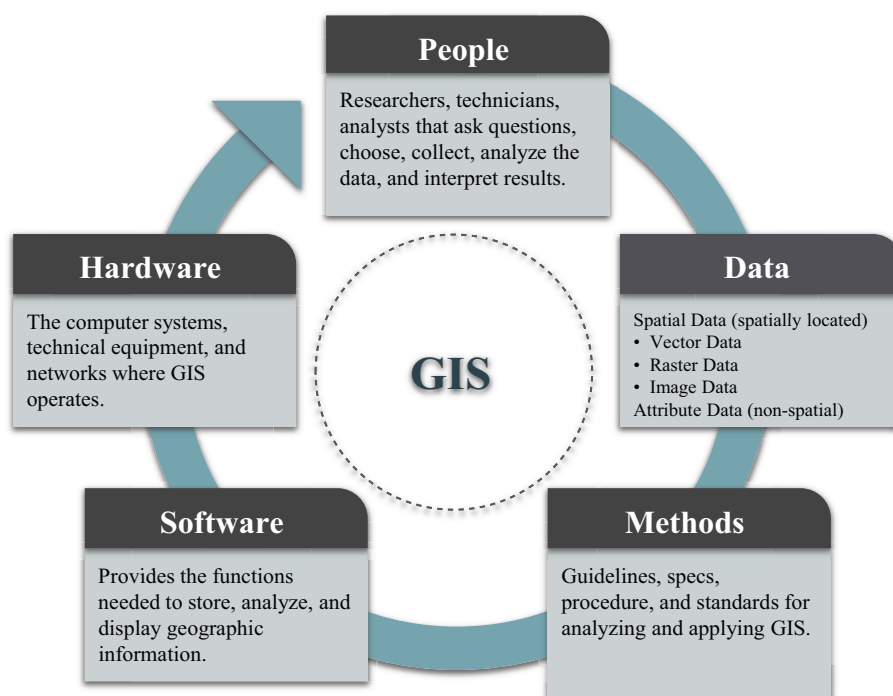


Figure 1. The five components of a GIS system. This figure was reproduced based on a figure by the Environmental Systems Research Institute, Inc. (1997)

In light of the changing nature of GIS, GIScientists and scholars of critical geography have offered divergent critiques about how GIS should and should not be used to address scientific inquiries. During the 1990s, critical poststructuralist scholars advocated for the decentralization of GIS' positivist-masculinist foundation (Crampton, 2001; Pavlovskaya, 2009; Sieber, 2006) and suggested alternative uses of GIS to consider marginalized populations, LGBTQIA+ knowledges, and the implications of space-time and place as social constructs (Kwan, 2002a). There was a call for a more reflexive GIS, one that reconsidered the implications of its positivist epistemological and ontological underpinnings (Schuurman, 2006). GIScientists, however, argued that poststructuralist critiques of GIS were grounded in theoretical abstraction, lacked relevance to the analytic, computational environment of GIS, and disconnected the technology from its inherent 'ontological basis in analysis and calculation' (Leszczynski, 2009a, p. 583). Although the debate between GIScientists and critical scholars has not always moved the discipline forward in productive ways (Kwan, 2002a, 2002b; Leszczynski, 2009b; Schuurman, 2006), the debates forged new opportunities for GIS to be applied in innovative capacities and across multiple disciplines and subfields.

In public health research, GIS are used for disease surveillance, mapping, and modeling (Fletcher-Lartey & Caprarelli, 2016; Parrott et al., 2010; Swienton et al., 2021); recognizing healthcare access and disparities within communities and

larger scale regions (Hawthorne & Kwan, 2012) and public participatory, collaborative efforts that facilitate community understandings of health (Cromley & McLafferty, 2011; Keddem et al., 2015). Many other disciplines, including anthropology (Padilla, 2013), policy planning (Greene, 2000), engineering (Haklay & Zafiri, 2008), sociology (Downey, 2006), and the digital humanities (Bodenhamer, 2008), have also used GIS in research.

Despite advances made in other disciplines, attention to GIS in organization studies remains scarce, although there have been several developments around geography in the current literature. Several approaches in the study of organizations explicitly draw from geography when positioning understandings of organizational space. This remains unsurprising, considering that familiarity with spatial possibilities continues to grow across disciplines (Doh & Hahn, 2008; Warf & Arias, 2008). Recent review studies published in the *Scandinavian Journal of Management*, *Organization Theory*, and the *Academy of Management Annals* reveal many concurrent and overlapping conversations about organizational space across the field of organization studies. Weinfurter and Seidl (2019), for instance, demonstrate in their review of 121 studies that scholarship on organizational space is primarily categorized by three predominant 'conceptual building blocks' (boundaries, distance, and movement), concepts that are widely discussed and applied in GIS research. Stephenson and colleagues (2020)

highlight various divergent understandings of organizational space, illustrating how authors foreground their theorizations in competing orientations and paradigms. Beyes and Holt's (2020) review also establishes that the focus of organizational space in the organization studies scholarship is largely rooted in varying theoretical conceptualizations of performativity and sociomateriality, namely how organizations are sited, situated, and enacted.

Developments of *organizational space* in the extant literature allows for the perpetual development of myriad interpretations and applications of the concept. Ratner (2019), for instance, situates organizational space as topological, examining how an organization emerges across a network of topological surfaces – these include documents, closed doors, presence of managers and staff – in the context of a management meeting. By understanding organizational space as topological, Ratner (2019) writes, 'organizational space [becomes] the emergent effect of socio-material agencies whose discontinuities take different topological shape' (p. 1525), ultimately demonstrating how organizational space can assume multiple forms. The geography of workspaces is also examined by Dale (2005), Hirst and Humphreys (2013), Pepper (2008), Sewell and Wilkinson (1992), Wasserman and Frenkel (2011), and Wilhoit Larson (2020), who comprise a small sampling of the *many* organization studies scholars who use spatio-geographic language to describe how organizational space enables, constrains, and shapes relations of power, workplace environments, productivity, and organizational identity. In a transnational context, Spicer (2006) uses the concept of spatial scales to theorize changes in space related to organizational globalization, defining spatial scales as 'different levels of space' that are 'socially produced' through political discourse and regulation through oversight mechanisms (p. 1470). Other scholars have sought to identify the socio-material processes of spatiality through alternative analytical frameworks. Vásquez (2016) proposes a spatial grammar of organising, a series of communicative processes 'involved in the constitution/materialisation/ embodiment of organisational spaces' (p. 358). Similarly, Beyes and Steyaert (2012, p. 53) call for an experiential understanding of organizational space 'as it happens' through performative organizational geography, an analytical framework that is 'attuned to the material, embodied, affective, and multiple sides and sites of organizing'. Bencherki (2021), Best and Hindmarsh (2019), Mengis et al. (2018), and Nash (2020), too, explore the practical, relational, and interactional constitution of organizational space through sensorial, embodied, and multimedia methodological approaches.

Capturing the various explications of organizational space is beyond the present scope of this article. Much of the extant critical organization studies and management literature place substantial conceptual and methodological emphases on space

and spatial theory as performative, embodied, discursive, and situated. However, the scholarship in which these studies build centers our attention on the geographic possibilities of organizations and organizing, yet only momentarily consider how we might apply such geographic considerations in the context of mapping efforts and spatial analysis. Considering GIS in organization studies may provide additional context around the network of spatial relationships between organizations, communities, public resources (e.g., education, healthcare), and the organizing and occurrence of events in more complex ways than are otherwise not possible to visualize. What differentiates GIS from existing theoretical and methodological approaches to organizational space is that it is not simply a method (see Figure 1). GIS is an information system, where methods/analyses are but one component of the system. GIS offers a divergent set of assumptions, research questions, and interpretations around space in its information systems environment through the quantification of space. We argue that it is through the application of a GIS system that allows us to further problematize space by adding an absolute metric to expand and offer new perspectives to the relational, relative understandings that currently exist in the literature. GIS can offer a visual, mapped quantitative context to qualitative findings.

Reproductive healthcare and GIS: An empirical case study

This study's case focuses on charting how GIS can yield deeper understandings of organizational space and the spatial relationships within and between organizations. To do this, we chose to build our case using organizations from the reproductive healthcare field. We define *reproductive healthcare* as the services and resources that assist in facilitating 'the physical, mental, and social well-being' of people, which empowers and promotes 'responsible, satisfying, and safe sex lives so [people] have the capability to reproduce and the freedom to decide if, when, and how often to do so' (World Health Organization, 2020).

Historical use of GIS in reproductive healthcare

To measure and analyze how reproductive healthcare is (un) available, barred, or (in)accessible among different communities and across geographic regions, scholars have used GIS to understand the geographic availability and distribution of reproductive healthcare (Gawron et al., 2017; McVeigh et al., 2017; O'Donnell et al., 2018); spatial inequalities and inequitable access to reproductive healthcare resources (Bearak et al., 2017; Sethna & Doull, 2013); and geographic barriers imposed by state and federal legislation (Grahovac, 2015; Pruitt & Vanegas, 2015).

Scholars who use GIS to understand organizations that support reproductive healthcare have drawn from many types of data sources and have engaged various qualitative, quantitative, and mixed methods to geospatial analyses. In the context of reproductive healthcare, geospatial analyses and related methods are often used to investigate distances to and from abortion clinics and/or other reproductive healthcare facilities to better understand barriers and restrictions related to reproductive healthcare access and determine the distribution of organizations that support reproductive healthcare across geographic regions.

