Spatial Approaches to the Study of Local Governance and Service Provision in the Middle East

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How does civil war change patterns of electricity access at the neighborhood level? Does local electoral competition affect the quality of infrastructure? Where and how do non-state actors provide crucial social services if the state fails to do so? Remote sensing and other forms of spatial data constitute vital tools for answering questions like these – particularly in the Middle East and North Africa (MENA), where states frequently fail to collect systematic, micro-level data that is free and accessible to the public.[2] In the MENA region and elsewhere, spatial data on electricity, road quality, infrastructural construction, and even pollution have been used to evaluate the micro-level roots of broader, state-level patterns of institutional durability and change.[3]

Here, I first describe how various spatial data sources have been used to understand distributive politics and local governance in the MENA region, with a focus on post-conflict contexts. I then discuss the methodological limitations of using spatial data, highlighting that complementary data must often be collected on-site using survey methods and/or qualitative fieldwork. I conclude with potential applications of spatial data analysis for scholars and policymakers interested in decentralization and local capacity-building.

Using spatial data to study local distributive politics

Scholars of Middle Eastern politics have grown increasingly interested in the study of sub-national distributive outcomes. Recent work links the quality of social service at the municipal or district levels to electoral competition,[4] political party affiliation,[5] and local institutions facilitating democratic participation.[6] In many contexts, however, data on the

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[2] During my dissertation fieldwork in Lebanon, for example, I found that a variety of quantitative data – including data on voter registration – were only officially available for purchase, often for several hundred USD or more.

[3] For examples outside the MENA, see Min, Brian, and Miriam Golden. "Electoral Cycles in Electricity Losses in India." *Energy Policy* 65 (February 1, 2014): 619–25; Carlitz, Ruth D. "Who Gets What–and How Efficiently? Assessing the Spatial Allocation of Public Goods." *Research & Politics* 6, no. 3 (2019): 1–6.

[4] Gao, Eleanor. "Tribal Mobilization, Fragmented Groups, and Public Goods Provision in Jordan." *Comparative Political Studies* 49, no. 10 (2016): 1372–1403.

[5] Pellicer, Miquel, and Eva Wegner. "Socio-Economic Voter Profile and Motives for Islamist Support in Morocco." *Party Politics* 20, no. 1 (2012): 116–33.

[6] Volpi, Frédéric, Fabio Merone, and Chiara Loschi. "Local (R)Evolutions in Tunisia, 2011–2014: Reconstructing Municipal Political Authority." *The Middle East Journal* 70, no. 3 (2016): 365–81.

core distributive outcome(s) of interest is not available from the state or other public sources. States may have an active interest in concealing such data and may hinder non-governmental data collection efforts. In other cases, states simply may not have the capacity to collect finely-grained micro-data, which requires extensive interfacing with municipal and/or regional institutions. These local institutions, similarly, may themselves lack the capacity to produce regular data on service provision.[7]

In many instances, survey research can be fruitfully used to account for distributive outcomes.[8] That said, there are a variety of reasons why survey data may not be feasible or preferable. First, surveys are often prohibitively costly to conduct, particularly for graduate students and when the analysis requires a repeated panel approach. Second, even if a survey is feasible, it may not be appropriate for the analysis of specifically local outcomes. Obtaining a sufficient sample size across a large number of localities – as opposed to a standard, nationally-representative sample – may make alternative approaches preferable where possible. Finally, in a variety of conflict and recent post-conflict contexts, surveys – either in-person or via phone – may be unsafe or fail to generate a sufficiently representative respondent pool.[9] In any of these cases, spatial approaches may offer comparatively better, more accessible data.

Spatial data have frequently been incorporated into the study of micro-level distributive outcomes in the MENA region, particularly in conflict contexts.[10] One key variant of spatial data used is the DMSP-OLS "nighttime lights" data, which are publicly available and contain time-series imagery since 1992. The "nighttime lights" data have chiefly been used to understand patterns of electricity provision and population displacement; they have also been employed as a measure of local socioeconomic status.[11] De La Cruz et al. (2007) use the "nighttime lights" to evaluate infrastructural damage incurred the 2006 Israel-Lebanon conflict, an outcome of key interest to scholars of post-conflict reconstruction.

