

Grounding the Digital: a Comparison of Waze ‘Avoid Dangerous Areas’ Feature in Jerusalem, Rio de Janeiro and the US

Valentina Carraro

This is a postprint that has been peer reviewed and accepted at *GeoJournal*.

Please cite as:

Carraro, Valentina. 2021. “Grounding the Digital: A Comparison of Waze ‘Avoid Dangerous Areas’ Feature in Jerusalem, Rio de Janeiro and the US.” *GeoJournal* 86 (3): 1121–39.

<https://doi.org/10.1007/s10708-019-10117-y>.

Grounding the Digital: a Comparison of Waze ‘Avoid Dangerous Areas’ Feature in Jerusalem, Rio de Janeiro and the US

Valentina Carraro

***Abstract:** This paper presents a comparative study of the Waze Avoid Areas (WADA) feature in Jerusalem, Rio de Janeiro, and the US. I argue that, through comparative approaches, geographers can ‘ground’ the digital, developing situated accounts of how emerging technologies work at different sites. Taking as a starting point the controversies raised by WADA, I address the following research questions: How does the feature work in the three research sites? What political problems does it raise? What are its effects? Drawing on 124 news articles, blog posts and forum threads in English, Arabic, Hebrew and Portuguese, the analysis complicates existing characterisations of similar apps as emblematic of the smart city’s most oppressive characteristics, pointing at three themes: the relevance of local settings in the enactment of WADA, the interplay of different logics in its definition of danger, and the heterogeneity of public reactions to the app. More broadly, the study demonstrates that grounded comparative studies can decentre and enrich the scholarship on digital geographies, underscoring the contingency and ambivalence of digital technologies.*

Introduction

The digital has become a focus of geographic research over the last decade, to the point that that the discipline is said to be undergoing a ‘digital turn’ (Ash et al. 2016). Moving past early enthusiasms for the emancipatory potential of information and communication technologies (ICT), geographers have come to emphasise that, shaped by dominant social forces, digital technologies are bound to reproduce and intensify existing systems of oppression (e.g Leszczynski and Elwood 2015).

This framing is a helpful corrective to the persistent rhetoric that casts the digital as a parallel realm untouched by the injustices that characterise the ‘real’ world (Kinsley 2014). When applied unreflexively, however, it quickly becomes a rigid explanatory scheme. Resulting accounts remain placeless, portraying the digital city as a segregated, securitized environment (Amoore 2009) that leaves little room for privacy and individual freedom (Crampton 2015), while promoting the commodification of everyday life (Thatcher 2017), all to the advantage of tech corporations and repressive governments. While raising justified concerns about the negative effects of corporate power and digital surveillance, this work leaves little room for appreciating geographical variations and envisioning alternative futures. My core argument is that comparative approaches will advance our understanding of what emerging technologies do in different places, and thereby contribute to a more ‘global’ digital geographies scholarship (Robinson 2016a).

To support this argument, I present a comparative study of Waze in Jerusalem, Rio de Janeiro and the US. Waze is a navigational app, developed in Israel and purchased by Google in 2013. In addition to providing routing and real-time traffic information, it integrates a reporting system that allows users to share information about accidents, traffic jams, road closures, speed traps and fuel prices, among other things. Adding to this list, Waze ‘avoid dangerous areas’ function (henceforth WADA) warns users when they are about to enter an unsafe area, offering routes that avoid such places. Although Waze (2016) prides itself on having a large user base (over 20,000) in thirty-eight countries, WADA is only available in Israel/Palestine and some parts of Brazil. It is on this function that I focus here. I refer to WADA and other applications designed to warn their users against geographically-located dangers as ‘danger-tracking’ apps. Previous studies have characterised this type of software as emblematic of the digital city’s most disturbing developments (Leszczynski 2016; Thatcher 2013). Here, I suggest that a comparative approach sensitive to geographical specificities

reveals the inherent ambivalence of danger-tracking apps, helping us to move beyond schematic explanations of the effects of ‘the Digital’ on ‘the City’.

Beyond this introduction, the paper comprises six sections. I start by discussing prevalent conceptualisations of the digital as a broad socio-technical phenomenon, and the associated tendency to assume that digital technologies have similar effects everywhere. Drawing on recent debates in urban studies, I argue that this mode of theorising overlooks geographical difference and depicts urban and technological assemblages as closed systems governed by a single logic.

Comparative approaches, I argue, can counter these tendencies, ‘ground’ knowledge on ICTs and thereby contribute to a more ‘global’ digital geographies scholarship. In the following section, I review recent work on danger-tracking apps, which characterises these technologies as ‘future-ing’ devices that contribute to the enactment of particular urban futures. The logics underpinning these apps shape the ‘city-to-be’, maximising order, reducing the chances for spontaneous urban encounters, and projecting existing patterns of socio-economic stratification into the future.

Although insightful, these interpretations well exemplify the trends described in the previous section, implicitly drawing on the experiences of US cities to produce a universal analysis of danger-tracking apps on ‘the City’. In section 4 I discuss my methodology, illustrating how I used the controversies surrounding WADA as a starting point for a comparative analysis. Further, I discuss my choice of case studies, present the research questions and methods. I then turn to the empirical research (section five). Here, I follow the evolution of WADA in Jerusalem, Rio de Janeiro and the US, tracing the media debates that surrounded it. In particular, I underscore key translations in WADA’s definition of territorial boundaries, in its technical features and in the reactions it elicits. In Israel/Palestine, ‘danger’ is associated with ‘Palestinian’, an association that ultimately highlights the discrepancy between the territorial and ethnic definition of the Israeli state. In Brazil, the launch of a stripped-back version of WADA took place amidst debates around the state’s failure to guarantee

the safety of citizens, in a climate of mounting pressure generated by the upcoming 2016 Olympics. Finally, in the US, the creation of several danger-tracking apps catalysed polarised discussions around race, likely dissuading Waze from activating WADA in the country. In the discussion, I draw on the case studies to enrich existing readings of danger-tracking apps, underscoring three themes: the relevance of local settings, the logics that contribute to WADA's definition of danger, and the heterogeneity of public responses to the app. Finally, I conclude by reiterating the study's contribution, noting some limitations and directions for future research.