Studies that consider distance as a factor in reproductive healthcare access attempt to investigate how the distribution and dispersion of organizations that support reproductive health perpetuate regional disparity. For instance, Sethna and Doull (2013) map women's travel routes to abortion service clinics across Canada using self-administered, written survey data and Canadian census data. Similarly, Gawron et al. (2017) consider the geographic availability of Veterans Healthcare Administration Medical Centers and family planning clinics for homeless Texan women veterans using publicly available administrative data (i.e., zip codes) to identify women veterans who experienced homelessness per the Veterans Healthcare Administration's identification.

McVeigh et al. (2017) also consider how organizations' geographic placement and distribution can hinder reproductive healthcare access impact accessibility. The authors investigate variations in the occurrence of crisis pregnancy centers (CPCs) – nonprofit organizations that seek to intercept women who might be considering abortion – across counties and how the overall distribution of CPCs is tied to religious values (Bryant & Swartz, 2018). Bearak et al. (2017), too, employ GIS methodological tools to investigate the unequal access to resources and services based on geographic location impacts individuals' accessibility to abortion clinics using abortion-clinic data from 2000, 2011, and 2014 to examine spatial disparities in travel distance to the nearest abortion clinic(s) at both state- and county-levels. Relatedly, Chaturvedi et al. (2015) explore the availability and distribution of abortion care at medical clinics by considering facilities within three districts of India's Madhya Pradesh region that provide reproductive healthcare services.

GIS has also been used to understand reproductive healthcare accessibility barriers and restrictions. For example, Grahovac's (2015) two-part, mixed-methods study explores the geographic and legislative impacts (2008–2013) on women's access to abortion at national, state, and local levels. O'Donnell et al. (2018) also explored the relationship between the county of residence and access to abortion care, which is more nuanced than measuring the distance to traveled care alone.

While these authors call our attention to how reproductive healthcare organizations and issues are influenced by

mitigating geographic factors, they do not necessarily consider the spatial relationships between organization types, which is a goal of this paper's case study (see Figure 2). There are examples in the organization studies literature that discuss how various internal and external spatial considerations impact organizations as they occur. However, there only exists the *possibility* to visualize and analyze these spatial effects from a geospatial perspective. Assessing the spatial relationships between CPCs and abortion clinics, for example, can provide insight into how spatial relationships between these organization types are understood and talked about in urban versus rural regions or in regions where access to reproductive healthcare is sparse. These spatial relationships might also reveal how the presence of one, or both, organization types juxtaposed against distances, community and individual knowledges, and other sociodemographic variables affect access to reproductive healthcare facilities that provide services and resources. Most importantly, GIS allows for both visual and metric depth to the cognitive, relative theorizations of space. In the following section, we discuss the methods of our case study and provide details about our data sources and spatial analyses.

Methods

Because GIS are so frequently used in the study of reproductive healthcare, we ground our case in organizations that function within this healthcare sector. We chose to focus our study on organizations within Texas for several reasons. Firstly, these organizations are a part of Texas' politically dynamic, shifting landscape of legislative initiatives that enable and constrain access to organizations that offer reproductive healthcare. For instance, when the Woman's Right to Know (WRTK) Act was passed in Texas in 2004, the legislation dramatically affected abortion availability across the state. Not only did it mandate a 24-h waiting period before *any* abortion procedure, but it also required that abortions after 16 weeks must be performed in specific facilities that met certified and approved ambulatory surgical center requirements (Colman & Joyce, 2011). The WRTK Act ultimately presented women with four limiting options for terminating their pregnancies – travel to another state to receive the abortion, abort the pregnancy before the 16-week mark, attempt to schedule a later abortion with a hospital, or see the pregnancy through to full term (Colman & Joyce, 2011). Subsequent legislation introduced nearly one decade later, such as House Bill 15 (HB15), which requires physicians to perform ultrasounds on women considering abortion care (Weitz & Kimport, 2015) and House Bill 2 (HB2), which further restricted abortion services and the presence of abortion clinics in Texas (Gerdts et al., 2016; Jones & Jerman,

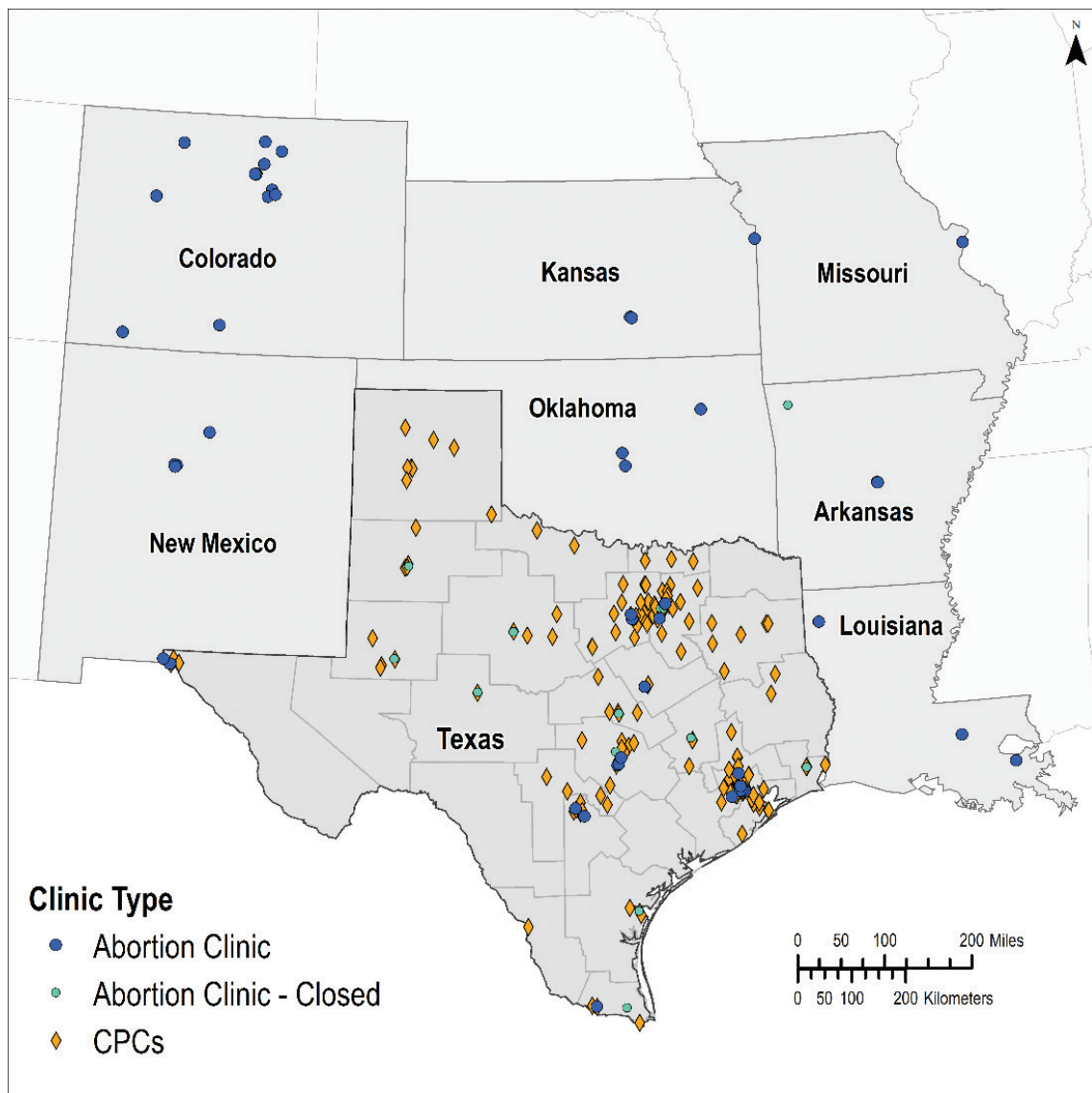


Figure 2. Study area – Abortion clinic and CPC locations in Texas and abortion clinics in the context of surrounding states

2014), diminished the availability of reproductive healthcare in Texas. Most recently, House Bill 1515 (HB1515)/Senate Bill 8 (SB8) (signed into law on May 19, 2021) is a near-total, 6-week abortion ban that creates a precedent for a private cause of action, allowing ‘anyone the authority to file suit against abortion providers’, regardless of their residency or connection to the person seeking abortion care (Nash & Cross, 2021; see also Davis, 2021; Tuma, 2021). WRTK, HB15, HB2, HB1515/SB8, among other anti-abortion legislation and initiatives in Texas, have contributed to larger issues that perpetuate disparity and stigma under the guise of promoting and defending women’s health (Hasstedt, 2014). In 2017 alone, more than 90% of Texas counties had no clinics that

provided abortions and more than 40% of Texan women lived in those counties (Guttmacher Institute, 2020). For this study, we pose the following research question: *What spatial relationships exist between organizations in the reproductive healthcare sector?*

As demonstrated in Figure 3, we built our GIS system for this project using different data sources and spatial analyses to answer key questions around the relationships between organizations in the reproductive healthcare sector in Texas. We, the authors, were the primary people responsible for asking questions and collecting, analyzing, and interpreting our data. Our data were derived mainly from public sources (e.g., the U.S. Census Bureau, American Community Survey [ACS]).

