International Journal of Communication 15(2021), 3645–3670 1932–8036/20210005

Topographies of Local Public Spheres on Social Media: The Scope of Issues and Interactions

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Following calls for a spatial turn in communication studies, we investigate the reach and topography of Twitter communication in two case studies of Berlin and Jerusalem. We theorize on the spatial dimensions of social media communication and their potential to establish a public sphere that can reach from the local to the global level. Empirically, we investigate the scope of Twitter communication of local users in Berlin and Jerusalem and ask to what degree their interactions and issues indicate a local public sphere or extend beyond the local level. We use a combination of topic modeling and a novel localization index to explore the spatial dimensions of the two Twitterspheres. Our data point to a considerable share of locally rooted conversations, but the majority of communication reaches beyond the local. At the intersection of interactions and issues, we uncover complex, semilocal configurations of public communication.

Keywords: local communication, digital public sphere, Twitter, communication geography, topic modeling, Berlin, Jerusalem

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Date submitted: 2021-01-26

[1] This research is funded by Deutsche Forschungsgemeinschaft/German Research Foundation, Project No. 290045248-SFB 1265.

Public communication in contemporary societies is no longer viable without online media, blogs, and social networks in addition to traditional news media. Digital platforms allow for an expansion of public communication spaces and form public spheres characterized by free access and the discussion of common concerns (Schäfer, 2015). Given that interaction and micromobilization of civil society predominantly take place within geographic proximity, public spheres are rooted in local communities (Friedland, Long, Shin, & Kim, 2007), and many issues of public concern are negotiated locally. Although these public spheres have been tied to the local press traditionally, in the digital age they also emerge from interactions in social media networks. However, given the affordances of digital platforms, the spatial dimensions of public spheres are hard to delineate. Technically, digital media transcend local or national boundaries and may facilitate communication of potentially global reach (Castells, 2008). The opportunity of bridging large physical distances with digital communication, on the one hand, and the local anchorage of many public issues, on the other hand, creates a particular constellation of public communication, which is explored in this study.

Despite early calls for a "spatial turn" in communication research (e.g., Jansson & Falkheimer, 2006, p. 7), the spatial dimensions and the boundaries of social media are hardly problematized in the literature, and we know almost nothing about their role as local public spheres. Only few studies deal with local communication in digital networks, and they usually focus on single issues (e.g., Friedland et al., 2007). Yet, even in a globalized and digitized world, the local remains critically important: Where people live determines "their schools, their taxes, their food choices; their transportation and their livelihoods; even the shape of Internet access that allows them to network personally" (Friedland, 2016, p. 25). Therefore, the nature of digital communication on the local level needs to be investigated. This conviction is the starting point of our research, which aims to determine the extent to which social media communication is rooted in local spaces.

Our study focuses on the Twittersphere as a venue of digital public spheres (Ausserhofer & Maireder, 2013). We conceptualize public spheres as communication spaces along three key dimensions—actors, interactions, and issues—all of which can be locally rooted to an extent ranging from low to high. Empirically, we investigate these aspects with two case studies in the cities of Berlin (Germany) and Jerusalem (Israel), asking the following: To what degree are social media communication and interactions locally rooted?

Berlin and Jerusalem offer contrasting conditions for local communication, as they differ strongly regarding political, social, and religious divides and spatial arrangements. We expected that these constellations would be reflected in the structure and contents of local communication.

Next, we review the literature on local communication to theorize about the spatial rootedness of digital public spheres. We develop a heuristic model that portrays local public spheres as emerging from the interactions of local actors and the issues they speak about. Afterward, we introduce our empirical study on the local Twitterspheres of Berlin and Jerusalem. Our findings on the topography of issues and interactions on social media demonstrate that digital public spheres are fluid in their degree of localness. A considerable share of communicative interactions is local, but the majority of Twitter communication reaches out to other places. Thus, we conclude that digital public spheres are characterized by the entanglement of local and nonlocal issues that are negotiated simultaneously.

Local Public Spheres and Digital Communication

In social theory, the public sphere denotes an accessible arena of communication among citizens to express their views on societal issues (Gerhards & Neidhardt, 1991). The concept is strongly linked to the writings of Habermas (1996), who conceptualizes the public sphere as a space of deliberation among citizens and intermediation between citizens and the state. The Habermasian concept of the public sphere is normatively tied to democracy and associated with the territory of the nation-state (Fraser, 2007). Considering the fundamental changes in the digital infrastructure of communication, new spaces and new structures of public discourse have emerged that are no longer bound to fixed territories. Thus, scholars question the Habermasian model of public spheres (Volkmer, 2019) and doubt that it is applicable to "the virtual sphere 2.0" (Papacharissi, 2009, p. 236). Instead, digital public spheres appear as fluid settings consisting of networks linking public and private dimensions of communication (van Dijk & Hacker, 2018).

If digital public spheres are understood as open communication spaces with less hierarchical, heterogeneous actor networks (Benkler, 2006), their topographies become relevant and the question of their spatial dimensions must be revisited. Recent research on digital public spheres has focused on Twitterspheres at the country level (e.g., Ausserhofer & Maireder, 2013; Bruns & Enli, 2018) and has seen some scaling up beyond the nation-state to European or transnational public spheres (Hänska & Bauchowitz, 2019).

However, to understand the multilayered topography of digital public spheres, it is necessary to add the local level. Local public spheres are public arenas grounded within local communities and networks and formed around shared problems (Friedland et al., 2007). Local communication networks of individuals, community organizations, and local media are critical in generating a sense of belonging among residents, as Ball-Rokeach, Kim, and Matei (2001) point out in their concept of neighborhood storytelling networks. Public communication on local issues should therefore be understood as essential for engaging local political communities and enhancing the public sphere. Kim and Ball-Rokeach (2006) further distinguish between settings with an open "communication action context" (p. 176) in terms of physical, psychological, and sociocultural features promoting communication among residents and a closed one constraining local engagement. This ecological perspective therefore posits that the resources and infrastructures in urban spaces influence the extent to which residents enter into communication. The communication action context can include factors as diverse as the availability of public spaces, area appearance, a sense of safety or fear, or ethnic and cultural diversity (Kim & Ball-Rokeach, 2006). It remains an open question, however, whether the social architecture of the neighborhood influences the extent to which digital public communication is locally rooted.

The boundaries of local public spheres "are shaped by geography, government, and the space of cultural imagination" (Friedland et al., 2007, p. 44). Research on local public spheres therefore focuses on communication that is oriented toward a relatively narrow geographic scope. But although in traditional, mass-mediated public spheres, the local is closely aligned with political and economic territories, we argue that such fixed territorial notions cannot appropriately grasp the scope of digital public spheres. The locality of digital public spheres is not a stable category. Instead, it emerges in the practice of communication, when actors from specific locations temporarily connect around issues of particular geographic scopes.