Grounding the Digital

In recent years, geographers have produced a large body of work on ICTs, examining their geographical dimension and spatial effects. Characterising these developments as a 'digital turn' in the discipline, Ash, Kitchin and Leszczynski (2016) underscore the volume and relevance of this work. Helpfully, they identify three areas of research: geographies produced through the digital, produced by the digital and of the digital. First, there are studies exploring how the digital inform the production of geographic knowledge: which forms of spatial analysis and representation are enabled by big data (Barnes and Wilson 2014), algorithms (Kwan 2016) and digital interfaces (Elwood and Leszczynski 2013)? Which ones are (de)legitimised (Burns and Meek 2015)? Second, geographers have investigated the role of the digital in the production of space. For example, How does the layering of geodata influences urban management (Kitchin 2014)? How does it transform economic production and consumption (Zwick 2018)? Finally, research into the geographies of 'the digital' examines digital information, usage and infrastructures in spatial terms. Which places and population groups have access to which digital technologies (Otioma et al. 2019)? How does this uneven distribution relate to longstanding patterns of socioeconomic inequalities (Halford and Savage 2010)?

Meanwhile, few studies have investigated the specific effects of digital technologies in different places (but see Datta 2015; Lin 2013). To be sure, there is no shortage of work conceptualising the relation between space and the digital, drawing, for instance, on notions of hybridity (Farman 2013; Wilson 2014), transduction (Kinsley 2014; Kitchin and Dodge 2005) and mediation (Leszczynski 2015; Rose 2017). Yet, these contributions tend to work at a high level of abstraction and stop short of explaining how these relations unfold in particular places. To my mind, this blind spot relates to prevalent conceptualisations of the digital in the geographic literature.

Most dictionaries define the digital in terms of the binary grammar that underpins code, whereby information and commands are expressed through a combination of ones and zeros. This definition, however, is both too generic and too specific, including non-electronic devices that operate on such a logic, i.e. the abacus, and none of the societal shifts associated with contemporary digital technologies (Kaufmann and Jeandesboz 2017). To avoid this pitfall, geographers, and social scientists more broadly, stress that the digital is also a social phenomenon, characterised by specific discourses, structures and practices. Ash et al. (2016, p. 02), for instance, state that their definition of the digital ‘extend[s] beyond computational technologies to encompass ontics, aesthetics, logics and discourses’. They clarify what this definition entails through a long list, which includes digital systems, media, art forms, spatialities, patterns of action and interactions, ordering practices, logics and ‘digital discourses’. Here, Ash et al. build on work by digital media theorist Peter Lunenfeld (1999, p. xvi), who proposes that ‘the digital’ works ‘as a placeholder for whatever term we or posterity chooses to describe our immediate present’, effectively replacing other qualifiers such as ‘modern’ and ‘postmodern’ as a description of the contemporary zeitgeist. Crucially, stressing that the digital is a socio-technical phenomenon underscore that technologies are embedded in the ‘real’ world (Kinsley 2014). An expansive definition of the digital, then, helpfully counters over-

enthusiastic accounts about the transformative effects of ICTs, which portray them as working unaffected by, or even against, existing social arrangements.

Such a definition, however, poses a different problem. Namely, it tells us very little about the distinctive characteristics of the digital, and risks presenting it as a global, uniform experience (Kaufmann and Jeandesboz 2017). Consequently, ‘the digital’ becomes another vague, all-encompassing term used as shorthand for complex entanglements of material technologies, social processes and discourses, when those entanglements are precisely what needs explaining.

I see some parallels between this way of thinking ‘the digital’ and classic conceptualisation of ‘the urban’. As postcolonial critiques of urban theory have underscored (e.g. Ong 2007; Robinson 2011; Roy 2015), knowledge about ‘the City’ has historically been produced starting from the experiences of a narrow range of places, mostly wealthier urban centres in North American or Western Europe. Thus, the very idea of ‘the urban’ has been so tightly associated with Western modernity that contemporary cities that do not conform to this model have been considered anachronistic: not only ‘over there’ in the so-called ‘Third World’, but also ‘back then’ in the past (Robinson 2011, p. 3). This way of thinking has produced troubling geographic taxonomies (Robinson 2011), entrenching a binary categorisation that divides cities into developed/underdeveloped, Global North/Global South, modern/traditional. Meanwhile, others have aptly argued that Western modernity itself is not the monolithic phenomenon it is often taken to be (Law 2015). Simply put, what is often viewed as the ‘urban experience’ is really the experience of certain social groups in certain cities.

My concern is that by conceptualising the digital as a singular phenomenon, we may repeat the same conceptual and political mistakes. That is, we risk taking a small number of cities as representative and assume all experiences that do not fit this account are exceptional or, worse, ‘not yet there’. A geographic taxonomy of the digital is emerging, which implicitly associates certain research topics to

certain sites. For example, a large share of studies of ICTs in the Global South deals with digital humanitarianism or digital development (e.g. Gutierrez 2018; Huggins and Frosina 2017; Poveda and Roberts 2018). Meanwhile, the digital geographies of Israel and Palestine are most often considered in studies of conflict in Volunteered Geographic Information (VGI) projects (Bittner 2016a; Carraro and Wissink 2018). And, as I discuss at length in the following section, analyses of danger-tracking apps almost invariably refer to US cities.