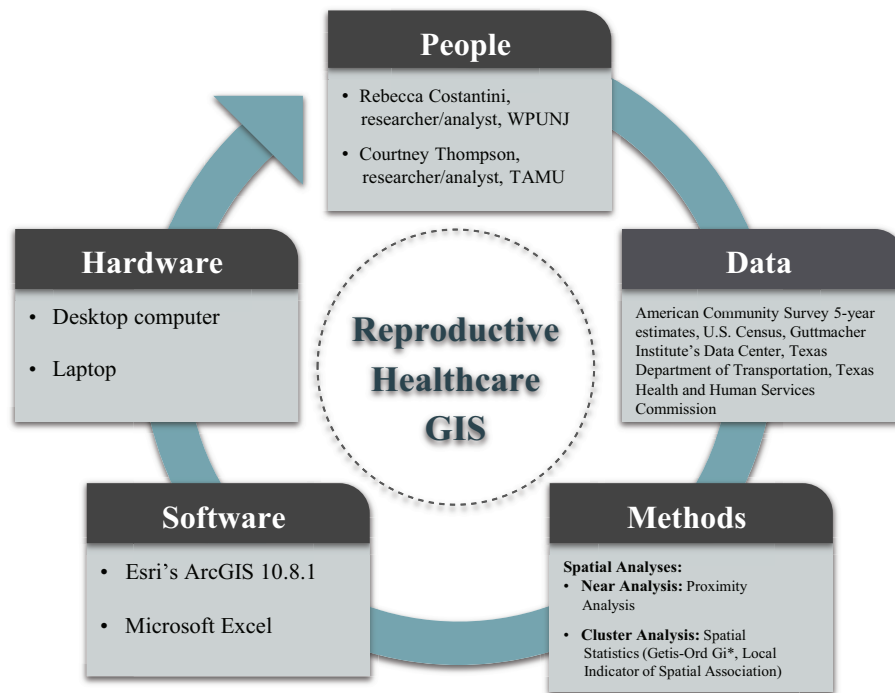


Figure 3. The five components of the GIS system created for this study. This figure was reproduced based on a figure by the Environmental Systems Research Institute, Inc. (1997)

The given methods describe the spatial analyses we employed to answer questions related to the distance proximities between CPCs and abortion clinics in Texas using Esri's ArcGIS (v.10.8.1) software and desktop computers.

Data collection

To understand approximate abortion clinic accessibility, several datasets were gathered for abortion clinics and crisis pregnancy centers, racial and ethnic population groups, and major roadways in Texas. Abortion clinic locations in Texas were collected as addresses and latitude and longitude coordinates through open records requests from the Texas Health and Human Services Commission and manual internet searches. Abortion clinics are defined as facilities that provide abortion care as a part of their reproductive health services (Jerman et al., 2017). Twenty-one locations were identified during the search and verified with the Guttman Institute's Data Center, which were then converted into a spatial point feature class. Spatial point feature classes are comprised of 'homogeneous collections of common features with the same spatial representation – such as points, lines, polygons – and a common set of attribute columns' (ESRI, 2008). This information is stored in a geodatabase. Broadly, a geodatabase stores spatial datasets in a common file system folder. ESRI identifies the four most frequently used feature classes in a geodatabase as points, lines,

polygons, and annotation (i.e., map text). Feature classes can be used to describe datasets in the same area. For instance, a neighborhood can be comprised of mailbox locations as *points*, water *lines*, parcel – or land – *polygons* and *annotations* for street names (ESRI, 2008).

CPC locations were also collected as addresses and latitude and longitude coordinates through open records requests from the Texas Health and Human Services Commission and internet searches. CPCs are defined as nonprofit, anti-abortion organizations that provide free services and resources to people to prevent abortion incidents (Bryant et al., 2014). At the time of data collection, 182 CPC locations were identified and cross-checked with manual internet searches. The website and address of each facility served as criteria to determine the legitimacy of each CPC location. The resulting data were then converted into a spatial point feature class.

Total population and racial and ethnic group populations estimates for Texas were gathered from the ACS 2017 5-year estimates at the block groups level. These table datasets (attribute data) were then joined to Topologically Integrated Geographic Encoding and Referencing (TIGER) Census vector shapefiles (spatial data), which are spatially referenced datasets (U.S. Census Bureau, 2020). Finally, major roads were downloaded as spatial datasets – or shapefiles – from the Texas Department of Transportation (TxDOT) Open Data Portal (Texas Department of Transportation, 2019).

Spatial analyses

Once the datasets were compiled and formatted for analysis in a GIS, several spatial analyses were conducted in ArcGIS to understand the availability and proximities of abortion clinics and CPCs surrounding Texas, which is important as abortion clinic accessibility is variable across the state. Spatial analyses are a type of statistical geographic analysis that explains patterns and spatial expressions of human and environmental phenomena, making them ideal for solving complex geographic problems. This project uses several types of spatial analyses, which are described in the sections that follow.

Near analysis. To examine abortion clinic accessibility across Texas, a series of proximity (or near) analyses were conducted using the abortion clinic and CPC facilities and the Texas population block group datasets. Near analysis measures the nearness between two variables. Proximity in this paper is measured in absolute units (i.e., miles) based on Euclidean distance, which is calculated based on straight lines (i.e., measuring distances from *Point A to Point B*). Euclidean distance is the distance algorithm used by most spatial analyses in ArcGIS, with the exception of network or cost analyses. A near analysis was employed between block group centroids and CPC and abortion clinic locations to determine the three closest abortion clinics or CPC facilities to each census block group as a proxy for accessibility. Block group centroids represent the central location within a given block group. The data were joined to the block group demographic information to calculate the percent of the population whose three closest facilities include at least one abortion clinic. The data were further analyzed to determine how abortion clinic accessibility varies between racial and ethnic groups throughout the state.

Another near analysis identified the distance between each block group and the closest abortion clinic. The resulting distances were then classified into five major categories: (1) *less than 5 miles*, (2) *5 to 14 miles*, (3) *15 to 24 miles*, (4) *25 to 49 miles*, and (5) *50 or more miles*. These distances were chosen based on previous literature that set precedents for calculating facility distances within Texas (see, e.g., Bearak et al., 2017; Gawron et al., 2017; Gerdtts et al., 2016; Grossman et al., 2017). This process was repeated for the closest CPC facility, whose distances were also reclassified into the five distance categories. The analysis results were then mapped by block group to illustrate the spatial differences between distance to abortion clinics versus CPCs across the state. The final near analysis calculated the proximity of abortion clinics and CPCs to the closest major road as another proxy for abortion clinic accessibility.

Cluster analysis. While proximity analysis provides context about abortion clinic accessibility, it does not identify spatial patterns between the location of abortion clinics and CPCs. We employed statistical cluster analyses to test the hypothesis

that potentially strategic placements exist when abortion clinics and CPCs establish themselves in certain areas. Specifically, the cluster analyses test the hypothesis that CPCs may not locate themselves near abortion clinics by random chance.

Two types of spatial clustering analyses were conducted to determine significant spatial clustering between abortion clinics and CPCs. A Getis-Ord G_i^* statistic was calculated using the ESRI Hot Spot analysis tool. The Getis-Ord G_i^* statistic identifies statistically significant (non-random) high- and low-value clusters (Getis & Ord, 1992; Ord & Getis, 1995). Spatial clusters of high values are hot spots, and clusters of low values are cold spots. Due to the binary nature of the dataset, the data were coded as 1 if the facility was an abortion clinic and 0 if otherwise. Thus, hot spots in the resulting analysis reflect the clustering of abortion clinics, and cold spots reflect significant clustering of CPCs. Spatial weights are based on Delaunay triangulation, where a mesh of nonoverlapping triangles is created from the point locations. Significant hot or cold spots are determined based on $p \leq 0.05$. The intensity of clustering is measured using z-scores (larger z-scores indicate more intense clustering) (ESRI, 2019b; Getis & Ord, 1992; Ord & Getis, 1995).

While the Getis-Ord G_i^* analysis identifies clusters of abortion clinics or CPCs, it does not demonstrate where there may be CPCs near abortion clinics and vice versa. A Local Indicator of Spatial Association (LISA) statistic was conducted to identify significant spatial relationships between the location of abortion clinics and CPCs (ESRI, 2019a). A LISA analysis is similar to the Getis-Ord G_i^* statistic in that it identifies clusters of high and low values (hot or cold spots). However, it also identifies spatial outliers (i.e., occurrences of a high value in a cluster of low values or vice versa) (Anselin, 1995). A LISA analysis was conducted on the same binary facilities dataset. Spatial weights are based on the same Delaunay triangulation conditions as the Getis-Ord G_i^* analysis. Significance is measured with a 95% confidence level and a $p \leq 0.05$. Clustering and outliers are indicated using z-scores, p -values, and a specific code for each significant feature's cluster type (High-High, High-Low, Low-Low, and Low-High) (Anselin, 1995; ESRI, 2019a). High-high (HH) values indicate clustering of abortion clinics, High-Low (HL) values indicate where outlier abortion clinics are near CPC clusters, Low-Low (LL) values indicate clusters of CPCs, and Low-High (LH) values indicate where outlier CPCs occur near abortion clinic clusters.