Recent empirical research on local public spheres has been relatively disparate. Most of it has focused on local journalism (e.g., Leupold, Klinger, & Jarren, 2018; Oliver & Myers, 1999) or has taken a historical perspective (e.g., Saldern, 2013). As relates to digital and social media, research has focused on how local governments employ these tools (e.g., Ellison & Hardey, 2014). Social media are also used by local activists for discussion and mobilization (Paulsen Lie, 2018) and can foster encounters among local residents who would not otherwise know each other (Rufas & Hine, 2018). All of this research has focused on a priori local forms of communication. We argue that on the social Web, localness itself should be treated as an empirical question, which we seek to conceptualize.

Dimensions of Local Rootedness

Based on a review of the literature, we propose that the local rootedness of digital public spheres can be studied with respect to three dimensions of public communication: (1) actors, (2) interactions, and (3) issues.

Actors

Traditionally, local public spheres emerge around public discussions of local concerns and politics in the mass media (Firmstone & Coleman, 2015; Oliver & Myers, 1999). However, as digital media come into play, everyone who is located in a specific community and engages publicly in the discussion of issues qualifies as an actor in a local public sphere. Although local actors share a common location (e.g., a city), they must not necessarily address a particular geographic scope in their communication.

Interactions

The public sphere has been conceptualized as a "network for communicating information and points of view" (Habermas, 1996, p. 360). From this perspective, not only speakers, but also their interactions and communicative linkages are relevant to pinpoint the local rooting of public spheres. Digital media have increased the fluidity of the spatiality of these interactions. On the one hand, they have enabled global connections, for instance, in social movements (Mercea & Bastos, 2016). On the other hand, even on a technically unbounded platform such as Twitter, most routine interactions cover only relatively short geographic distances (Takhteyev, Gruzd, & Wellman, 2012).

Issues

We understand issues as topics about which interested actors publicly communicate (Miller & Riechert, 2001). Issues always have a spatial dimension, defined through the locations where events occur and where people are affected by them. We understand issues as local if they pertain to a limited geographical scope, such as (part of) a city. The localness of issues is often indicated through place-naming (Gutsche, 2014; Wiard & Pereira, 2019) or references to local actors, institutions, or events.

Interactions Among the Dimensions of Local Rootedness

In mass-mediated public spheres, the three dimensions of local rootedness tend to strongly align: Journalists interact with local stakeholders to write stories about local issues for local audiences. Given that digital media are not locally bound by the same constraints, their local rootedness becomes a theoretical and empirical question. Theoretically, the combination of actors, interactions, and issues enables different constellations of local rootedness. Actors from far-away places may discuss an issue relevant in a different city or actors in a shared location may come together over their interest in a global issue.

In our study, by examining actors originating from specific cities, we focus on the intersection between issues and interactions to determine the degree and quality of local rooting. We refer to national, transnational, and global scopes (i.e., nonlocal scopes) as dichotomously distinct from local scopes (references at the level of the neighborhood or the city). Following this, issues and interactions may separately be conceptualized as local or nonlocal. At their intersection, four configurations of local rootedness arise. The contingency table in Figure 1 of the two dimensions shows these four generic configurations of the scope of public spheres.

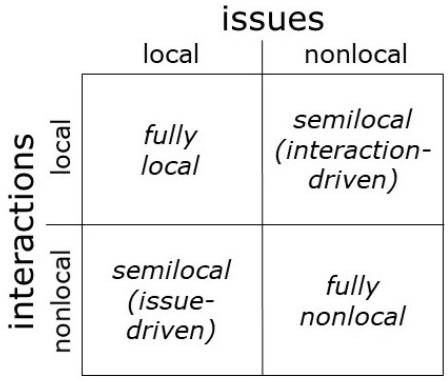

Figure 1. Different configurations of local rootedness in social media public spheres.

The first configuration of digital public spheres may be described as fully local. Here, actors located in the same place interact with each other about a topic pertaining specifically to that place. In digital settings, neighborhood apps, such as Nextdoor, are designed to facilitate this type of exchange. Beyond such apps, the role of fully local constellations in digital discourse remains an empirical question.

We refer to the second configuration as interaction-driven semilocal. People located in the same place join in discussing an issue, even though it is not specific to their location and pertains to far-away places. A discussion of national politics among neighbors or a local chapter of a transnational protest movement exemplifies this configuration.

The third configuration is described as issue-driven semilocal. Here, an issue pertaining to a specific local space is discussed, but the interactions extend beyond this place to include far-away actors. Expats engaging with the news from a place they once lived (Wehden & Stoltenberg, 2019) may serve as an example.

Fourth, neither interactions nor issues discussed by local speakers necessarily have to be locally rooted. Instead, issues refer to a larger scale or far-away locations and are discussed with actors in other places. We refer to this array of configurations as nonlocal.

In the following sections, we use two case studies of urban Twitter communication to identify the different configurations of local, semilocal, and nonlocal public communication and assess their prevalence and contexts. Our findings indicate a strong context dependency in the role of the local in digital public spheres.

Study Design and Background

We present two case studies of the Twitterspheres of the cities of Berlin and Jerusalem. The cities reflect contrasting conditions for local public communication. Most important, Jerusalem is a divided and contested city (Shtern, 2016), which stands out for its cultural and religious chasms between East and West Jerusalem. The city's divide is not only reflected in the segregated living of West Jerusalem Israelis and East Jerusalem Palestinians. Segregation and contestation are also manifest in daily life practice such as separate public transportation systems, the use of different languages (Hebrew and Arabic), and the practice of different religions and political cultures. Moreover, this divide is reinforced by use of social media, with some recent research highlighting the unique ways in which East Jerusalem Palestinians use Facebook, WhatsApp, and Twitter as part of the negotiation and expression of their political identity and activism (de Vries, Kligler-Vilenchik, Alyan, Ma'oz, & Maoz, 2017; de Vries, Simry, & Maoz, 2015; Kligler-Vilenchik, de Vries Kedem, Maier, & Stoltenberg, 2020).

Jerusalem is considered the epicenter of the Middle East conflict. By contrast, Berlin is considered a secular, pluralist, and multicultural city. Even though Berlin also has a history of political separation and features large segments of diverse multicultural groups, no comparable chasms to the Jerusalem case exist, nor is it the location of looming international conflict. Referring back to Kim and Ball-Rokeach's (2006) notion of communication action contexts, Jerusalem with its multiple chasms may align more closely with a closed communication action context, whereas Berlin can be classified as a more open one.

Altogether, the conditions for local communication in Berlin and Jerusalem vary with respect to size, national political context and social and linguistic structure. However, in spite of this stark contrast, both cities are the largest of their countries and have highly diverse populations. In addition, both host political institutions and major political and cultural elites of their countries, as well as international diplomatic institutions and civil society actors.

In Israel, Internet use rates are 88%; approximately 83% of all Israeli Internet users are active on social media (Pew Research Center, 2020). Twitter is used by 15% of adults (Bezeq Report, 2019), but it is an important venue of political communication in Israel, used prominently by journalists, politicians, and celebrities. It has been a key means of disseminating information during major events, such as elections

or violent conflicts (Kligler-Vilenchik et al., 2020; Tenenboim, 2017). Among Palestinians, Twitter is used by 18% (Social Studio, 2017). Its users are predominantly young and highly educated.