Here, my argument intersects with recent critiques to the critical scholarship on smart urbanism (Farías and Widmer 2018; McFarlane and Söderström 2017), accused of viewing the smart city as ‘a kind of universal, rational and depoliticised project’ (Shelton et al. 2015, p. 14), entirely shaped by neoliberal forces and bound to serve the interests of tech corporations. These forms of ‘theoretical determinism’ (Pow 2015) render scholarly descriptions of technological urban futures more and more similar to the synopsis of films like *Minority Report* or *Blade Runner*. These narratives evoke, for example, ‘algorithmic wars’ – the pervasive expansion and normalisation of violence through algorithms (Amoore 2009). Surveillance technologies, we learn, have surpassed George Orwell’s bleakest predictions (Haggerty and Ericson 2000). The elites fill cities with smart technologies – devious devices that entrap the rest of us in ‘a seamless web of surveillance and power’ (Sadowski and Pasquale 2015, p. 1). Meanwhile, the digital has brought about a ‘new dark age’, leaving us drowning in an overload of information, as our lives are increasingly governed by unintelligible code (Bridle 2018). Paraphrasing and extending Ong (2007), we could summarise the plot underpinning much of the critical digital geographies literature by saying that Neoliberalism with a capital ‘N’ (a totalising structural condition) shapes the Digital with a capital ‘D’ (a universal and singular phenomenon), with disastrous effects on the City with a capital ‘C’ (a place that is everywhere but nowhere in particular).

To counter this trend, I find it useful to follow Kaufmann and Jeandesboz (2017, p. 310), who conceptualise ‘the digital’ as ‘an artefact with specific affordances’, using it as ‘a vantage point to speak about its various affordances and the situated relationship it entertains with politics’. In their convincing formulation, digital objects and practices present certain characteristics – e.g. they are numeric, searchable and transferable - which ‘fold into numerous field-specific relationships which pre-exist the digital’ (Savage 2013, pp. 145–146; quoted in Kaufmann and Jeandesboz 2017), thereby engendering distinct ‘local’ artefacts. This way of thinking raises the profoundly geographical question of *what digital technologies do in different places* (see also Anderson and Adams 2008 for an STS perspective on these issues). Through comparison, researchers can reveal the differentiated properties and effects of a given technological object, investigating the contingent effects of technological artefacts. Such a shift would ‘ground’ the digital and open the way for a more ‘global’ digital geographies scholarship (Robinson 2016a), where the distinct configurations that a given technology takes in different places provides a basis for novel insight and productive theoretical conversations.

Danger-tracking Apps from a US Perspective

Since, to my knowledge, no study so far has focused on WADA, in this section I review previous research on similar danger-tracking apps, particularly the work by Thatcher (2013) and Leszczynski (2016). Centring on the US, these contributions have characterised these apps as devices of ‘future-ing’ that extend long-standing patterns of inequality and segregation along economic and racial lines. This is a valid interpretation, but, I argue, one limited by the US-centrism of this literature.

Arguably, the first company to conceive of a danger-tracking feature was Microsoft, which registered a Pedestrian Route Production patent in 2012. The feature would use information from maps, weather reports, crime statistics and demographics to create pedestrian routes that avoid bad weather, difficult

terrain and unsafe areas. Thatcher (2013) builds his argument on a close reading of this patent and the commentaries it elicited. On this basis, he paints two future scenarios, one ‘hopeful’, predicated on coordination, efficiency and safety, and one ‘fearful’, ‘wherein encounters on the street are sorted by race; an unseen algorithm enabling users to only ever encounter those already sorted as demographically similar’ (Thatcher 2013, p. 974).

While seemingly opposite, for Thatcher both scenarios depend on the same acceptance of technology as an organising force of society:

In simple terms, even though it is not required to follow a route provided by a navigational aid, when millions of human beings do they are engaging in a process by which their movement is called into being via an always teleological process of calculation between two known points. This process mediates the experience of travel through a counted and known order that can be thought of as standing-reserve. In a field of calculated locations and teleological navigation, human life is sorted and ordered through technology. (Thatcher 2013, p. 977)

From this perspective, the ‘original sin’ of danger-tracking apps lies less in their specific functionalities than in their promise to put people’s mobility into the hands of private corporations, who will use that power to extract a profit. By recording and communicating users’ location, these technologies extend the modern political rationality that drives standardization, calculation and order, a system that Thatcher tellingly characterises, quoting Marcuse, as being ‘everywhere and in all forms’ (2013, p. 977).

After Microsoft, several companies developed apps that rely on statistical data and/or user-contributed reports to identify high-crime zones, such as *SketchFactor* and *Ghetto Tracker*, later renamed *Good Part of Town*. Leszczynski (2016) discusses these apps as exemplar of the recent convergence between big data and urban governance. Her suggestion is that we ‘engage with modes of urban algorithmic governance and governmentality as material-discursive projects of future-ing, i.e., of

anticipating particular kinds of cities-to-come' (Leszczynski 2016, p. 1692). She notes that the notion of future tends to be articulated as a promise of radical difference from both the present and the past, a promise that can be seen as an opportunity but is more often framed as loaded with threats of disasters from which liberal democracies need to protect themselves. Danger-tracking apps embody this logic, since they aim to manage uncertainty about the future through probabilistic calculus. Concretely, this means translating data about past events (for example, criminal acts) into actionable decisions (a route). According to Leszczynski (2016, p. 1698),

what is important about these apps is how they position themselves as material-discursive devices for enacting data-driven urban futures. They are highly speculative in orientation, anticipating cities that are risky by virtue of being socio-spatially stratified—around every city street loom threats to personal harm and safety bound up in the possibility of undesirable urban encounter.

Amoore (2009) describes such fear-ridden spatial imaginaries as 'war-like architectures' that divide cities 'us' and 'them', 'here' and 'there', 'safe' and 'risky'. For Leszczynski, while promising safety in these dystopic settings, danger-tracking contribute to their enactment by reproducing existing patterns of inequality and spatial segregation. In contrast to Thatcher, Leszczynski (2016, p. 1704) concedes that predictive algorithms are not inherently harmful, presenting as a positive example the *Citizens Police Data Project (cpdp.co)*, which reverses the logic of danger-tracking apps by using big data to foresee incidences of bad policing. However, she insists, since anticipatory calculus is based on data that refers to the present conditions, its main effect is to 'project[s] the certainty of what is—the characteristic unevenness of the contemporary social geography of cities—forward in time and space, anticipating equally uneven cities-to-come' (Leszczynski 2016, p. 1704).