The Getis and LISA maps provide different information about the relationship between CPCs and abortion clinics. The LISA analysis identifies significant clustering of abortion clinics or CPCs and HL and LH outliers the Getis-Ord G_i^* would otherwise obscure. As a result, using both forms of spatial statistics is beneficial for understating spatial relationships between CPCs and abortion clinic locations. The results of the

Getis-Ord G_i^* hot spots and the LISA analysis were mapped to illustrate how the clustering of abortion clinics and CPCs vary across Texas.

Case study results

Near analyses

Based on the near analyses, most racial and demographic groups are closest to a CPC facility (see Table 1). A smaller percentage of white populations (8.34%) are closest to an abortion clinic than other racial populations (11.03 to 13.33%). This pattern is true for both the first and second closest facilities.

Abortion clinics are also more accessible in urban areas. Figure 2, combined with the ranked facilities, demonstrates that while some block groups may have an abortion clinic in their three closest facilities, those are not necessarily accessible in terms of distance. Therefore, the closest facility does not automatically indicate accessibility. Furthermore, CPCs are more prevalent and accessible in rural areas than in urban areas.

Table 2 summarizes the average distances of an abortion clinic or CPC to major roads. The average distance from an abortion clinic to a major road is less than 2 miles. This pattern accurately reflects the unequal distribution of abortion clinics in urban areas as compared with rural, as abortion clinics are predominately located in major urban population centers. Rural areas that are served more predominately by CPCs are similarly proximal to those locations. However, the maximum distance is much larger than abortion clinics, and there are far more CPCs than abortion clinics in general.

Table 1. Abortion clinic and CPC accessibility by racial and ethnic populations

Closest three facilities (by miles)		Racial/ethnic population groups				
		White (%)	Black (%)	Asian (%)	Other* (%)	Hispanic or Latino (%)
1st facility	Abortion clinic	8.34	13.33	12.38	11.47	11.03
	CPCs	91.66	86.67	87.62	88.53	88.97
2nd facility	Abortion clinic	12.94	12.93	10.88	15.59	16.82
	CPCs	87.06	87.07	89.12	84.41	83.18
3rd facility	Abortion clinic	15.30	11.34	10.28	16.59	20.22
	CPCs	84.70	88.66	89.72	83.41	79.78

CPC, crisis pregnancy center.

The near analyses do have some limitations. These distance calculations are based on block group centroids (i.e., population totals) and Euclidean distance. Conducting the same analysis using home parcels and an accurate road network to determine true distances traveled along with a road network to the nearest clinics would provide a more accurate facility accessibility assessment. However, this is difficult to accomplish at the state level because the level of detail necessary for an accurate road network for Texas and population estimates at a finer resolution than census block group is incredibly computationally costly or may not even exist, as block groups are purposefully delineated in a way that protects individuals' anonymity. Such an analysis would be more feasible for a smaller study area.

Overall, the near analysis exhibits a different method of thinking about and analyzing space. As we have demonstrated, space can be positioned in *absolute* terms, such as a unit of measurement, or relative terms, usually expressed in time, effort, or cost. While the maps in Figure 4 only illustrate absolute distance, this information still provides *additional* context for relative measures of accessibility, distance, and other attributes of space that currently exist in the organization studies literature. While such analyses are beyond the scope of this paper, there is scholarship that actively works to layer interview (and other qualitative) data into maps produced through GIS. Such studies have used GIS to demonstrate global and local economic trends in the Ugandan wedding industry (Whitesell & Faria, 2020), community-based knowledge of health effects (Keddem et al., 2015), and healthcare accessibility among low-income populations (Hawthorne & Kwan, 2012), among many other considerations. The methods we demonstrate here may provide the foundation for future opportunities to guide conceptual abstractions of space into the empirical in organizational science.

Clustering analyses

Figure 3 illustrates several areas identified by the Getis Ord* cluster analysis with significant abortion clinic hot spots (left map), all of which are located in urban areas and near major

Table 2. Statistics for miles from any facility to the closest major road

Clinic type	Number of clinics	Minimum	Maximum	Average	Standard deviation
Abortion clinic	21	0.001	1.554	0.440	0.485
Abortion clinic – closed	14	0.011	1.516	0.433	0.442
CPCs	182	0.002	5.095	0.671	0.798

CPC, crisis pregnancy center.

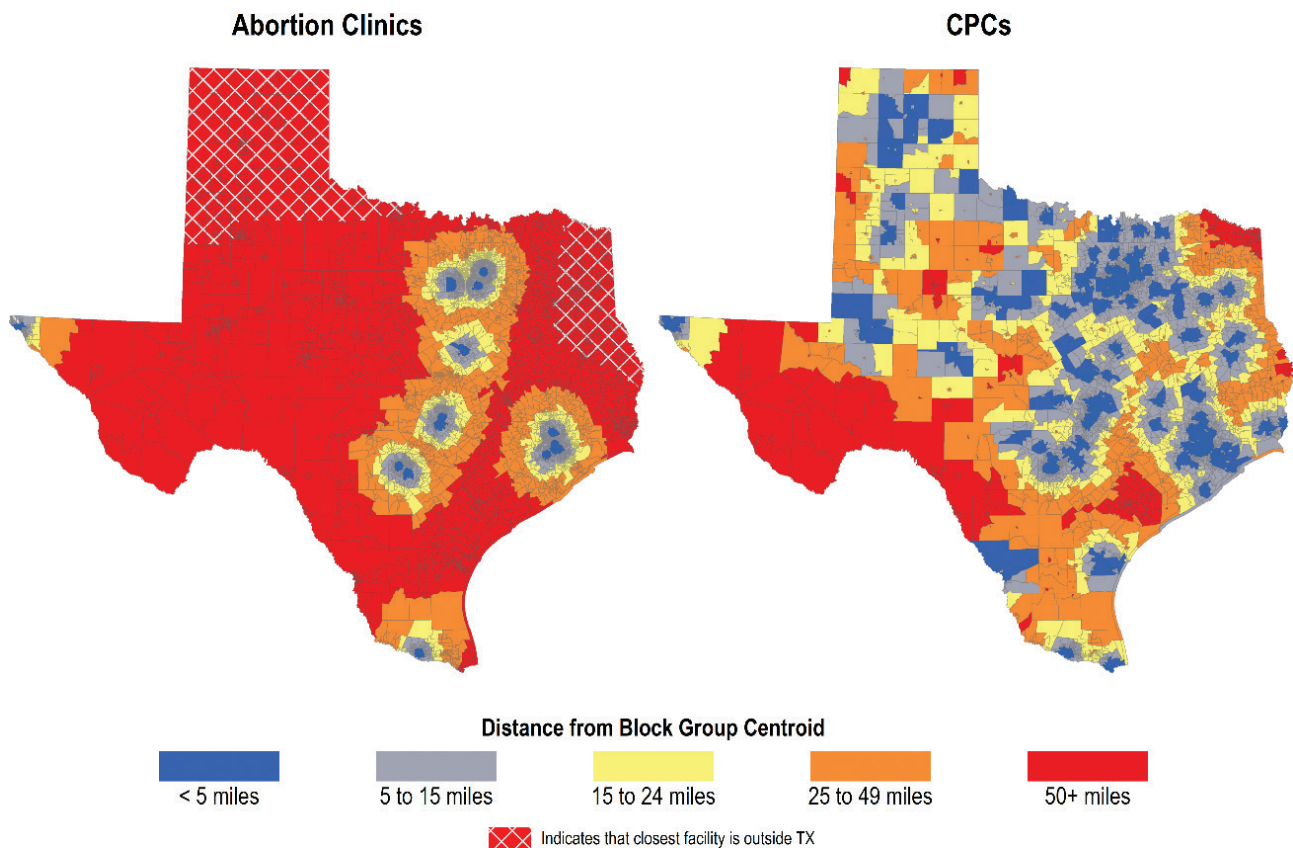


Figure 4. Distances from block group centroids to the nearest abortion clinic (left) and CPC (right) facility

population centers. This spatial pattern could occur due to several legislative restrictions, such as WRTK, HB15, and HB2 (see, e.g., Colman & Joyce, 2011; Hasstedt, 2014; Weitz & Kimport, 2015), meaning there are limited areas where abortion clinics can legally be located in the state of Texas. Notably, there is no significant clustering of CPCs (Figure 3), indicating a non-random factor that primarily influences abortion clinic locations alone.

While the Getis analysis demonstrates small levels of clustering of either CPCs (cold spots) or abortion clinics (hot spots), it does not identify spatial relationships between abortion clinics and CPCs. The LISA results examine clustering between abortion clinics and CPCs, as well as spatial outliers. The LISA results highlight several areas where there are CPC outliers near clusters of abortion clinics in the Getis maps (particularly in El Paso, Houston, San Antonio, and Austin). This suggests that there are CPCs located near abortion clinics that are likely not located there by random chance. Several abortion clinic outliers are also located near significant clusters of CPCs in other areas. Unsurprisingly, the analyses revealed a higher prevalence of abortion clinics in highly populated areas and a greater presence of CPCs in urban and rural areas. However, it is critical to highlight what else is true of the

specific connection between the locality of CPCs and abortion clinics in populated areas. The results indicate that CPCs and abortion clinics are competing presences in major city centers. The results also reflect location constraints that abortion clinics alone faced – and continue to grapple with – due to various legislative initiatives that have diminished the presence of abortion clinics in Texas, ultimately determining the locality of these clinics (Gerdt et al., 2016; Hasstedt, 2014; Jones & Jerman, 2014; Weitz & Kimport, 2015). It is important to note that the Getis and LISA analyses cannot determine the causality of these spatial relationships between CPCs and abortion clinics. Spatial statistics only identify spatial relationships that likely exist due to underlying socioeconomic processes.