In Germany, 13% use Twitter at least once a week (Hölig & Hasebrink, 2020). Twitter users are overall younger and more likely to be men than the overall German population. Twitter usage is high among politicians, journalists, and activists, and—as in Jerusalem—the platform may be described as an elite medium (Hölig, 2018).

Unlike most research on Twitter public spheres, which tends to be centered around specific issue debates, our approach did set any a priori limits regarding what issues or interactions are relevant. Instead, we investigated the spatial patterns of public communication among actors located in a shared space, Berlin or Jerusalem. Because very little similar work exists, we chose an open, explorative approach and did not formulate specific hypotheses. At the same time, we set out with some preliminary expectations regarding local communication in Berlin and Jerusalem. For interactions, we expected close spatial proximity to translate into a substantial share of within-city interactions. For issues, we expected a simultaneity of local and nonlocal issues, with a higher degree of politicization in Jerusalem. At the intersection between interactions and issues, we generally expected local issues to co-occur with local interactions, while also tackling the question of when issue-driven and interaction-driven semilocal configurations occur. Based on the sociopolitical conditions of our cases, we expected a strong representation of the Middle East conflict and its local dimensions in the Jerusalem Twittersphere. For Berlin, we expected the Twittersphere to represent the city's cultural diversity without comparable sociopolitical chasms.

Data and Method[2]

Our data consisted of tweets from users in Berlin and Jerusalem over a period of two natural weeks (July 23 to August 5, 2018). We identified local users by querying Twitter's API via the rtweet package (Kearney, 2018).[3] To identify the most relevant public speakers, we focused on the 1,000 users per city with the largest audience (by follower count). For these, we retrieved all tweets, including retweets, replies, and quote tweets. These 1,978 users (Berlin: 1,000; Jerusalem: 978) and their 193,240 tweets (Berlin: 102,750; Jerusalem: 90,490) form the basis of all empirical analyses. As we were interested in public debates and Twitter is primarily a text-based platform, we limited our analysis to textual message content and excluded images, videos, etc.

[2] An extended version of the data and methods section is available at https://osf.io/ut824/?view_only=34a51b163cbd47eeb995d41aceec6fe0

[3] We used the self-reported location field to identify local users. We manually validated this information to eliminate misclassifications. To this end, we looked at all location field entries to ensure that they contained Berlin/Jerusalem or a place within the city (rather than, e.g., a neighboring city). Moreover, all profiles were manually coded for actor types, during which obvious mismatches could still be eliminated. Still, we cannot rule out the possibility that, in some rare cases, users not located within the city may have become part of the sample if they claimed Berlin/Jerusalem as their location.

To provide context on the speaker set underlying our further analyses, we manually coded the profiles by sector of society (codebook adapted from Thorson, Edgerly, Kligler-Vilenchik, Xu, & Wang, 2016).[4] The distribution of actor types in Figure 2 reveals differences between the two cities: In Berlin, the largest group of Twitter profiles stems from media (26%). Speakers from business/economy, representatives from culture/sports, and private individuals make up for about 20% each. Political actors (8%) and civil society actors (4%) play only a minor role. In Jerusalem, private individuals (39%) are by far the most visible group, followed by media (14%), civil society (12%), and actors from culture/sports (11%). Six percent of profiles belong to political actors as well as to religious groups or individuals.

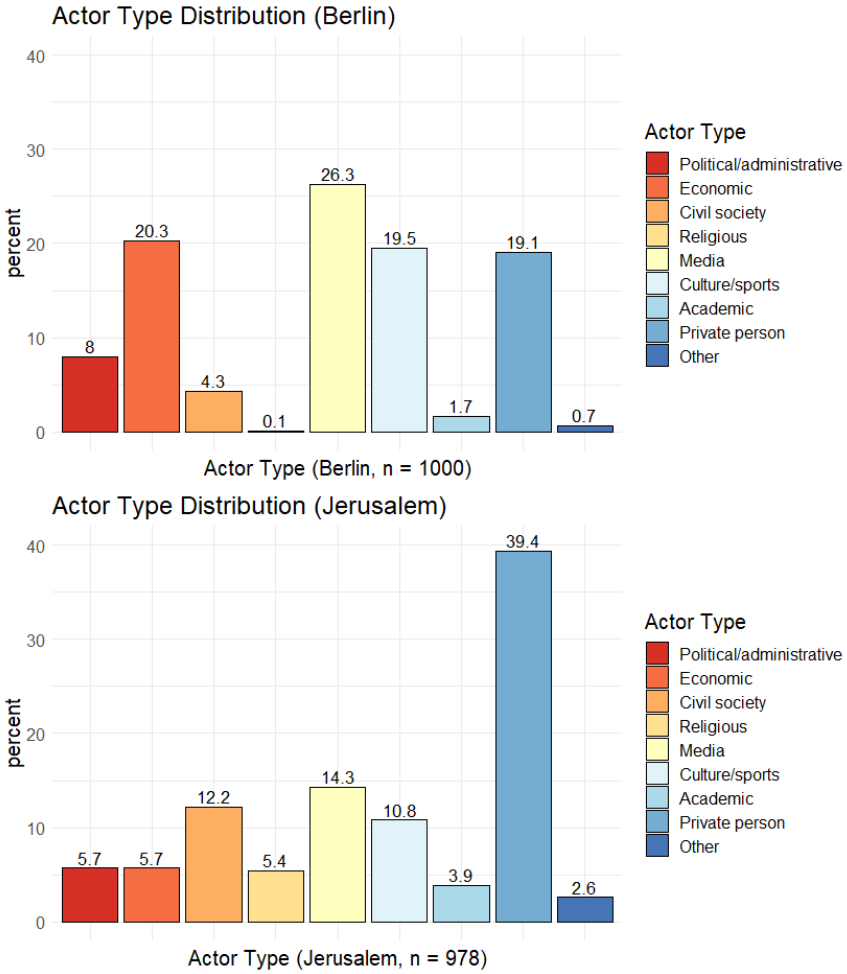

Figure 2. Relative frequency of actor types in Berlin and Jerusalem.

[4] A reliability test was conducted based on a total of 200 randomly chosen user profiles from both cities, with a simple percentage agreement of 0.79 (Holsti, 1969).

Scope of Interactions

To determine whether these local actors interacted with others within the city or beyond, we developed a localization index, which measured the scope of communication based on interaction markers (retweets, quotes, replies, mentions). Each interaction was coded with a binary value, indicating whether it addressed a user within (+1) or outside (−1) the city. The mean was computed for each tweet. The resulting tweet–localization matrix could be analyzed for the Twittersphere overall or on the level of actors or topics. Further details on the localization index are provided in the Online Appendix (see Footnote 2).