Although Leszczynski's observations focus on algorithmic security, a similar shift towards algorithmic governmentality has taken place in many other realms, such as the insurance industry

(Ericson and Doyle 2004), disaster management (Adey and Anderson 2011) and public health (Klawiter 2002). Similarly, the modern political rationality to which Thatcher refers is not specific to locational digital technologies, but rather represents a key trait of our era. In both readings, universal digital logics embedded in code dictate all action, while people, place and institutions remain almost completely absent. Significantly, for Leszczynski, big data itself ‘looks into the future’ and ‘seeks to securitize urban life’ (2016, p. 1704): a personified, self-coherent technical system that leaves little room for other actors. Users only appear as products of these apps, which ‘prefigure and shape self-regulating subjects who willingly position themselves within, and actively contribute to, an urban security calculus as a means of minimizing their own personal exposure to urban risks (...)’ (Leszczynski 2016, p. 1697). Meanwhile, little attention is paid to how people actually interact with these apps.

Both contributions also refer to the digital urban experience in absolute terms, without reference to any specific city. Their geographical focus, however, transpires from the choice of data sources – English-language media, almost all from the US – as well as from their framing. For example, Thatcher and Leszczynski both reflect on terms such as ‘ghetto’ or ‘unsafe neighbourhoods’, which in North America work as euphemism for poor inner-city areas, generally inhabited by people of colour, as observed by Leszczynski (2016, p. 1697). Without an explicit discussion of location, many important questions remain unaddressed. Do people everywhere share the same understanding of urban danger? Do they use danger-tracking apps in the similar ways? Do they always work as ‘future-ing’ devices, and if so, do the futures they produce have the same characteristics everywhere? How do place-specific discourses about race, travel and urban governance interact with these technologies?

Controversies as Comparative Experiments

In section two, I have argued that the digital geographies scholarship tends to rely on universal explanatory schemes that overlook geographical differences, promoting dystopic accounts about *the* digital city. Studies of danger-tracking apps, I showed in section three, well exemplify these trends. To enrich such explanations, the present study compares the working of WADA in Jerusalem, Rio de Janeiro, and the US. My aim is to explore the place-specific problems raised by the app in these locations, suggesting that its effects are more ambiguous and contingent than it is generally assumed. The analysis takes as a starting point the debates and disputes raised by the app in local and international online media. Here, the study draws on the tradition of controversy analysis that emerged from STS (e.g. Collins 1981; Latour and Woolgar 1979), and was later adopted by several geographers (Landström et al. 2011; Whatmore 2009) and digital geographers (Bittner 2016b; Kumar 2017). The broad idea underpinning this family of approaches is that controversies can ‘slow down reasoning’ (Stengers 2005), bringing attention to those parts of reality that normally go unnoticed, creating opportunities for new insight and new realities. In the case in question, disputes around WADA provide both researchers and the general public with an occasion to reconsider how this technology works, to what ends and with what effects.

At the time of writing, Waze offers the WADA function only to users in Israel/Palestine and the Rio de Janeiro area. In the first phase of my research (described below), I became aware that, in US media, Waze and WADA also frequently feature in discussions about other apps, as the possible introduction of WADA in the US is alternatively seen as threat or a desirable goal. From this point of view, WADA ‘exists’ in the US, if not as a piece of software than as an object of discussion, and I have therefore included the US as a third location for comparison. Thus, I take the presence of WADA as an object of dispute as an opportunity to compose a comparative ‘experiment’ (Robinson

2016b), bringing together these three cases to generate new insight about danger-tracking apps. Juxtaposing two cities and a state may seem an unorthodox move, but the analysis does not take bounded territories as unit of analysis, following WADA as it moves from one place to the next. Thus, drawing on recent urban studies contributions (Robinson 2016b, 2016a; Schmid et al. 2018; Wood 2019), I understand comparison in expansive terms, as ‘the broad practice of thinking cities/the urban through elsewhere’ (Robinson 2016a, p. 5), rather than as the systematic juxtaposition of variable across cities with similar characteristics. That is, I see commensurability not as an inherent property of cities, but something that is created by researchers with a specific research aim in mind (Stengers 2011).

Concretely, the research can be divided into two phases. To begin with, I ran a series of Google Search queries to identify relevant sources discussing Waze and WADA, taking steps to ensure a broad range of results (following Rogers 2014). These steps included setting up my browser to minimize the influence of location and search history on the results and constructing research queries using terms associated with different actors. For example, given the political connotations of different place names, I searched for ‘Waze AND Jerusalem’, ‘Waze AND Israel’, ‘Waze AND Palestine’, ‘Waze AND Palestinian Territories’, and ‘Waze AND Judea and Samaria’, etc. I run the initial queries in English, but repeated them in Portuguese, Hebrew and Arabic after the case study selection. This allowed me to build a database of 124 items, including news articles, blog posts and messages on the Waze user forums. Of these, 55 referred to Jerusalem, 34 to Rio de Janeiro and 35 to the US. In the second phase of the research, I examined the content of these articles looking for expression of disagreement or worry about WADA’s functions. For non-English language sources, I relied on automated translation software. Clearly, my understanding of these texts was coarse, yet I could grasp the meaning and overall tone of this material. Grouping together quotes related to similar issues, I moved from the specific towards the general to identify concerns shared by several

sources, while also paying attention to dissenting voices whose claims diverged from the predominant narratives about WADA. I represented such claims in a tree-like diagram, which I then used as a guide for the analysis, pursuing the following research questions: *How does WADA work in the three research sites? What political problems does it raise? What are its effects?*

A major drawback of this approach is that the use of Google Search focused my attention on highly mediatic events, which happened in the recent past (Introna and Nissenbaum 2000) and were likely to generate many ‘clicks’ (Rieder and Sire 2014). Aware of this limitation, I have taken these episodes as a starting point, rather than the focus of the investigation. Since this study is part of a broader project (reference removed for peer review), in the case of Jerusalem I could complement the digital research with field observations. This is reflected in the findings, which are more extensive when it comes to Jerusalem than the other locations.