Taken together, the cluster analyses in Figure 5 show that the clusters of CPCs and abortion clinics that we identified are statistically significant and not randomly distributed.

Uncovering the reason behind the clustering was recently explored in Costantini (2021), who identified spatial context in interview quotes from 67 interviews with members from abortion clinics, abortion funds, CPCs, and other related organizations across Texas. Quotes from the interviews demonstrated two dominant narratives about the locality of abortion clinics and CPCs. On the one hand, it was apparent that

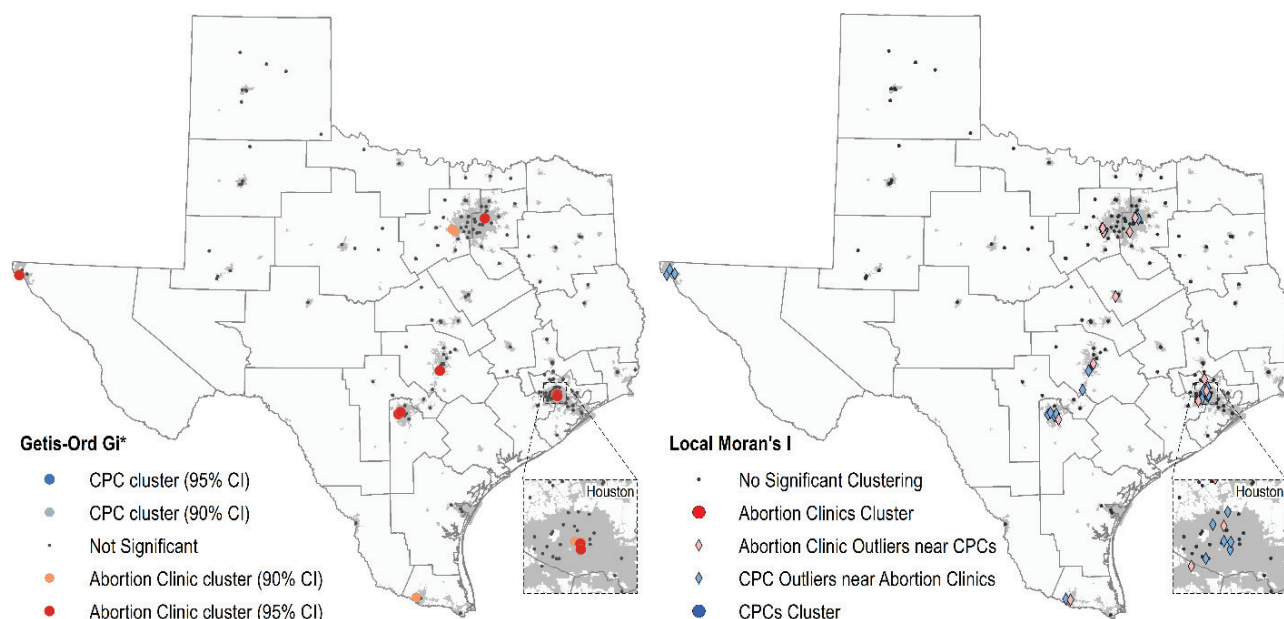


Figure 5. Getis-Ord Gi* (left) and Local Moran's I (LISA) (right) showing spatial clustering between abortion clinic and CPC locations

abortion-forward organizations are limited in how they can serve communities outside of where they are located. For these organizations, distance and locality are barriers that affect how service and care are delivered and accessed, particularly by rural clients. On the other hand, because CPCs have a dominant presence across Texas, it follows that issues and barriers related to locality, distance, and travel do not necessarily constrain their work or hinder their services and care delivery. Locality was not an issue for CPCs. Clustering is not a random process. Costantini (2021) demonstrated that other cultural, socioeconomic, planning processes, and limitations at work materialize the spatial patterns we identified. As such, the clustering patterns we identified do not occur randomly in space, suggesting that intentionality exists around abortion clinic and CPC locations across Texas.

Discussion

In this paper, we have presented an empirical case study around how GIS – as an information system – can be applied in the study of organizations. To accomplish this, we investigated the spatial relationships between organizations in the reproductive healthcare sector (see Figure 2). Our review of the geographic possibilities that exist in the organization studies literature identifies several hypotheses that could be explored and adapted further through the use of GIS: CPCs are attracted to specific locations based on population density and existing abortion clinic locations; abortion clinics' presence is greater in urban areas for accessibility purposes; CPCs have a

widespread presence in rural areas and abortion clinics have a diminished presence in rural areas due to restrictive legislation limiting their presence.

Our case study demonstrates how GIS exhibits the various spatial effects between organizations and organizing efforts. Our results identify spatial relationships between CPC and abortion clinic organizations. The results also illustrate that abortion clinics and CPCs are influenced by several spatial factors driven by legislation, locality, and demographics. However, it should be observed that our analysis offers only one example of how organization studies scholars may begin to use spatial data and analyses to understand how organizations and organizational effects are positioned in space. In reality, GIS can increase the information and context of organization studies scholars' current spatial endeavors by adding an absolute metric to a relative, conceptual understandings of space.

The near analysis shows us that accessibility, demographics, and locality matter while identifying where CPCs and abortion clinics are located in space. This mirrors developments made in the organization studies literature that consider how organizational locality is critical in understanding how organizations locate themselves in juxtaposition to similar and competing organizations, shape the land they occupy, their immediate communities, and their environments through organizational practices (Alcácer & Delgado, 2016; Chakrabarti & Mitchell, 2013; Guthey et al., 2014). The near analysis results also show that the distribution of CPCs and abortion clinics are dispersed unevenly across space in terms of accessibility and distance, which further establishes that organizations are constructed,

constituted, and situated in complex networks across space, in this case, urban and rural regions (Owen-Smith & Powell, 2004; Yeung, 1998). The methodological application of space and spatial proximities in the context of near analysis then shifts from: *How do organization studies scholars spatially theorize organizations and organizing?* to *How are hypotheses formulated to understand the spatial relationships in and between organizations and organizing?*

The cluster analyses illustrate that CPCs and abortion clinics are not randomly located in space; rather, they are likely *intentionally* located. These results align with developments that have been made in the organization studies and strategic management literature, specifically scholarship with an interest in understanding the geographic influences of the location choices of organizations and organizing efforts (Alcácer & Delgado, 2016; Guthey et al., 2014; Owen-Smith & Powell, 2004). Our results further support the benefits of using GIS across organizational studies to materialize geographic inquiry into visual spatial analyses, ultimately providing additional support for existing non-spatial scholarship.

Incorporating geospatial practices into organization studies

Although the spatial analyses demonstrated in this paper are relatively complex in relation to other spatial organizational studies, we believe the analyses – and the geospatial principles underlying the analyses – effectively reveal the opportunities GIS offers the organization studies discipline. As Leonardi and Barley (2008) remind us, ‘technologies that transform information not only offer affordances that change work practices; they often change the nature of [the] work itself’. To that end, GIS can change how organization studies scholars understand space, locality, problems of accessibility, and inequity by providing a quantitative context that can support qualitative findings. GIS are useful for delivering visual information about these types of phenomena because they ‘maximize public access to mapping and may be the most cost-effective means of providing people with analytical tools that would not otherwise be affordable’ (Krygier, 2005, p. 335). Approaching GIS in this way helps to increase access to a technology that can facilitate, organize, and visualize spatial data to identify spatial relationships between organization and organizing. Through GIS, organization-focused scholars can visualize spatial relationships that exist between organization types in a particular geographic region; illustrate where resources/services are located when identifying economic opportunities; encourage organization–community and organization–organization partnerships and help managers and company personnel, and decision-makers to understand existing demographic patterns, trends, and organizing of which they may not be aware. As an interdisciplinary field, we believe

organization studies are prime to embrace GIS to facilitate a new understanding of organizing, organizations, and locality. However, the question remains: *How do we begin?*

Given that complex quantitative geospatial approaches are an often-overlooked form of spatial analysis in the organization studies literature, adopting these approaches for understanding the spatial constitution of organizations can provide context that existing methods do not depict. A critical contribution of our analysis shows how mapping the geographic possibilities present in organizations *visually* illustrates the spatial relationships that exist between organizations. We recommend that organization studies scholars begin their endeavors by creating maps that illustrate their interpretations of organizational space. Traditionally, maps are defined as ‘a symbolized image of geographical reality, representing selected features or characteristics’ (Crampton, 2001, p. 240). Maps are rhetorical devices that participate in persuasive communication and exert authority through specific symbology (Harley, 1989). Decisions on what and how to convey information ultimately drive the spatial questions that underlie the creation of the map, such as control over content area, emphasis, and spatial relationships. This process is similar to how scholars purposefully situate and choose paradigms and theoretical frameworks that best support the research questions guiding their projects. We encourage the development of maps that call attention to the nuances of organizational space using some basic cartographic principles – such as legibility, visual contrast, and balance – to guide their visualizations. In a GIS context, maps are one of the main outputs used to communicate spatial information.