Scope of Issues

The content of public debate in the Twitterspheres was measured using structural topic models (Roberts, Stewart, & Tingley, 2019). To overcome the problem of language heterogeneity, we translated tweets in the most prevalent non-English languages (Jerusalem: Hebrew, Arabic; Berlin: German) via the Google Translate API, following recent methodological research, which has shown topic models of machine-translated corpora to yield valid results (Lucas et al., 2015; Reber, 2019). For each city, we calculated and evaluated multiple candidate models with a different specification for the number (K) of topics on the basis of various metrics and group discussions (following the procedure described by Maier et al., 2018). This process led to final models with $K = 25$ topics for Jerusalem and $K = 30$ topics for Berlin. During the topic validation process (Maier et al., 2018), which included a close reading of tweets with high shares for each topic, the research group judged whether topics were explicitly local or partly local by searching for references to local places, actors, institutions, or events.

Findings

First, the two dimensions of local rootedness—interactions and issues—are examined separately. Afterward, we bring together the scope of interactions and issues to differentiate among local, issue-driven semilocal, interaction-driven semilocal, and nonlocal constellations of communication.

Whom Locals Interaction With: Scope of Interactions

We assess the degree to which local users' outgoing interactions address other locals or reach out beyond the city. Then, we investigate the difference between actor groups regarding the scope of their interactions. In Berlin, a substantial share of interactions (25.3%) occurs locally, within the city. In Jerusalem, however, fewer than one of 10 interactions (9.2%) is local.[5] The degree of local rootedness of interactions is thus much larger in Berlin than in Jerusalem. Because users frequently address the same others multiple times, we introduced the frequency of interactions between two users as a weight variable.[6]

[5] Calculations exclude users who were addressed in the tweets but who did not provide location information or whose profile information was restricted (Berlin: 36,033 users; Jerusalem: 64,639 users). Calculations are based on interactions for which information was available (Berlin: $n = 125{,}858$; Jerusalem: $n = 134{,}248$).

[6] We created a data set with 42,522 unique relations for Jerusalem and 53,876 for Berlin. These unique relations originate from 852 unique source users in the case of Berlin and 692 in the case of Jerusalem.

In both cities, local interactions are more intense, that is, they feature higher weights (Berlin: *M* = 2.58, *SD* = 13.77; Jerusalem: *M* = 3.94, *SD* = 12.50) than nonlocal ones (Berlin: *M* = 2.20, *SD* = 12.73; Jerusalem: *M* = 2.40, *SD* = 8.7).[7] Thus, although most interactions reach beyond the scope of the city, local relations are more intense than nonlocal ones.

In both cities, political actors display the highest degree of local rootedness (see Figure 3).

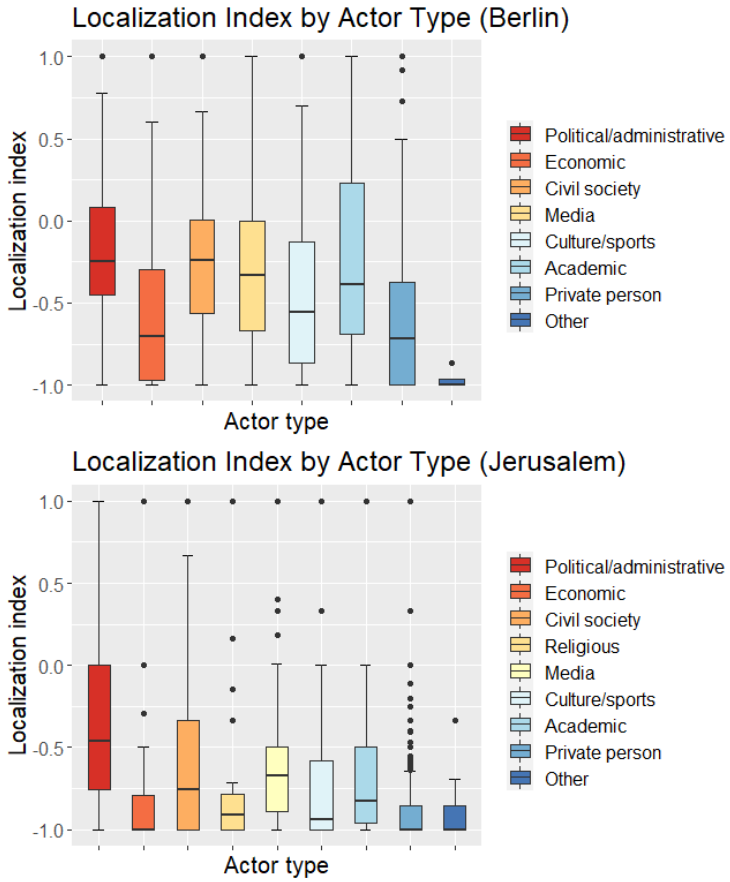

Figure 3. Localization index across actor types in Berlin and Jerusalem. The higher the localization index, the more frequently users refer to local others compared with others beyond city boundaries. Religious actors are not plotted for Berlin (left).

[7] Due to the skewness, the high standard deviations and the long tails of the distributions, a comparison of means was not applicable. Instead, the weight variables were sorted into six categories (1, 2–10, 11–20, 21–30, 31–40, 41–50, 51+) and chi-square tests for independence were conducted. Local interactions are significantly different from nonlocal interactions: Berlin: $\chi^2(df = 6, N = 53{,}876) = 331.1$, $p < .05$; Jerusalem: $\chi^2(df = 6, N = 42{,}522) = 249.7$, $p < .05$.

In Berlin, media and civil society actors behave similarly. The local Twittersphere in Berlin appears to be shaped by strong local networks maintained by political, media, and civil society actors, and economic actors stand out as the least local in their relations. In Jerusalem, all but political actors dominantly reach out beyond the city in their interactions.[8]

The Content of Conversation: Scope of Issues

Although nonlocal interactions outweigh local ones in both cities, the question remains whether local issues still play a role in the content of discussions. Here, we analyze which issues may be understood as local on the basis of their content (i.e., issues that pertain to events or issues specific to the city).

Berlin

The Twitter conversation in Berlin can be sorted into 23 topics (seven topics were excluded because of poor interpretability). Of these, four were classified as local and two more were partly local, and the majority of 17 topics did not contain specific local references.

At the core of local communication in Berlin (see Table 1 and Figure 4) are issues of daily life in the city such as traffic and public transportation (Topic 10), which are raised by media, economic, private, and political actors. Media also tweet about crime and accidents (Topic 28) and, together with cultural actors, promote upcoming cultural events (Topic 22). Economic actors talk about the Berlin job market and promote open positions (Topic 1). The most salient topic overall is discussed by culture and sports actors and concerns games and sports, including the activities of local leagues (Topic 8). Finally, another issue with some local references concerns summer holidays and the school break in Berlin, which is discussed by media and private actors (Topic 16).

The majority of topics does not explicitly mention Berlin, even though some of them touch on prevalent features of the city culture such as the vibrant start-up scene and digital businesses. Mainly economic actors raise a cluster of issues regarding the tech industry (Topic 21), customer service (Topic 18), smartphones and apps (Topic 14), social media marketing (Topic 11), e-business (Topic 5), crypto currencies (Topic 4), and general social media statistics (Topic 3).