WADA in Jerusalem, Rio de Janeiro and the US

In this section, I present the study’s findings, detailing the development of WADA in Jerusalem, Rio de Janeiro and the US. In the case of Jerusalem and Rio de Janeiro, dramatic events have drawn significant media attention to the app. US sources, on the other hand, generally mention Waze in relation to other danger-tracking apps, including Microsoft’s ‘ghetto GPS’ and Ghetto-tracker, analysed by Thatcher (2013) and Leszczynski (2016), respectively. Here, I observe, media have a decidedly critical outlook on this kind of software, which is widely regarded as racist. Overall, the three sets of debates show that the politics of danger-tracking apps are ambiguous and diverse, inextricably enmeshed with place-specific processes and discourses.

Jerusalem

Waze first introduced WADA for users in Israel/Palestine. Although I was unable to establish its launch date, WADA is mentioned as a familiar feature in the user forums as early as 2012, i.e. the

same year Microsoft registered its patent. In these early years, information is scarce, since the feature did not generate much debate, being widely considered a sensible and necessary feature in the Israel context. Contrary to most danger-tracking apps, the Israeli version of WADA defines dangerous areas not by means of statistical data or user-contributed reports, but through the geopolitical lines drawn by the Oslo Accords. The agreements signed in the 1990s between Israel and representatives of the Palestinian Liberation Movement were supposed to lay the basis of a future Palestinian state. They envisioned the gradual transfer of control over the West Bank from Israeli authorities to the newly established Palestinian Authority (PA). To this end, the West Bank was divided into three discontinuous jurisdictions: Area A, B and C. Area A comprises major Palestinian towns and is under PA control. Area B includes Palestinian villages and their surrounding lands. It is administered by the PA, while Israel retains control over security. Area C, defined by exclusion as those areas outside Areas A and B, amounts to over 60% of the West Bank's territory and is under full Israeli control. To facilitate a settlement, Jerusalem was deliberately excluded from the Oslo negotiations (for more on this topic see Caplan 2010; Dumper 2014). Fig. 1 shows a map of this repartition.

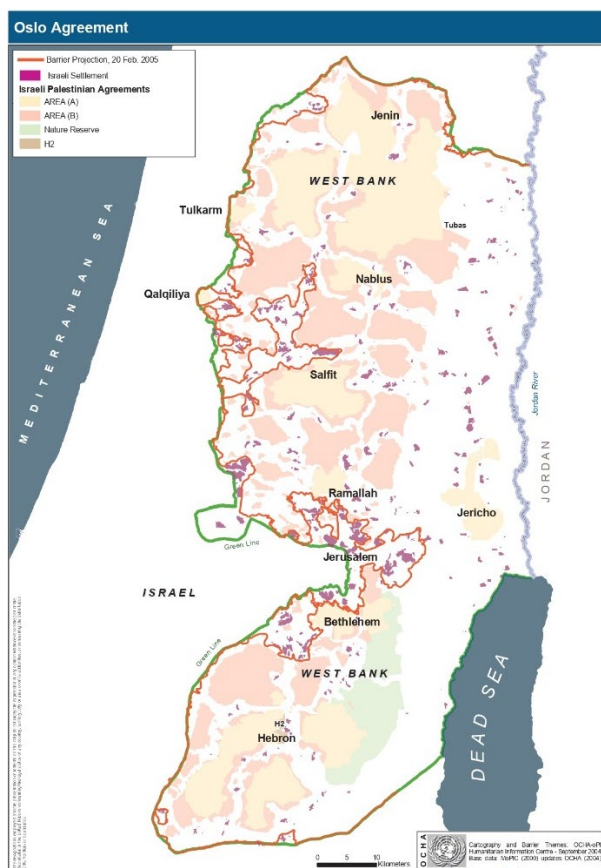


Fig. 1 UN Office for the Coordination of Humanitarian Affairs (2005), *West Bank: Oslo Agreement & Barrier Projection*. Source: ochaopt.org

As shown in Fig. 2, Waze considers the Areas A and B dangerous. Clearly, the app starts from the unspoken premise that users are Israeli Jews. At first sight then, the Israeli version of WADA seems to perfectly encapsulate and reinforce the logic described by Amoores (2009) and Leszczynski (2016): an ‘architecture of war’ that divides the city into us/them, safe/dangerous, here/there, generating a sense of constant danger. The analysis of the disputes arisen around Waze, however, complicates this reading.

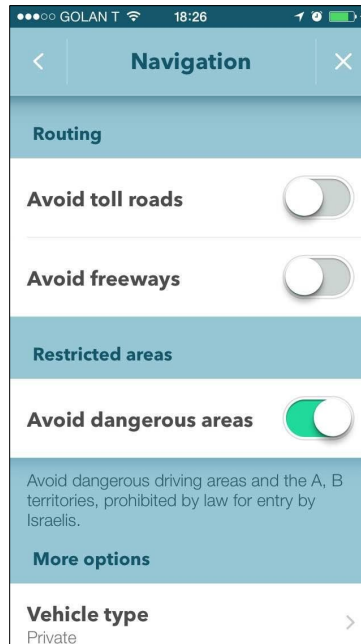


Fig. 2 Screenshot of the Waze interface for users in Israel/ Palestine

In 2014, several Israeli users experienced physical attacks or threats while driving through Palestinian areas, especially neighbourhoods in the Eastern part of Jerusalem (e.g. Dvir 2014; Schechter 2014). These incidents happened against the backdrop of a wave of unrest involving stabbings, rock-throwing and demonstrations. The following year, Waze initiated a collaboration with the Israeli police and security forces (Yanovsky 2015) to generate dynamic dangerous areas that covered ‘hot’ Palestinian neighbourhoods, taking into account up-to-date security reports. This move turned out to be surprisingly controversial. *Yedioth Ahronoth*, one of Israel's leading newspapers, accused Waze of considering some parts of Jerusalem as Palestinian. The report elicited comments from prominent political figures, starting from Jerusalem mayor Nir Barkat, who had recently gained public support by physically intervening to block the politically-motivated stabbing of an Israeli civilian (Chandler 2015). He declared:

Waze's designation of areas of Jerusalem as belonging to the Palestinian Authority is factually incorrect and unacceptable. I demand the company's management to change it and not turn an app into a political tool. (quoted in Yanovsky 2015)

Aryeh King, member of the Jerusalem City Council and director of the Israel Land Fund, an organisation dedicated to increase Jewish land ownership in the Palestinian Territories, rhetorically asked:

Is it conceivable that the police would tell Jews where and where not to go? We are talking about defining areas of Jerusalem as Area A (Palestinian Authority territory). I expect the minister of public security to order the police to set guidelines so that Waze stops, in effect, dividing Jerusalem.
(quoted in Yanovsky 2015)

When, a few months later, two Israeli soldiers were caught into another Waze-related accident (Beaumont 2016), Israeli leftists blamed right-wing nationalists for putting pressure on Waze to restrict its dangerous areas. On Facebook, in a post that gathered thousands of likes, Israeli journalist and blogger Haim Har-Zahav (2016) voiced this sentiment writing:

*'(...) we showed everyone what Israeli pride is in the app, and we insisted that we would not give up a single inch on the virtual map - it was worth it! Wasn't it?'*²

These debates suggest that, at least at that point in time, WADA unwittingly problematized, rather than reinforced, the local 'architecture of war'. Namely, by putting Palestinian areas on a map, it drew attention to a fundamental discrepancy between a spatial definition of danger ('there') and one

¹ The article, originally published in Hebrew on 08 August 2015, was republished on the Yedioth Ahronoth's English-language website (www.ynetnews.com) on 28 August. All quotes are taken from the English version.

² Automatic translation by Google, with minor edits in the interest of readability.

based on ethnic identity ('they'), or, to flip the perspective, between a spatial definition of Israeli territory ('here') and a definition based on Jewishness ('us'). The tension between these competing definitions is integral to the Israeli state project, which depends on annexing Palestinian land while excluding Palestinian populations (Parsons and Salter 2008). This project has been pursued through the complex system of non-linear borders made up by checkpoints, ID documents and travel permits. This system, as Tawil-Souri (2012, p. 153) observes, 'produce[s] distinct people and bind[s] them to specific territories (such as the Palestinians), while allowing others (Jewish-Israelis) to "trespass" over those same boundaries'. The fuzziness of these boundaries creates the need for an app that alerts Israeli drivers when they are about to cross the 'enemy lines'. Yet, since WADA works by recording danger in the form of discrete polygons, the app must acknowledge the Palestinian presence in areas that many consider non-negotiably Israeli, most notably the heart of Jerusalem. By making this presence visible, WADA draws attention to the fact that 'they' are in fact 'here' (see also Veracini 2013).

The US

Although Waze does not offer WADA to US-based users, my research returned many US news articles and blog posts that discuss Waze in relation to other danger-tracking apps. Contrary to what happens in Israel – where there is broad acceptance of WADA's usefulness – and Brazil – where media regard WADA with mixed feelings – US sources are overwhelmingly hostile to it. Of 18 news items I examined, 15 are strongly against danger-tracking apps, with only one presenting some arguments in favour. For the most part, commentators vehemently objected to the very concept of danger-trackers, opposing the idea that low-income, high-crime areas should be avoided in the first place. For example, the blog Citylab suggested that these apps straddle 'a touchy line between a utilitarian application of open data and a sly wink toward people who just want to steer clear of "those kinds of neighborhoods"' (Badger 2013). Another blog pointed out that high-crime areas are

inhabited by a majority of honest individuals, and are often vibrant with culture and ‘positivity’ (Holmes 2013).

Race played a crucial role in these debates, as evidenced by titles such as 'Is Your Turn-By-Turn Navigation Application Racist?' (Silver 2013), 'Enough Already With the Avoid-The-Ghetto Apps' (Badger 2013) and 'GhettoTracker is the worst site on the Internet' (Holmes 2013). Commentators criticised these apps’ choice of words (‘sketchy’, ‘ghetto’) and branding, which generally depicts users as white and middle-class. Beyond the branding, US sources suggested that the use of user-contributed data was likely to reflect users’ racial bias. Expressing this concern, Joe Silver (2013) of the *American Civil Liberties Union* noted:

Applications like Waze rely on users and social networking connections to share travel information and suggest particular routes. It’s easy to imagine very subtle judgments among loosely connected social groups having a large influence on where drivers and pedestrians are directed in their travels.