Other work has used this dataset to probe questions of distributive favoritism by the state and non-state actors. De Juan and Bath (2015), for example, show that areas of Syria favored by the Ba'athist regime subsequently experienced better-quality electricity provision and fewer blackouts during the country's civil war.[12] In recently published work, I use the "nighttime lights" data to show how affiliation with non-state political movements affected

[7] Administrative capacity in local governments is often much lower than at the national level. In Lebanon, for example, 87% of municipalities have fewer than six employees, and about a third only have one. See Atallah, Sami. "About Administrative Decentralization in Lebanon." Beirut: Lebanese Center for Policy Studies, 2015.

[8] For a discussion of survey methodology in the MENA region, see Benstead, Lindsay. "Survey Research in the Arab World: Challenges and Opportunities." *PS: Political Science & Politics* 51, no. 3 (2018): 535–42.

[9] For a discussion of survey techniques in hard-to-survey populations, see Khoury, Rana B. "Hard-to-Survey Populations and Respondent-Driven Sampling: Expanding the Political Science Toolbox." *Perspectives on Politics* 18, no. 2 (2020): 509–26.

[10] For more on using spatial data in conflict settings, see Alexei Abrahams and Diana Greenwald's contribution to this symposium.

[11] For the latter in MENA research, see Bozçaga, Tugba, and Fotini Christia. "Imams and Businessmen: Islamist Service Provision in Turkey." *Working Paper* (2020).

[12] De Juan, Alexander, and Andre Bank. "The Ba 'athist Blackout? Selective Goods Provision and Political Violence in the Syrian Civil War." *Journal of Peace Research* 52, no. 1 (2015): 91–104.

local access to electricity in post-invasion Baghdad.[13] I argue that one non-state actor, the Sadrist Movement, leveraged local ties to redirect electricity at the neighborhood level to its areas of core support.
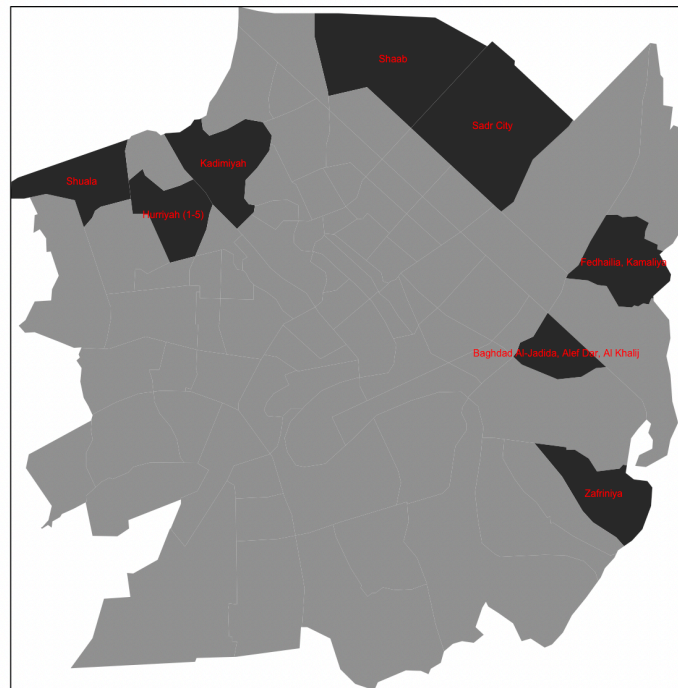

Figure 1: Sadrist office locations by neighborhood in Baghdad, 2003–06

Other creative approaches to spatial data have also been used to understand patterns of local governance and service delivery in the MENA region. Shapiro and Weidmann (2015) use spatial analysis of cell phone data in Iraq to associate cell phone use with a decrease in sectarian violence.[14] Cammett (2014) develops an original geolocated dataset of brick-and-mortar welfare institutions in Lebanon to demonstrate party tactics for delivering clientelism that vary at the local level.[15] A recent study by the American University of Beirut's Issam Fares Institute creatively assessed the relationship between ambient levels of pollution and spatial patterns of electricity generator use in Beirut during blackouts.[16] These analyses demonstrate the wide range of data sources that can be used to generate insights into local governance and service delivery.