A second group of topics without local references concerns political issues such as international trade (Topic 17), migration policy (Topic 19), health and social policy (Topic 13), and human rights (Topic 6). These clusters, dominated by media and political actors, are indicative of Berlin's status as Germany's political capital. Media also talk about racism in sports and society more broadly, triggered by the resignation of Mesut Özil, a player of Turkish descent, from the national soccer team (Topic 26).

[8] Reported differences are significant, based on a nonparametric Kruskal–Wallis test for group differences and a post hoc Dunn test for intergroup comparisons with Bonferroni-adjusted *p* values.

Table 1. Topic Model for the Berlin Tweet Collection.

Index and label	%	Top words
Local and partly local topics		
City life		
(10) Berlin traffic	3.4	train, line, car, fly, airport, traffic, due, run, bvg, city
(28) Crimes and accidents	2.8	fire, forest, apartment, police, injure, bomb, kill, attack, murder, near
(22) Arts and culture	2.7	art, p.m, award, exhibition, museum, september, august, information, field, note
(1) Berlin job market	1.9	job, startup, berlin, csdberlin, manager, csd, pride, career, engineer, operation
(8) Gaming and sports	4.8	win, game, final, ticket, event, team, advertise, vs, league, premier tour
(16) Summer holiday	3.1	sea, vacation, photo, ice, school, red, day, holiday, rescue, picture
Nonlocal topics		
Digital business		
(21) Tech industry	3.9	energy, datum, ai, system, iot, technology, innovation, tech, develop, project
(18) Customer service	3.8	hello, please, sorry, hey, email, dm, contact, us, send, regard
(14) Smartphones and apps	2.6	apple, phone, test, app, x, store, iphone, camera, card, smartphone
(11) Social media marketing	2.1	content, facebook, instagram, brand, post, blog, strategy, ad, market, success
(5) E-business	1.9	medium, via, social, customer, business, service, amazon, sale, management, experience
(4) Crypto currencies	1.6	join, community, comment, crypto, follow, campaign, address, participate, retweet, worth
(3) Social media statistics	2.5	non, follower, find, already, new, today's, york, board, magazine, partner
Politics		
(17) International trade	4.4	trump, brexit, trade, eu, stock, billion, china, economic, foreign, president
(19) Migration policy	4.3	afd, asylum, green, wing, spd, election, refugee, seehofer, party, political
(13) Health and social policy	3.4	care, health, federal, nurse, law, staff, parent, aid, must, strengthen
(6) Human rights	2.3	press, review, interview, journalist, der, protest, human, von, activist, lawyer
(26) Racism and soccer	4.0	mesut, özil, dfb, racism, metwo, racist, özil's, integration, erdogan, german

Table 1 (continued). Topic Model for the Berlin Tweet Collection.

Index and label	%	Top words
Culture		
(20) Music	3.3	music, album, festival, song, track, la, club, concert, celebrate, check
(29) Techno music and dance	3.2	podcast, cover, book, tune, e, radio, listen, episode, shirt, arrive, techno
(23) Entertainment media	3.2	woman, film, season, man, star, dog, trailer, series, fan, young
Summer		
(27) Travel	3.1	week, travel, summer, half, trip, hotel, flight, visit, cool, park
(24) Heat wave	2.9	heat, wave, degree, climate, weather, temperature, drought, coal, hot, lunar

Note. The topic model was estimated using the structural topic models R package stm (Roberts et al., 2019). Initially, K = 30 topics were estimated. Seven topics were excluded because of poor interpretability and/or high concentration. Classification into local, partly local, and nonlocal topics was based on references to local places, actors, institutions, or events. The % column gives the prevalence of the topic within the corpus.

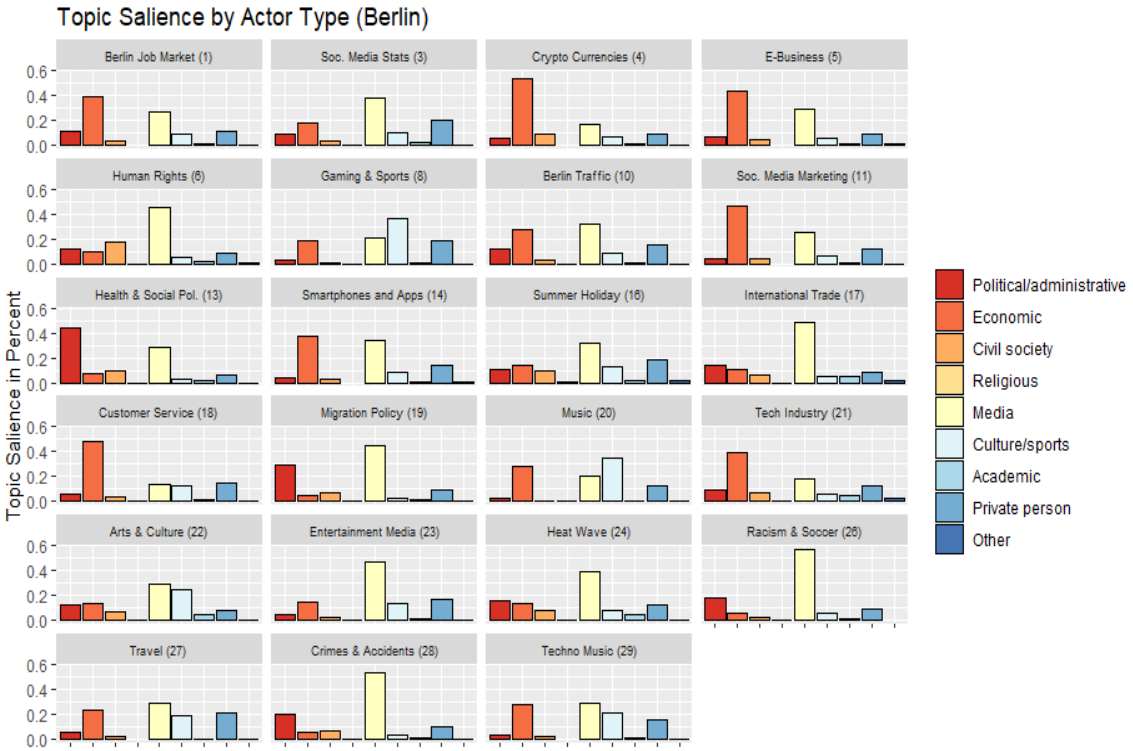

Figure 4. Actor type distribution by topic (Berlin).

The remaining clusters in the nonlocal Twitter conversation, brought up by media, concern various aspects of culture or music (Topic 20), techno music (Topic 29), and entertainment media (Topic 23). Travel (Topic 27) and heat wave (Topic 24) topics reflect the summer period.

Overall, we found that, although the majority of topics do not contain explicit local references, users also turn to Twitter to discuss aspects of their daily life experiences in Berlin. These topics reflect the city's large cultural offerings, as well as its economy and start-up scene, and typical urban issues, such as traffic. Politics is discussed regarding national and global problems, while local political issues are absent.