Overall, the analysis highlights marked uneasiness towards danger-tracking apps in US society, putting into perspective the characterisation of users as either entirely passive or enthusiastically embracing these technological developments. One can find some different views on the Waze forums, where several users felt that the public slamming of danger-tracking features was both simplistic and elitist. A particularly emphatic post read:

Political correctness once again leads to people literally being killed. I'm so sick of knee-jerk reactions that "discrimination:bad" - guess what: discrimination is a part of life. (...) how about getting out of your ivory tower and leaving your current country and go travel the world a little bit?
(EricE27 2016)

It is difficult to say whether these findings effectively reflect the sentiments of the majority of the US public, or if Google's ranking algorithms could be filtering out dissenting perspective. Yet, I take Waze's decision not to activate WADA in the US as an indicator that the fear of a possible backlash is strong enough to act as a disincentive. Other companies' behaviours also support this interpretation. Seven years after filing its patent, Microsoft has not yet implemented the 'avoid-the-ghetto' function. Some of the apps examined by Leszkinsky, too, have ceased to exist. The GhettoTracker app was first rebranded into Good Part of Town and, soon afterwards, permanently discontinued. Fuelled by the extensive media coverage, SketchFactor enjoyed a brief spell of popularity, becoming the third-most downloaded navigation app, behind Google Maps and Waze. However, this was a mixed blessing for the app's commercial success, as users flooded the platform with ironic reports warning pedestrians against the pretentiousness of hipster neighbourhoods, or the app's racism. In 2015, the app creators gave up on the project and turned SketchFactor into Walc, an app dedicated to making city streets more walkable (Marantz 2015). Granted, many more danger-tracking apps have sprung up in the years since, albeit with limited success. One of the most popular is RedZone, with 50,000+ downloads recorded by the Google Store. For comparison, Waze has 100,000,000+.

Rio de Janeiro

In Brazil, attacks on drivers who venture unwittingly into gang-controlled areas are a relatively common occurrence (e.g. Euronews 2016; G1 2015). Yet, until 2015, Waze refused to make WADA available to Brazilian users. The company's standard response to the numerous users request on the app forum (hatzemberg 2015; joaotavolaro 2015; mchibly 2014; petwork 2014; zeo_hound 2012) reads:

I know this is an important subject. But the fact is we can't designate an area as dangerous just because we decided to, or even because community members say it is. In Israel some areas are restricted by law, and we follow that law. In other countries situations like these can't be solved by us. (quoted in AndyPoms 2015)

The company's attitude changed in October 2015, when a 70-year-old woman was shot dead after following Waze's directions into Caramujo, a favela in the Niteroi municipality, near Rio de Janeiro. This dramatic incident shocked the Brazilian public and drew the international media's attention (e.g. CNN 2015; Fox News 2016; Phillips 2015).

The upcoming Olympic Games in Rio de Janeiro put pressure on Waze to intervene since, media insisted (CNN 2015; Martín 2015), visitors unfamiliar with the city were bound to be at risk. To contextualise these remarks, security and violent crime were contentious issues in the lead-up to the Games. On the one hand, the high rates of murders and robberies in the city generated worry for the safety of the 500,000 foreign visitors expected to attend the Games (Kaiser and Jacobs 2016; Morgan 2016). On the other, activists accused the Brazilian authorities and police forces of inefficiency, extrajudicial violence (Amnesty International 2015) and of using the Olympics as a tool for the social-cleansing of prime areas for real estate development (Gibson and Watts 2013).

It was in this climate that, a few days after the murder, Waze added a 'danger' marker to its map of the Niteroi area; it then announced its intention to eventually integrate statistics into the app (Ramalho 2015). The Brazilian version of WADA was developed over the following year, and officially launched at the start of August 2016, just in time for the Olympics. Reversing the statement previously posted in the user forums, Waze explained to the press that providing this type of feature 'comes back to the moral responsibility we have to promote safety and care for people by highlighting information that we may have at our disposal' (quoted in Marshall 2016).

The Brazilian version of WADA differs from the Israeli one in significant ways. At the interface level, it refers to unsafe neighbourhoods as 'high crime areas' because 'higher crime is data-driven. It's not blanketly naming a neighbourhood dangerous', as a company representative was keen to stress (quoted in Moffett 2016). At the data level, it uses data from the anonymous crime-reporting hotline 'Disque Denuncia' (Barreto-Filho 2016), complemented by Waze-generated data and statistical figures from research institutions (Marshall 2016). At its launch, WADA identified 25 neighbourhoods to be avoided, with the perspective of periodically updating the list. To minimise stigmatisation, the company did not release the names of the affected areas, making them visible only to users who selected them as destinations, or were about to drive through them (Soprana 2016).

Media tended to characterise the feature as both useful and problematic (e.g. Andrade 2016; Barreto-Filho 2016; Soprana 2016). Commentators generally conceded that WADA responded to a real need, but underlined the risk of further marginalising favela residents, both socially and economically. Most importantly, they tended to frame the pervasive insecurity experienced by Brazilian drivers as a symptom of the country's broader 'violence problem'. As the magazine *Epoca* (Ferrari 2015) put it:

Shifting responsibilities and focusing the discussion around existing or possible Waze functions are dangerous distractions from the real debate. Rather than demanding improvements to the app, it would be more sensible to blame those who are responsible for the lack of security in Brazilian cities. This is a chronic problem that precedes the emergence of GPS, the Internet and cell phones.

*(...). Is it Waze or the traffickers who fired the shots? Or the State, which fails to provide security to the population?*³

Thus, the state's unfulfilled responsibilities are identified as the main issues, both by those who advocate for harder measures against criminals, and by those who believe the solution lies in better social policies and greater equality.

Discussion

As seen earlier, previous contributions have characterised danger-tracking apps 'future-ing' devices, emblematic of the Digital City's most regressive features. In this interpretation, the logics embedded in this software contribute to the enactment of 'cities-to-be' where order is maximised, reducing the changes for spontaneous urban encounters and projecting long standing socio-spatial inequalities into the future. A comparative analysis of WADA does not necessarily undermine existing interpretations of danger-tracking app, but complements them through geographical comparison, revealing how place-specific actors, discourses and processes that intervene of digital applications. Specifically, I want to discuss three ways in which the findings add to our understanding of these technologies.