Tools for analysis of spatial data and associated challenges

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[13] Parreira, Christiana. "Power Politics: Armed Non-State Actors and the Capture of Public Electricity in Post-Invasion Baghdad." *Journal of Peace Research*, OnlineFirst (2020).

[14] Shapiro, Jacob N, and Nils B Weidmann. "Is the Phone Mightier Than the Sword? Cellphones and Insurgent Violence in Iraq." *International Organization* 69, no. 2 (2015): 247–74.

[15] Cammett, Melani. *Compassionate Communalism: Welfare and Sectarianism in Lebanon*. Ithaca, NY: Cornell University Press, 2014.

[16] Shihadeh, Alan, Marc Helou, Najat Saliba, Sara Jaber, Nader Alaeddine, Elias Ibrahim, Zahra Salahieh, and Maher Chiit. "Effect of Distributed Electric Power Generation on Household Exposure to Airborne Carcinogens in Beirut." Issam Fares Institute for Public Policy, American University of Beirut, 2013.

Several key tools for collection and analysis of spatial data are particularly relevant for scholars of local and/or distributive politics. The DMSP-OLS data[17] on "nighttime lights" contains time-series data that can be downloaded and analyzed in GIS software, both ArcGIS and the open-source QGIS. While "nighttime lights" are sometimes used to proxy for population density, as well as electricity quality, the East View LandScan[18] data are an alternative source of population data, also updated annually. DMSP-OLS data can also be accessed at a more frequent time interval (weekly, monthly, etc.), though this data is not free to the general public. Once collected, the "nighttime lights" and other analogous spatial data are compatible with several useful R packages, which may complement or substitute for common GIS software. These include sp,[19] rgdal,[20] classInt,[21] raster,[22] maptools,[23] RColorBrewer,[24] and ggplot2,[25] the last of which also provides tools for enabling Google services via R.

Additionally, a key resource for contemporary data on local infrastructure is Google Earth, which provides detailed satellite images that lend insights into reconstruction, infrastructural damage, public works, and road quality.[26] Analysis of such imagery has been used to understand local variation in distributive outcomes in other regions of the developing world, like sub-Saharan Africa,[27] but has not been (to my knowledge) used in scholarly work on the MENA region. There are some challenges associated with Google's data, notably that it does not extend far back in time for much of the world. The use of this data, therefore, is likely to require or be complemented by historical mapping approaches or other data collected on-site.[28]

Challenges and limitations

A key limitation of spatial data in the study of distributive politics is that it rarely provides key insights independent of other data sources, which often must be collected on the ground. In my paper on electricity provision in Baghdad, for example, I use remote-sensing data in tandem with other data on the location of Sadrist Movement offices in the city, which was collected by a research team in Iraq in the post-invasion period.[29] Work by Levin et al. (2018) combines remote-sensing data and social media data to understand how periods of violent

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[17] https://ngdc.noaa.gov/eog/dmsp/downloadV4composites.html
[18] https://www.eastview.com/resources/e-collections/landscan/
[19] https://CRAN.R-project.org/package=sp
[20] https://CRAN.R-project.org/package=rgdal
[21] https://CRAN.R-project.org/package=classInt
[22] https://CRAN.R-project.org/package=raster
[23] https://CRAN.R-project.org/package=maptools
[24] https://CRAN.R-project.org/package=RColorBrewer
[25] https://CRAN.R-project.org/package=ggplot2
[26] See the piece by Abrahams and Greenwald in this symposium.
[27] Burgess, Robin, Edward Miguel, Remi Jedwab, and Ameet Morjaria. "The Value of Democracy: Evidence from Road Building in Kenya." *American Economic Review* 105, no. 6 (2015): 1817–51.
[28] See the piece by Elshehawy in this symposium for more on historical maps.
[29] Data was collected by the International Crisis Group in collaboration with Melani Cammett; see Parreira (2020) for further details.

conflict affect migration throughout the MENA region.[30] Other studies that relate remote-sensing data on service delivery to other variables, like ethnicity, party affiliation, or electoral behavior require similarly diverse approaches to data collection.