Jerusalem

The Jerusalem Twittersphere is classified into 20 interpretable topics (five were excluded because of poor interpretability). Unlike in Berlin, no topic is exclusively local. Rather there are five partly local topics, and the remainder has no specific local component (see Table 2 and Figure 5).

Among the partly local topics, three political ones stand out in the debate of media, civil society, and private people: Topic 9, Israeli occupation, is a politically loaded discussion about al-Aqsa Mosque (located in East Jerusalem; see de Vries et al., 2017) and about settlements in contested places in the outskirts of Jerusalem. Similarly, Topic 18 concerns the role of the Temple Mount in the context of inner-Jewish contestation (i.e., among Jewish-Israeli left and right wingers). The third politically loaded topic deals with the Gay Pride parade in Jerusalem (Topic 24). Due to Jerusalem's mix of secular, orthodox, and ultra-orthodox populations, this event is potentially disruptive. Other, less contentious local topics include the weather in Jerusalem and Israel more broadly (Topic 1) and educational institutions (Topic 12), the latter pertaining to student life in the city during the summer.

The remaining 15 topics in the Jerusalem Twittersphere do not specifically reference local sites or events. They can be roughly grouped into four topical categories. Three of them are political, referring to international, Middle East, and Israeli politics. The cluster of international politics includes a debate among individuals about the role of new media for politics (Topic 17) and one about U.S. politics (Topic 10). Media actors in the Jerusalem Twittersphere discuss international relations with countries such as Turkey, Iran, and Russia (Topic 4), as well as U.S.–Israel relations (Topic 2).

The second cluster of political issues refers to Middle East politics, which are debated by the media and citizens alike. One topic covers the conflicts in the Golan Heights and along the Gaza border (Topic 16). The other one considers Palestinian activism as well as violence (Topic 23), referring to two cases of attacks by Palestinians against an Israeli soldier and an Israeli settler.

On the level of national Israeli politics, we found a discussion by media and private individuals of minorities in Israel, including Druze and ultra-orthodox Jewish populations (Topic 21). This topic is closely connected to Israel's controversial nation-state bill of July 2018 (Topic 22), which is discussed as racist on Twitter.

Table 2. Topic Model for the Jerusalem Tweet Collection.

Index and label	%	Top words
Partly local topics		
Local politics		
(9) Israeli occupation	4.0	occupation, al, aqsa, urgent, martyr, mosque, palestine, khan, prisoner, ahmar
(18) Temple Mount	2.4	wall, stone, temple, police, mount, western, fall, activist, silence, wing
(24) Gay Pride parade	3.6	jew, pride, jewish, parade, judaism, gay, christian, community, support, lgbt
City life		
(1) Weather	0.6	c, gt, cloud, current, pressure, weather, lt, sky, bank, unit
(12) Educational institutions	4.5	university, student, education, job, program, city, summer, festival, museum, recommend
Nonlocal topics		
International politics		
(17) Politics and new media	4.0	post, facebook, new, article, france, update, publish, immigrant, editor, website
(10) US politics	3.2	via, white, helmet, threaten, rescue, suffer, ever, history, american, president
(4) International relations	3.3	iran, turkey, iranian, saudi, billion, regime, arabia, erdogan, russian, oil
(2) U.S.–Israel connection	2.7	thank, late, show, daily, friend, dear, management, great, incredible, wish
Middle East		
(16) Middle East conflict	5.6	hamas, idf, gaza, border, golan, syria, rocket, syrian, missile, fence
(23) Palestinian activism/ violence	4.5	murder, old, year, month, ahed, sentence, prison, tamimi, release, refugee
Israeli politics		
(21) Minorities in Israel	5.3	knesset, ultra, orthodox, druze, nationality, national, law, equality, committee, opposition
(22) Israel's nation-state bill	4.0	anti, corbyn, nation, state, labour, zionist, antisemitism, party, semitism, racist

Table 2 (continued). Topic Model for the Jerusalem Tweet Collection.

Index and label	%	Top words
Daily life		
(8) Interpersonal relationships	7.0	fuck, lol, play, league, win, game, team, get, think, wow
(5) Muslim religious discourse	3.9	lord, god, praise, o, mercy, oh, forgive, forgiveness, heart, glory
(7) Jewish religious discourse	2.4	rabbi, book, shalom, hebrew, shabbat, page, marry, tu, lesson, wed
(20) Research and health	4.4	need, water, disease, datum, risk, experience, cancer, low, store, office
(3) Digital media	1.7	video, add, return, episode, playlist, voice, fast, youtube, healthy, battle
(11) Twitter	3.8	twitter, mention, tweet, reach, week, account, retweet, vote, follower, ban
(13) Economics	4.5	development, economic, tech, rate, relation, company, discuss, ministry, international, economy

Note. The topic model was estimated using the structural topic models R package stm (Roberts et al., 2019). Initially, $K = 25$ topics were estimated. Five topics were excluded because of poor interpretability and/or high concentration. Classification into local, partly local, and nonlocal topics was based on references to local places, actors, institutions, or events. The % column gives the prevalence of the topic within the corpus.

In addition to these political debates, private users engage in speaking about different aspects of everyday life ranging from interpersonal relations (Topic 8) to religious discourse, either Muslim (Topic 5) or Jewish (Topic 7). We also see them involved in discussions about research and health (Topic 20), as well digital media (Topic 3) and Twitter (Topic 11). Finally, there is one topic in which media, business, and political actors discuss economic questions (Topic 13).

Overall, the Jerusalem Twittersphere is highly political, with the Middle East conflict, Israeli politics, and American politics all being salient. We do not see fully local topics. Even issues pertaining to local contested places or events are discussed beyond the city in a broader political context. The transnational aspect is strong, with discourse relating to Middle East countries, as well as the United States and Russia. However, this public sphere also includes topics around daily life—mostly national in scope, but also topics that relate to city life. Another salient difference to the Berlin discussion is the role of religious issues, appearing in two separate topics (reflecting the divided character of discussion in the city)—one pertaining to Jews and one to Muslims.