As we have reviewed, space is many things across the organization studies literature – conduits, boundaries, channels, discursive, networks, constituted, constructed, bounded, embodied, performative, relational, built, socially produced. From these conceptualizations, what does space actually look like? How might we map these spatial considerations? How, for instance, might Ratner (2019) map topological space in an organization? What does ‘being far’ and ‘feeling close’ (Wilson et al., 2008), conflict among geographically dispersed teams (Hinds & Mortensen, 2005), and managers’ locational experiences (Guthey et al., 2014) *look* like? More broadly, how might we begin to apply geospatial principles to discourses and the sociomaterial, affective, multi-mediated articulations of space?

Adopting more complex spatial methods and presenting information through the practice of mapping offers several methodological opportunities for organization studies scholars. The visual practice of mapping may continue to advance and crystallize the *topological understanding of organization* that exists in the organization studies literature. For Ratner (2019), topology provides a foundation ‘to explore organization as unfolding in different topological shapes, as an ongoing ‘process of figuration’ (p. 1514). Broadly, topology refers to spatial features’ relative (not absolute) positions (DiBiase, 2018).

Many geographers have articulated the contested use and application of topology, but as Martin and Secor (2014) put it, 'if there is something that unites geographers' uses of topology, it is a move to conceptualize the dialectic between continual change and enduring relations' (p. 422). Mapping a topological understanding of organization, then, compels us to communicate and show the changing nature of organizational space, the various processes, networks, and power relations that constitute organizational space and how they work, and how organizational space assumes multiple forms.

We also hope that communicating spatial organizational processes through maps might begin to press organization studies scholars to develop spatial reflexivity. We understand spatial reflexivity as a two-fold process: (1) recognizing how articulations of organizational space may advance or hamper extant conceptualizations and (2) how applications of organizational space as a theoretical concept and analytic situate real-world phenomena in productive, concrete ways. Developing spatial reflexivity invites organization studies scholars to visually detangle the multiple, diverging understandings of space in current literature. Practicing spatial reflexivity may also curb the excessive usage of space and related geographic terms in the organization studies literature for the sake of popularity. Therefore, we urge scholars to consider how their applications of organizational space advance existing theoretical arguments and incorporate other spatial perspectives – including geospatial approaches – in their continued efforts to evolve scholarship around organizational space.

Limitations and additional methodological directions

We recognize that organization studies scholars who draw from critical geography and socio-spatial perspectives may take issue with the positivist approaches presented in this paper. While GIS have been used in historically positivistic ways, this does not mean that the technology is rendered to be automatically positivistic (Leszczynski, 2009b). Similar to how space is conceptualized as a social construct, so, too, are GIS. GIS are a social construction and 'power relation' that embody the ideologies of those who use the technology to privilege and reify certain ways of thinking and doing over others (Pavlovskaya, 2009). The knowledge-based nature of GIS and map products is wholly driven by abstraction and, therefore, does not entirely mirror reality. As such, qualitative research has been used in parallel with GIS to examine how qualitative data and analysis methods can aid in the representations of map products and spatial analyses. Kwan (2002a), for example, explores the potentialities of revisiting and re-envisioning GIS and how feminist geographic research can help to enhance GIS practices, methods, and visualization technologies. Jung and Elwood (2010) evaluate efforts to merge GIS and qualitative

research to promote mixed methods research across disciplines. The authors raise important questions around this endeavor, including *How might photographs, transcripts of interviews, sketches, audio and video recordings, or other forms of evidence common to qualitative methods be integrated into a GIS?* (Jung & Elwood, 2010, p. 64). Relatedly, Keddem et al. (2015) use a mixed-methods, qualitative GIS approach to understand the asthma experiences and symptoms of those who live in low-income communities in West Philadelphia. One contribution Keddem et al.'s (2015) study offers is that the maps created for this study were generated based on community members' responses to, knowledges of, and experiences with asthma. Thus, a combination of methods may provide deeper, more robust explanations to pair with GIS. This is already at work in public participation geographic information systems (PPGIS) research.

PPGIS may also be valuable to organization studies scholars. Briefly, PPGIS are GIS information systems meant to 'map individuals by class, employment, ethnicity, religion, language, gender, and age; spatially analyze differential public mobility and access to social services; and comparatively visualize community deficits and assets' (Sieber, 2006, p. 493). PPGIS recognizes the tensions of power-knowledge dynamics, an awareness for alternative, hidden discourses and ways of imagining space and place (Cromley & McLafferty, 2011). In this way, PPGIS are mutually constituted through numerous perspectives in which individuals and organizations interact to develop and use technological systems that (re)produce those systems. However, Sieber (2006) cites that the primary weaknesses of PPGIS lie in its absent measurement strategies, which make it difficult for scholars to evaluate its effectiveness because the measurement strategies tend to be grounded in abstraction.

This paper provides one example of the multiple possibilities of employing GIS and geospatial principles in organization studies, so the conversation offered here is but one introductory discussion strand. Therefore, several overarching limitations should be addressed. It should be noticed that the CPC dataset we drew from is limited in some respects. Firstly, not all CPCs in Texas are represented. Some locations could also include other (non)religiously affiliated establishments or unidentifiable locations that do not publicize their addresses and have an online presence. Secondly, CPC locations are in constant flux, specifically 'pop-up' locations, which are established in informal settings, such as homes and churches. While operational at the time of the data collection, these locations could now be obsolete. This study only utilized CPC locations where the addresses and websites could be verified, with the understanding that the dataset is not comprehensive. It is also important to note that the maps crafted for this paper are not the sole representation of the collected data. Indeed, as we reflected earlier, there is no one true representation of data; various representations of data enable multiple applications of

the data to support different populations and needs. This study ultimately serves as a beginning conversation to understanding how GIS and geospatial principles can be applied to existing relational understandings of organizational space in the organization studies literature.

Finally, in a broader context, we recognize that a substantial learning curve exists when navigating any GIS for the first time. This paper is not meant to provide an all-encompassing overview of GIS. However, we offer an initial set of broad departure points for future work related to organizations, organizing efforts, and GIS. GIS can be used to understand: mobilities, pathways, and migration patterns of organizations and organizational teams; resource and service availabilities and efficiency across particular areas or regions; the effects of legislation and policies across concentrated or expansive areas, organization locality and the effects of time and distance, and risk and disaster assessment and management among organizations and teams. We also recognize that a substantial learning curve exists when navigating any GIS system for the first time. Many useful open source GIS software, texts, and tutorials are accessible online. In addition, we encourage readers to contact us, the authors, to continue these conversations.

Conclusion

We believe GIS matters in advancing the study of organizations, specifically within research articulating the influence of geographic location on organizational structures. The increasing opportunity and interest around grounding theoretical understandings of organizational space in technical, spatial terms raises new questions and hypotheses around how GIS can identify spatial relationships that exist between organizations, public goods, communities, and organizing efforts. Currently, there are little-to-no compelling conversations in the organization studies literature that speak about the possibilities of including GIS in organization studies scholarship. We attempted to address this gap with an empirical case study that demonstrates various spatial analyses and mapping techniques related to organizations within the reproductive healthcare sector. Furthermore, this paper illustrates the dynamics and function of spatial analyses for organization studies scholars interested in investigating and articulating geographic possibilities within their research.

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Author note

Rebecca A. Costantini is an Adjunct Professor in the Department of Communication at William Paterson University, USA. Dr. Costantini's research explores the communicative and spatial dynamics of contested organizations and organizing.

Courtney M. Thompson is Affiliate Faculty in the Department of Geography at Texas A&M University, USA. Dr. Thompson's research focuses on human-environmental inter-actions, specifically relationships between social systems and natural hazard impacts using GIS, survey analysis, and spatial statistics.

Disclaimer

At the writing of this paper, abortion access was available in Texas. In June 2022, the Supreme Court overturned *Roe v. Wade*, eliminating the constitutional protection to abortion access. Following this decision, abortion access was banned in Texas.