Though scholars may rely on pre-fabricated datasets to complement spatial approaches to distributive outcomes, much of this data is ultimately only possible with on-site fieldwork and local knowledge. At the very least, this type of data collection should be appropriately sourced and acknowledged by scholars, even when paired with remotely collected data. As Gharbieh's contribution to this symposium discusses more at length, this applies even to the "baseline" data that often provides the foundations for more extensive analysis, like GIS shapefiles with administrative borders and/or basic population characteristics. Such data, while commonplace in some contexts, is frequently hard to find or subject to rapid change in the MENA region. During my dissertation fieldwork on local governance in Lebanon, for example, I was unable to find up-to-date shapefiles at the municipal level, where boundaries frequently change as new municipalities are created. I instead relied on a variety of data made available through other researchers and the UNHCR to interpolate municipal boundaries.

Recent initiatives by MENA scholars have gathered remote-sensing and other spatial data collected on-site into more cohesive formats that are publicly accessible and available to other scholars. The Empirical Studies of Conflict (ESOC) initiative, for example, provides a variety of spatial data on conflict, demographics, borders, and post-conflict reconstruction – though the only MENA country they provide such data for (at this point) is Iraq.[31] Similarly, the Mapping Cairo initiative provides electoral and demographic spatial data for the city, disaggregated in many cases down to the neighborhood level.[32] Such integrative approaches are particularly promising for future scholarship.

Policy applications and conclusion

The development of local political institutions into vehicles of citizen inclusion and better service provisions have been core goals of activists and scholars in the MENA region.[33] In a broader comparative perspective, decentralization and empowerment of local institutions are perennial recommendations among social scientists and policymakers alike. Ideally, such interventions allow for citizen engagement and elite accountability, particularly in recently democratized and/or post-conflict contexts.[34] With that said, ties between central and local political institutions often evolve in order to retrench elite interests, rather than improve the

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[30] Levin, Noam, Saleem Ali, and David Crandall. "Utilizing Remote Sensing and Big Data to Quantify Conflict Intensity: The Arab Spring as a Case Study." *Applied Geography* 94 (2018): 1–17.

[31] https://esoc.princeton.edu/country/iraq

[32] https://www.alexandrablackman.com/mapping-cairo

[33] Sleiman, André. "Reforming Decentralization in Lebanon: The State of Play." Beirut: Democracy Reporting International, 2017; Blackman, Alexandra, Julia Clark, and Aytug Sasmaz. "Local Political Priorities during Tunisia's First Democratic Municipal Elections." *Working Paper* (2020).

[34] Myerson, Roger. "Federalism and Incentives for Success of Democracy." *Quarterly Journal of Political Science* 1, no. 1 (2006): 3–23; Tosun, Mehmet Serkan, and Serdar Yilmaz. "Centralization, Decentralization, and Conflict in the Middle East and North Africa." The World Bank, 2008.

quality of governance.[35] Obtaining micro-level data on social service delivery, infrastructural quality, and other distributive outcomes is crucial to understanding the evolution of center-local ties – who wins and loses from different institutional arrangements – and spatial data constitute a core tool of this type of analysis.

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[35] Clark, Janine A. *Local Politics in Jordan and Morocco: Strategies of Centralization and Decentralization.* Columbia University Press, 2018; Parreira, Christiana. "The Art of Not Governing: Local Politics in Postwar Lebanon." Dissertation: Stanford University, 2020.