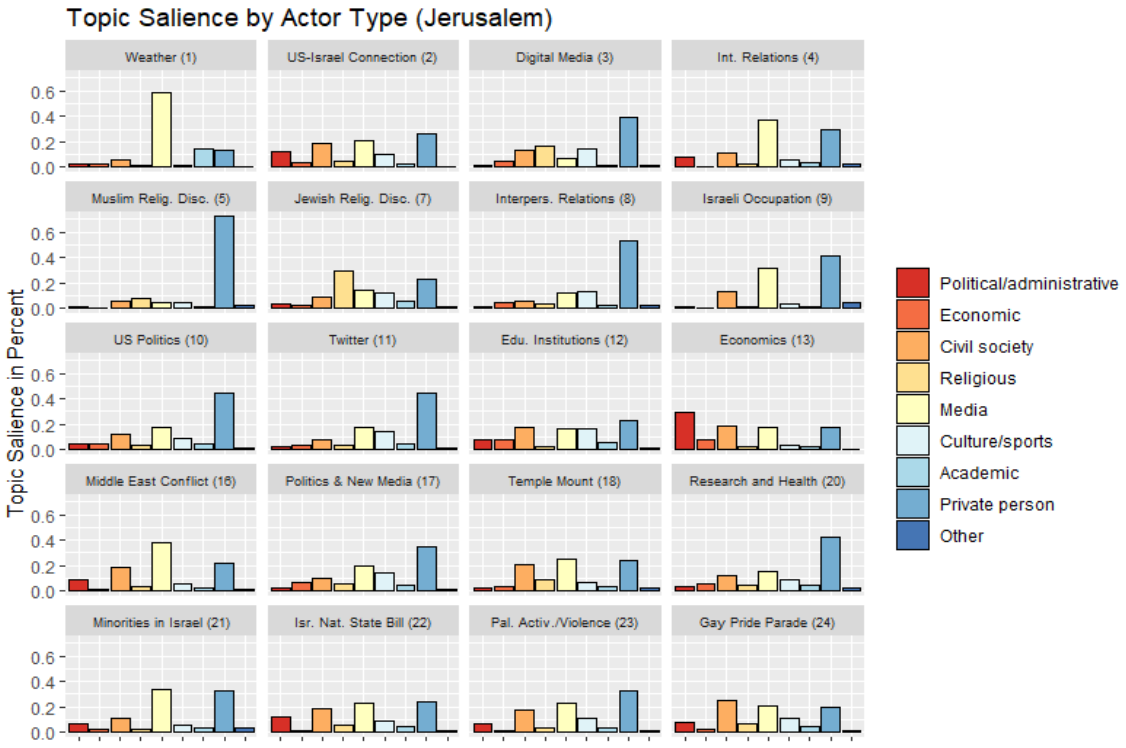

Figure 5. Actor type distribution by topic (Jerusalem).

Local, Semilocal, Nonlocal: The Intersections of Issues and Interactions

We proposed that at the intersection of issues and interactions, different configurations of localness would emerge in the same digital space. We now empirically investigate these settings of local, issue-driven or interaction-driven semilocal and nonlocal public spheres (see Figure 6). We bring together the classification of issues as more or less local based on their content (see above) with the localization indices, which describe the scope of user interactions within each topic.

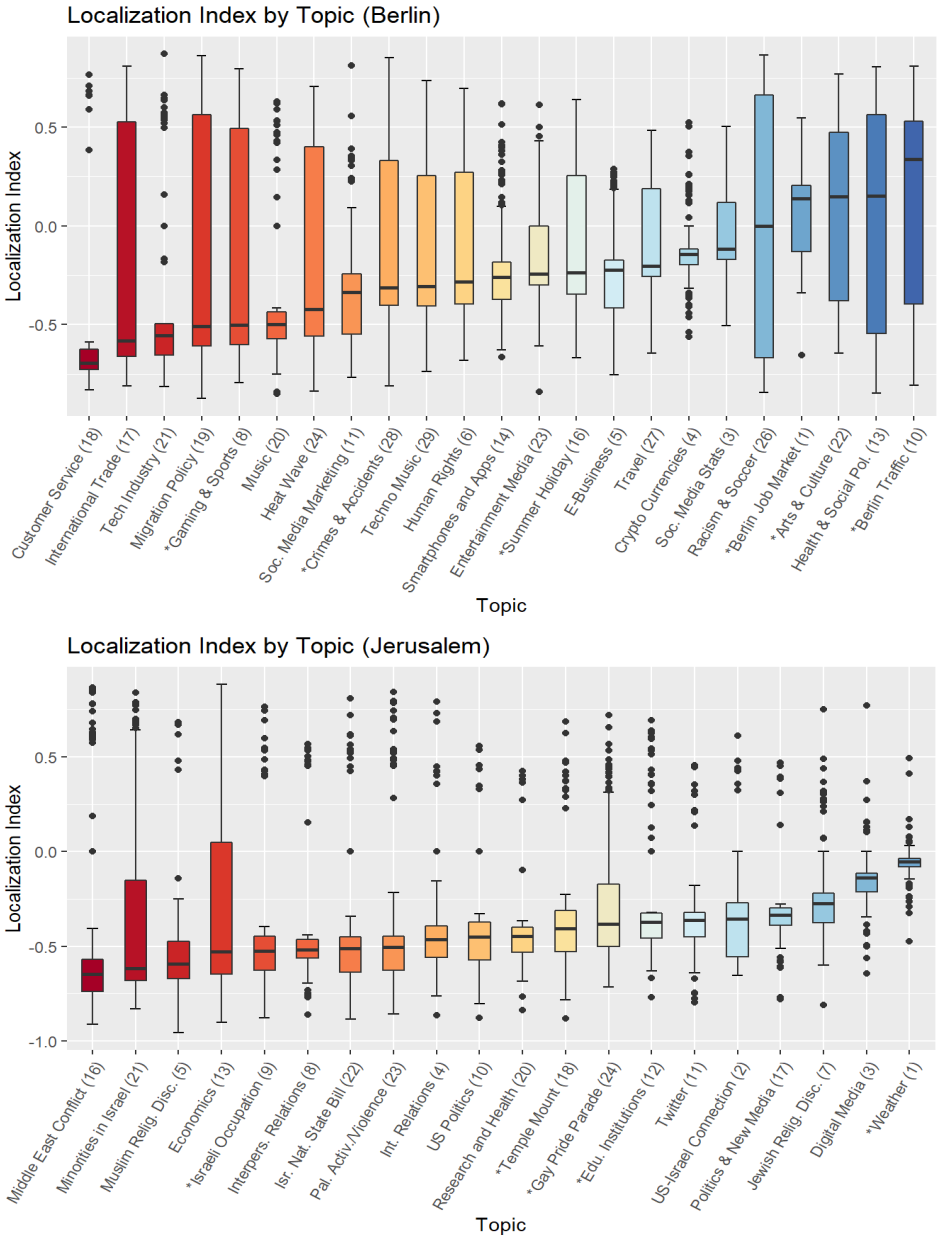

Figure 6. Localization index across topics in Berlin and Jerusalem. The higher the localization index, the more frequently users discussing the topic refer to local others compared with others beyond city boundaries. Topics marked with an asterisk (*) were classified as (partly) local in content.

Berlin

In the Berlin Twittersphere, there is significant alignment between local interactions and locally focused content. Of the five topics with the highest localization index, three are cases of fully local configurations in the Twittersphere, namely Berlin traffic (Topic 10), arts and culture (Topic 22), and the Berlin job market (Topic 1). That is, these local issues are also discussed among local actors.

Conversely, only one of the five topics with the lowest localization index is classified as (partly) locally rooted in its content. The other four—customer service (Topic 18), international trade (Topic 17), tech industry (Topic 21), and migration policy (Topic 19)—are examples of fully nonlocal configurations. Customer service and tech industry, for instance, are dominated by digital workers connecting with business partners all over the world.