References

- Alcácer, J. & Delgado, M. (2016). Spatial organization of firms and location choices through the value chain. *Management Science*, 62(11), 3213–3234. doi: 10.1287/mnsc.2015.2308
- Anselin, L. (1995). Local indicators of spatial association – LISA. *Geographic Analysis*, 27(2), 93–115. doi: 10.1111/j.1538-4632.1995.tb00338.x
- Ashcraft, K. L., Kuhn, T. R. & Cooren, F. (2009). Constitutional amendments: 'Materializing' organizational communication. *Academy of Management Annals*, 3, 1–64. doi: 10.5465/19416520903047186
- Bearak, J. M., Burke, K. L. & Jones, R. K. (2017). Disparities and change over time in distance women would need to travel to have an abortion in the USA: A spatial analysis. *Lancet Public Health*, 2, e493–e500. doi: 10.1016/S2468-2667(17)30158-5
- Bencherki, N. (2021). Using video methods to uncover the relational, interactional and practical constitution of space. In S. Grosjean & F. Matte (Eds.), *Organizational video-ethnography revisited* (pp. 99–116). Palgrave Macmillan.
- Best, K. & Hindmarsh, J. (2019). Embodied spatial practices and everyday organization: The work of tour guides and their audiences. *Human Relations*, 72(2), 248–271. doi: 10.1177/0018726718769712
- Beyes, T. & Holt, R. (2020). The topographical imagination: Space and organization theory. *Organization Theory*, 1, 1–26. doi: 10.1177/2631787720913880
- Beyes, T. & Steyaert, C. (2012). Spacing organization: Non-representational theory and performing organization space. *Organization*, 19, 45–61. doi: 10.1177/1350508411401946
- Bodenhamer, D. J. (2008). Creating a landscape of memory: The potential of humanities GIS. *International Journal of Humanities and Arts Computing*, 1(2), 97–110. doi: 10.3366/E1753854808000207
- Bolstad, P. (2016). *GIS fundamentals: A first text on geographic information systems* (5th ed.). XanEdu.
- Bryant, A. G., Narasimhan, S., Bryant-Comstock, K. & Levi, E. E. (2014). Crisis pregnancy center websites: Information, misinformation and disinformation. *Contraception*, 90(6), 601–605. doi: 10.1016/j.contraception.2014.07.003

- Bryant, A. G. & Swartz, J. J. (2018). Why crisis pregnancy centers are legal but unethical. *American Medical Association Journal of Ethics*, 20(3), 269–277. doi: 10.1001/journalofethics.2018.20.3.pfor1-1803
- Carroll, G. R. (1984). Organizational ecology. *Annual Review of Sociology*, 10, 71–93. doi: 10.1146/annurev.so.10.080184.000443
- Chakrabarti, A. & Mitchell, W. (2013). The persistent effect of geographic distance in acquisition target selection. *Organization Science*, 24(6), 1805–1826. doi: 10.1287/orsc.1120.0811
- Chaturvedi, S., Ali, S., Randive, B., Sabde, Y. et al. (2015). Availability and distribution of safe abortion services in rural areas: A facility assessment in Madhya Pradesh, India. *Global Health Action*, 8, 1–7. doi: 10.3402/gha.v8i2.26346
- Colman, S. & Joyce, T. (2011). Regulating abortion: Impact on patients and providers in Texas. *Journal of Policy Analysis and Management*, 30(4), 775–797. doi: 10.1002/pam.20603
- Costantini, R. A. (2021). *The constitution of reproductive health(care): Understanding the communicative tensions of organization, identity, and geography* (Unpublished doctoral dissertation). Texas A&M University.
- Crampton, J. W. (2001). Maps as social constructions: Power, communication and visualization. *Progress in Human Geography*, 25(2), 235–252. doi: 10.1191/030913201678580494
- Cromley, E. K. & McLafferty, S. L. (Eds.). (2011). *GIS and public health*. Guilford Press.
- Dale, K. (2005). Building a social materiality: Spatial and embodied politics in organizational control. *Organization*, 12(5), 649–678. doi: 10.1177/1350508405055940
- Davis, W. [@wendydavis] (2021, April 22). *Friends, next week one of the most dangerous anti-abortion bills in the country will be voted on in the TX House. HB 1515 bans abortion at 6 wks (before most women even know they're pregnant) and creates a private cause of action against ANYONE who helps someone get an abortion.* [Tweet thread]. Twitter. Retrieved from <https://twitter.com/wendydavis/status/1385329584514551808>
- DiBiase, D. (2018). *The nature of geographic information. An open geospatial textbook*. Retrieved from <https://openlibrary-repo.ecampusontario.ca/jspui/bitstream/123456789/391/5/Nature-of-Geographic-Information.html>
- Doh, J. P. & Hahn, E. D. (2008). Using spatial methods in strategy research. *Organizational Research Methods*, 11(4), 659–681. doi: 10.1177/1094428107300340
- Downey, L. (2006). Using geographic information systems to reconceptualize spatial relationships and ecological context. *American Journal of Sociology*, 112(2), 567–612. doi: 10.1086/506418
- ESRI. (2008). *Feature class basics*. Retrieved from <https://desktop.arcgis.com/en/arcmap/10.3/manage-data/geodatabases/feature-class-basics.htm>
- ESRI. (2019a). *How cluster and outlier analysis (Anselin Local Moran's I) works*. Retrieved from <https://desktop.arcgis.com/en/arcmap/10.6/tools/spatial-statistics-toolbox/h-how-cluster-and-outlier-analysis-anselin-local-m.htm>
- ESRI. (2019b). *How hot spot analysis (Getis-Ord Gi*) works*. Retrieved from <https://pro.arcgis.com/en/pro-app/tool-reference/spatial-statistics/h-how-hot-spot-analysis-getis-ord-gi-spatial-stati.htm>
- Fairhurst, G. T. & Cooren, F. (2009). Leadership as the hybrid production of presence(s). *Leadership*, 5(4), 469–490. doi: 10.1177/1742715009343033
- Fletcher-Lartey, S. M. & Caprarelli, G. (2016). Application of GIS technology in public health: Successes and challenges. *Parasitology*, 143(4), 401–415. doi: 10.1017/S0031182015001869
- Gambardella, A. & Giarratana, M. S. (2010). Organizational attributes and the distribution of rewards in a region: Managerial firms vs. knowledge clusters. *Organization Science*, 21(2), 573–586. doi: 10.1287/orsc.1090.0449
- Gawron, L., Pettey, W. B. P., Redd, A., Suo, Y., Turok, D. K., & Gundlapalli, A. V. (2018). The "Safety Net" of Community Care: Leveraging GIS to Identify Geographic Access Barriers to Texas Family Planning Clinics for Homeless Women Veterans. *AMIA ... Annual Symposium proceedings, 2017*, 750–759. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5977597/>.
- Gerds, C., Fuentes, L., Grossman, D., White, K. et al. (2016). Impact of clinic closures on women obtaining abortion services after implementation of a restrictive law in Texas. *American Journal of Public Health*, 106(5), 857–864. doi: 10.2105/AJPH.2016.303134
- Getis, A. & Ord, J. K. (1992). The analysis of spatial association by use of distance statistics. *Geographic Analysis*, 24(3), 189–206. doi: 10.1111/j.1538-4632.1992.tb00261.x
- Grahovac, A. (2015). *Abortion access in the U.S.: Is it a fading reality? A mixed-methods approach*. [Master's thesis]. University of Illinois at Urbana-Champaign.
- Greene, R. W. (2000). *GIS in public policy: Using geographic information for more effective government*. ESRI Press.
- Grossman, D., White, K., Hopkins, K. & Potter, J. E. (2017). Change in distance to nearest facility and abortion in Texas, 2012 to 2014. *The Journal of the American Medical Association*, 317(4), 437–439. doi: 10.1001/jama.2016.17026
- Guthey, G. T., Whiteman, G. & Elmes, M. (2014). Place and sense of place: Implications for organization studies of sustainability. *Journal of Management Inquiry*, 23(3), 254–265. doi: 10.1177/1056492613517511
- Guttmacher Institute. (2020). *State facts about abortion: Texas*. Retrieved from <https://www.guttmacher.org/fact-sheet/state-facts-about-abortion-texas>
- Haining, R. (2003). *Spatial data analysis: Theory and practice*. Cambridge University Press.
- Haklay, M. & Zafiri, A. (2008). Usability engineering for GIS: Learning from a screenshot. *Cartographic Journal*, 45(2), 87–97. doi: 10.1179/174327708X305085
- Harley, J. B. (1989). Deconstructing the map. *Cartographica*, 26(2), 1–20. doi: 10.3138/E635-7827-1757-9T53
- Hasstedt, K. (2014). The state of sexual and reproductive health and rights in the state of Texas: A cautionary tale. *Guttmacher Policy Review*, 17(2), 14–21.
- Hawthorne, T. L. & Kwan, M. P. (2012). Using GIS and perceived distance to understand the unequal geographies of healthcare in lower-income urban neighbourhoods. *The Geographic Journal*, 178, 18–30. doi: 10.1111/j.1475-4959.2011.00411.x
- Hinds, P. J. & Mortensen, M. (2005). Understanding conflict in geographically distributed teams: The moderating effects of shared identity, shared context, and spontaneous communication. *Organization Science*, 16(3), 290–307. doi: 10.1287/orsc.1050.0122
- Hirst, A. & Humphreys, M. (2013). Putting power in its place: The centrality of edgelands. *Organization Studies*, 34(10), 1505–1527. doi: 10.1177/0170840613495330
- Jerman, J., Frohwirth, L. F., Kavanaugh, M. L. & Blades, N. (2017). Barriers to abortion care and their consequences for patients traveling for service: Qualitative findings from two states. *Perspectives on Sexual and Reproductive Health*, 49(2), 95–102. doi: 10.1363/psrh.12024
- Jones, R. K. & Jerman, J. (2014). Abortion incidence and service availability in the United States, 2014. *Perspectives on Sexual and Reproductive Health*, 49, 17–27. doi: 10.1363/psrh.12015
- Jung, J. K. & Elwood, S. (2010). Extending the qualitative capabilities of GIS: Computer-aided qualitative GIS. *Transactions in GIS*, 14, 63–87. doi: 10.1080/10647313.2009.01182.x
- Keddem, S., Barg, F. K., Glanz, K., Jackson, T. et al. (2015). Mapping the urban asthma experience: Using qualitative GIS to understand contextual