Still, although most topics fall either into the fully local or fully nonlocal categories, the Berlin data also display examples of the more complex semilocal configurations. Health and social policy (Topic 13) deals with national policy, but is still the topic with the second-highest localization index for interactions. Owing to the political actors involved, this configuration is likely a reflection of Berlin's status as home of the German government. Racism and soccer (Topic 26) is another example of an interaction-driven semilocal issue. Although the topic deals with racism at the national level, many interactions are rooted in Berlin.

Finally, gaming and sports (Topic 8) as well as crimes and accidents (Topic 28) are examples of an issue-driven semilocal configuration, meaning that local Berlin events are discussed beyond city limits.

Jerusalem

In the Jerusalem Twittersphere, user interactions are generally less local than in Berlin. However, issues such as the weather (Topic 1) are strongly discussed among local actors. The Gay Pride parade (Topic 24) displays a relatively high localization index as well, meaning that the Jerusalem Gay Pride parade is discussed to a large extent among Jerusalem-based users.

In contrast, some partly local topics, such as Israeli occupation (Topic 9), are issues with a low localization index. Because they are discussed by nonlocal actors as well, they belong in the issue-driven semilocal category.

The other Jerusalem topics are less local in terms of their content, and vary in terms of the dominance of local interactions in their discussion. Of these, the nonlocal topics most pertinently discussed among local users are economics (Topic 13) and minorities in Israel (Topic 21), putting them in the interaction-driven semilocal quadrant. This may be explained by the nature of the Jerusalem Twittersphere where we see media, civil society, and culture/sports actors discussing these topics.

The remaining nonlocal topics are also ones with relatively low localization indices, such as discussion of Israel's nation-state bill (Topic 22), the Middle East conflict (Topic 16), or the U.S.–Israel

connection (Topic 2). Such fully nonlocal issues are testament to the way the contested city of Jerusalem is embedded in discourses that reach far beyond the city's borders.

Discussion and Conclusion

In our study, we assessed the spatial dimension of Twitter communication and its significance for local public spheres in particular. By conducting our research in two cities with contrasting social and political environments, we were able to characterize variations relating to the specific topography of local Twitterspheres in terms of actors, issues, and interactions.

Our findings show that even though a substantial minority of communicative interactions is local and deals with daily life topics and issues of the city, the majority of local actors' Twitter communication refers to nonlocal topics and reaches out to other places. Our results suggest a smaller extent of local rootedness than a previous study by Takhteyev and colleagues (2012), who found that 39% of interactions on Twitter occurred among users in the same metropolitan region. Note the different operationalizations of localness: Takhteyev et al. considered interactions to be local if they spanned less than 100 km, but we set the markers on administrative city limits. After all, our results suggest that Twitter is not primarily a venue of local interactions, but that local and nonlocal forms of communication coexist on the platform. More important, our findings suggest that the spatial dimensions of public communication on Twitter are not clear-cut. Instead, the topography of public communication emerges in different constellations of issues and interactions of local Twitter users. It is characterized by the coexistence and entanglements of local and nonlocal aspects of communication.

In the cases of Berlin and Jerusalem, we found that the actor and topic constellations that constitute the degree of local boundedness differ decisively. Jerusalem's Twittersphere turns out to be highly political and embedded in its wider geopolitical context, centering on the Middle East conflict and politics in Israel and the United States. The character as a venue of public discussion of private citizens explains that, in the Jerusalem Twittersphere, larger political problems regarding the ongoing Israeli–Palestinian conflict are far more important than local ones. The Berlin Twittersphere, by contrast, centers around a more diverse range of local topics—from transportation and sports to the digital start-up scene—and, to a lesser degree, political topics of national and transnational scope.

Kim and Ball-Rokeach's (2006) concept of specific local communication action contexts offers one way to make sense of the differences in these topographies and rootedness of public communication in our two cases. They claim that, depending on a local space's social architecture (including physical, psychological, sociocultural, economic, and technological features; see Ball-Rokeach et al., 2001) that enables or constrains interaction and congregation, a communication action context can be considered open or closed. Accordingly, the findings for Berlin illustrate the conditions of an open communication action context that are conducive to higher levels of "neighborhood storytelling" (Kim & Ball-Rokeach, 2006, p. 177). Whereas prior research has largely focused on face-to-face forms of engagement, our study suggests that these dynamics play out on digital platforms as well. By contrast, the segmentation of physical and communicative space in Jerusalem discourages communicative action on the local level. It rather represents the setting of a closed communication action context, where the larger political and social divides of

Jerusalem push aside the exchange about local issues on social media. Future research should shed further light on the role of communication action contexts in digital communication spaces, including within different cultural contexts, in different digital fora, and at different scales (e.g., city vs. neighborhood).

Methodologically, we have proposed novel measures and indicators to assess the role of localness in digital public spheres. Most important, our newly developed localization index enabled us to systematically assess the spatial rootedness of different topics and sets of actors. Beyond our study, it can be applied to the comparison of different topical constellations, time periods, or languages within one location and beyond. Although we primarily used the localization index in conjunction with topic modeling, it holds promise for other methodological approaches as well, including manual forms of content analysis, but also social network data based on interviews. It thus offers an intuitive and flexible way of integrating space and locality into many avenues of communication research.

In sum, our study contributes to better understanding the spatial anchoring of digital public spheres. Following calls for a "spatial turn" of communication research (Jansson & Falkheimer, 2006, p. 7), we demonstrate that space is, in fact, a relevant dimension of digital communication. However, the empirical patterns we found in our study prompt us to not think of space as an independent analytical category in the context of social media communication. Rather, because every user or event is located somewhere, the spatial dimension is woven into the issue-specific interaction networks of users. Due to the fluidity of digital communication, spatial relations are not fixed, but emerge when (local) users interact digitally and thereby discuss (local) issues of common concern.

Our proposed heuristic of four configurations enables researchers to grasp the differential degrees of localness that emerge through digital communication. Local public spheres appear in different communicative configurations as primarily local, interaction-driven or issue-driven semilocal, as well as nonlocal. Digital communication spaces resist clear-cut delineation through borders, fences, or economic imperatives. They are multidimensional and can (but do not have to) have a local rooting. The heuristic's strength, in our view, lies in its clarity and intuitiveness, which make questions of spatiality easily assessable and lend themselves to empirical inquiry. On the flipside, more empirical research will be needed to fill in and understand the facets of the spatiality of digital public spheres: In most cases, topics will not be discussed exclusively among locals or nonlocals, but instead, their relative prominence in an issue discourse will vary along a continuum.

Our heuristic and methodological approaches will enable future research to address some limitations of the empirical inquiry presented here. First, we focused exclusively on text-based communication, here, but media such as images and video can also transport spatial scopes and contexts. Moreover, our study was limited to only two cities and one platform, and covered a relatively short time period, which raises questions of generalizability. Even between our two case studies, we found considerable variation in the role of the local in digital communication. To better understand the conditions of the spatial rootedness of digital communication, future inquiries into other platforms, places, and scales are desirable.

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