- factors affecting asthma control. *Social Science & Medicine*, 140, 9–17. doi: 10.1016/j.socscimed.2015.06.039
- Krygier, J. B. (2002). A praxis of public participation GIS and visualization. In W. J. Craig, M. Harris & D. Weiner (Eds.), *Community participation and geographic information systems* (pp. 330–345). Taylor & Francis.
- Kwan, M. P. (2002a). Feminist visualization: Re-envisioning GIS as a method in feminist geographic research. *Annals of the American Association of Geographers*, 92(4), 645–661. doi: 10.1111/1467-8306.00309
- Kwan, M. P. (2002b). Is GIS for women? Reflections on the critical discourse in the 1990s. *Gender, Place & Culture*, 9(3), 271–279. doi: 10.1080/0966369022000003888
- Leonardi, P. M. & Barley, S. R. (2008). Materiality and change: Challenges to building better theory about technology and organizing. *Information and Organization*, 18(3), 159–176. doi: 10.1016/j.infoandorg.2008.03.001
- Leszczynski, A. (2009a). Poststructuralism and GIS: Is there a 'disconnect'? *Environment and Planning D: Society and Space*, 27(4), 581–602. doi: 10.1068/d1607
- Leszczynski, A. (2009b). Quantitative limits to qualitative engagements: GIS, its critics, and the philosophical divide. *The Professional Geographer*, 61(3), 350–365. doi: 10.1080/00330120902932026
- Maliene, V., Grigonis, V., Palevičius, V. & Griffiths, S. (2011). Geographic information system: Old principles with new capabilities. *URBAN DESIGN International*, 16, 1–6. doi: 10.1057/udi.2010.25
- Martin, L. & Secor, A. J. (2014). Towards a post-mathematical topology. *Progress in Human Geography*, 38(3), 420–438. doi: 10.1177/0309132513508209
- McVeigh, R., Crubaugh, B. & Estep, K. (2017). Plausibility structures, status threats, and the establishment of anti-abortion pregnancy centers. *American Journal of Sociology*, 122(5), 1533–1571. doi: 10.1086/691127
- Mengis, J., Nicolini, D. & Gorli, M. (2018). The video production of space: How different recording practices matter. *Organizational Research Methods*, 21(2), 288–315. doi: 10.1177/1094428116669819
- Nash, E. & Cross, L. (2021, April). *2021 is on track to become the most devastating anti-abortion state legislative session in decades*. Guttmacher Institute. Retrieved from <https://www.guttmacher.org/article/2021/04/2021-track-become-most-devastating-antiabortion-state-legislative-session-decades>
- Nash, L. (2020). Performing place: A rhythm analysis of the city of London. *Organization Studies*, 41(3), 301–321. doi: 10.1177/0170840618789161
- O'Donnell, J., Goldberg, A., Betancourt, T. & Lieberman, E. (2018). Access to abortion in Central Appalachian states: Examining county of residence and county-level attributes. *Perspectives on Sexual and Reproductive Health*, 50(4), 165–172. doi: 10.1363/psrh.12079
- Ord, J. K. & Getis, A. (1995). Local spatial autocorrelation statistics: Distributional issues and an application. *Geographical Analysis*, 27(4), 286–306. doi: 10.1111/j.1538-4632.1995.tb00912.x
- Owen-Smith, J. & Powell, W. W. (2004). Knowledge networks as channels and conduits: The effects of spillovers in the Boston biotechnology community. *Organization Science*, 15, 5–21. doi: 10.1287/orsc.1030.0054
- Padilla, S. G. (2013). Anthropology and GIS: Temporal and spatial distribution of the Philippine negrito groups. *Human Biology*, 85(1/3), 209–230. doi: 10.3378/027.085.0311
- Parrott, R., Volkman, J. E., Lengerich, E., Ghetian, C. B. et al. (2010). Using geographic information systems to promote community involvement in comprehensive cancer control. *Health Communication*, 25, 276–285. doi: 10.1080/10410231003711755
- Pavlovskaya, M. (2009). Non-quantitative GIS. In M. Cope & S. Elwood (Eds.), *Qualitative GIS: A mixed methods approach* (pp. 13–37). SAGE.
- Pepper, G. L. (2008). The physical organization as equivocal message. *Journal of Applied Communication Research*, 36(3), 318–338. doi: 10.1080/00909880802104882
- Pruitt, L. R. & Vanegas, M. R. (2015). Urban normativity, spatial privilege, and judicial blind spots in abortion law. *Berkeley Journal of Gender, Law & Justice*, 30, 76.
- Ratner, H. (2019). Topologies of organization: Space in continuous deformation. *Organization Studies*, 41(11), 1513–1530. doi: 10.1177/0170840619874464
- Schuurman, N. (2006). Formalization matters: Critical GIS and ontology research. *Annals of the American Association of Geographers*, 96(4), 726–739. doi: 10.1111/j.1467-8306.2006.00513.x
- Sethna, C. & Doull, M. (2013). Spatial disparities and travel to freestanding abortion clinics in Canada. *Women's Studies International Forum*, 38, 52–62. doi: 10.1016/j.wsif.2013.02.001
- Sewell, G. & Wilkinson, B. (1992). Someone to watch over me: Surveillance, discipline and the Just-In-Time labour process. *Sociology*, 26(2), 270–289. doi: 10.1177/0038038592026002009
- Sieber, R. (2006). Public participation geographic information systems: A literature review and framework. *Annals of the American Association of Geographers*, 96(3), 491–507. doi: 10.1111/j.1467-8306.2006.00702.x
- Spicer, A. (2006). Beyond the convergence–divergence debate: The role of spatial scales in transforming organizational logic. *Organization Studies*, 27(10), 1467–1483. doi: 10.1177/0170840606067515
- Star, J. & Estes, J. (1990). *GIS: An introduction*. Prentice Hall.
- Stephenson, K. A., Kuismin, A., Putnam, L. & Sivunen, A. (2020). Process studies of organizational space. *Academy of Management Annals*, 14(2), 797–827. doi: 10.5465/annals.2018.0146
- Swienton, H., Thompson, C. M., Billman, M., Bowlick, F. et al. (2021). Direct injuries and fatalities of Texas tornado outbreaks from 1973 to 2007. *The Professional Geographer*, 73(2), 171–185. doi: 10.1080/00330124.2021.1871767
- Texas Department of Transportation (2019). *TxDOT roadway inventory OnSystem*. Retrieved from <https://www.txdot.gov/inside-txdot/division/transportation-planning/roadway-inventory.html>
- Tuma, M. (2021, April 30). *Local legal leaders come out swinging against anti-abortion bills*. *The Austin Chronicle*. Retrieved from <https://www.austinchronicle.com/daily/news/2021-04-30/local-legal-leaders-come-out-swinging-against-anti-abortion-bills/>
- U.S. Census Bureau. (2020). *TIGER/line with selected demographic and economic data (2018)*. Retrieved from <https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-data.html>
- Vásquez, C. & Cooren, F. (2013). Spacing practices: The communicative configuration of organizing through space-times. *Communication Theory*, 23, 25–47. doi: 10.1111/comt.12003
- Vásquez, C. (2016). A spatial grammar of organising: Studying the communicative constitution of organisational spaces. *Communication Research and Practice*, 2(3), 351–377. doi: 10.1080/22041451.2016.1221686
- Warf, B. & Arias, S. (2008). *The spatial turn: Interdisciplinary perspectives*. Routledge.
- Wasserman, V. & Frenkel, M. (2011). Organizational aesthetics: Caught between identity regulation and culture jamming. *Organization Science*, 22(2), 503–521. doi: 10.1287/orsc.1100.0583
- Weinfurter, T. & Seidl, D. (2019). Towards a spatial perspective: An integrative review of research on organisational space. *Scandinavian Journal of Management*, 35, 1–30. doi: 10.1016/j.scaman.2018.02.003
- Weitz, T. A. & Kimport, K. (2015). The discursive production of abortion stigma in the Texas ultrasound viewing law. *Berkeley Journal of Gender, Law & Justice*, 30, 6–21.
- Whitesell, D. K. & Faria, C. V. (2020). Gowns, globalization, and 'global intimate mapping': Geovisualizing Uganda's wedding industry. *Environment*

- and Planning C: Politics and Space*, 38(7–8), 1275–1290. doi: 10.1177/2399654418821133
- Wilhoit Larson, E. (2020). Where is an organization? How workspaces are appropriated to become (partial and temporary) organization spaces. *Management Communication Quarterly*, 34(3), 299–327. doi: 10.1177/0893318920933590
- Wilson, J. M., O’Leary, M. B., Metiu, A. & Jett, Q. R. (2008). Perceived proximity in virtual work: Explaining the paradox of far-but-close. *Organization Studies*, 29(7), 979–1002. doi: 10.1177/0170840607083105
- World Health Organization. (2020). *Reproductive health in the Western Pacific*. Retrieved from <https://www.who.int/westernpacific/health-topics/reproductive-health>
- Yeung, H. W. (1998). The social-spatial constitution of business organizations: A geographical perspective. *Organization*, 5, 101–128. doi: 10.1177/135050849851006