The Relevance of Local Settings

The analysis highlights key translations in WADA's definition of territorial boundaries, its technical features and in the reactions of media and publics. In Israel/Palestine, Waze's mapping of Palestinian 'dangerous' areas underscores the tensions within Israeli society, as people disagree on territorial and ethnic definitions of the state. In Brazil, WADA's development is shaped by the widespread experience of crime violence, ongoing debates around the state's failure to guarantee

³ Automatic translation by Google, with minor edits in the interest of readability.

safety, and the media attention generated by the Olympic Games. Finally, in the US, WADA is never activated, likely also due to the negative responses raised by other danger-tracking apps, accused of racism. In short, a comparative perspective underscores that WADA is not the faithful translation of any single regime but emerges from the associations of different actors: Waze as company, the technical features of locational apps, local users, politicians, media and broader publics. What is more, though existing discourses around race and security inform the app, so do the ‘material’ geographies of territorial agreements, checkpoints, policing, gang violence, flows of people and capital related to the Olympics. As a result, WADA mutates as it travels from Israel/Palestine to the US (as an idea rather than as a piece of software) and to Rio de Janeiro. Nor are the differences just a matter of framing: on the contrary, they also extend to the app’s code, its interface and data sources.

Definition of Danger

A key theme emerging from the research is WADA’s definition of danger, and its influence on people’s way of thinking and navigating urban space. Like the studies by Thatcher (2013) and Leszczynski (2016), my analysis also underscores the folding of ethnic and racial identities in the mappings performed by WADA, as the app defines danger with a particular user groups in mind, e.g. Israeli Jews and Brazilians who live outside of favelas. Thatcher and Leszczynski’s readings also emphasise the importance of an anticipatory logic that frames encounters with racialised others as dangerous, and then seeks to minimise the possibility of such encounters through data and algorithms. By contrast, here I have highlighted that anticipatory calculus is not the only logic at work in WADA. This perhaps is most evident in the case of Jerusalem, where danger is delimited by geopolitical boundaries, called into question on the base nationalist claims, and then modified following the recommendation of police forces. In this example, then, the software depends more on ‘traditional’ understandings of nation and territory than on big data and algorithmic calculations.

In this context, the common indictment of danger-tracking apps as reinforcing segregation by minimising the chance of spontaneous encounters (Amoore 2009; Leszczynski 2016; Thatcher 2013) loses much of its persuasive power, since an extensive bordering apparatus already separates Israeli Jews from Palestinian West Bank residents (on this topic, see Tawil-Souri 2012). Here, rather than challenging or reinforcing segregation, WADA highlights its inconsistency, pointing at the discrepancy between spatial and ethnic definitions of the Israeli state. More generally, I argue that, since territory, race and ethnicity are dynamic, place-specific categories, their relationship with danger-tracking apps cannot be linear nor universal. Indeed, as powerfully argued by Sansone (2003, p. 3), the case of Brazil is particular apt to demonstrate that ethnic identity is ‘a social construction that differs from context to context’, interacting with racial myths and social class. Ironically, the most trenchant critiques of danger-tracking apps – in the popular media as well as in scholarly journals, tend to disregard this dynamism, referring to dangerous areas as closed containers of antagonistic relations between insiders and outsiders, as if these identities could be ascribed unambiguously and once and for all.

Software beyond Code

Among the differences between local versions of WADA highlighted by the study, it is also worth emphasising people’s responses to the app. I find this is a thought-provoking result, given that previous research pays little attention to usage practices. In the cases examined here, people’s engagements with WADA do not take the shape of absolute compliance or radical resistance. In Jerusalem, few people question WADA’s fundamental idea and usefulness, but fierce debates surround the demarcation of the dangerous areas, both in terms of spatial boundaries and political meaning. So, for the political right, to admit that an area is dangerous is to symbolically recognise that it is not controlled by the Israeli state, while for the Zionist Left such nationalist concerns should not get in the way of users’ safety. Meanwhile, in Brazil, several commentators imply that

users' desire for an app like WADA proves that the state is failing its essential responsibilities.

Finally, in the US, media reports frame danger-tracking apps as symptoms of racist bias, within the coding industry and in society at large. Arguably, an even more striking example of users shaping the meaning and effects of danger-tracking comes from Datta (2018), who tells us of how women living in a slum resettlement colony in New Dehli use this software as a tool to lobby policy makers and planners.

These heterogenous responses matter, in the first instance, because they have the power to influence technological development, as it may have happened in the case of the US, where the uptake of danger-tracking apps has been limited. In addition, regardless of their direct effects on Waze's decisions, they matter because maps acquire meaning through use and context (Del Casino and Hanna 2005, p. 26), rather than being fully defined by code. In this sense, danger-tracking apps frame but do not determine how people interact with the urban environment. Take the label 'dangerous': though it may be stigmatising in some cities, it is in my experience a point of pride for Palestinian neighbourhoods in Jerusalem, where lack of integration is widely respected as a form of resistance. Through interpretation and debates, users, journalists, bloggers, Waze representatives and public figures contribute to shape WADA's effects. These dynamics are part of WADA just as much as algorithms and datasets.

Conclusion

To return to the central theme of this paper, I have argued that there is a tendency for digital geographers to treat danger-tracking apps and other smart technologies as the product of universal social forces, bound to have the same (often disastrous) effects anywhere. The scholarship on danger-tracking apps well exemplifies this trend: firmly focused on the US context, it provides a compelling reading of these technologies as future-ing devices, but falls short of exploring the

interplay between software and local settings. Through a comparative analysis of WADA in Jerusalem, Rio de Janeiro and the US, I have shown that danger-tracking apps do different things at different sites. My findings complicate rather than invalidating existing interpretations, underscoring the plurality of logics that converge in the shaping of this type of applications. As software and devices become embedded in a place, they intersect with local geographies, user cultures, discourses and political problems. How these actors interact with code is a matter of deeper empirical investigation: apps can reproduce amplify and extend, but also expose and publicise, and perhaps, in some cases, have little effect at all.

As mentioned, the choice of case studies was based on the presence of WADA and related controversies, rather than on the identification of similarities or differences between the three locations. The analysis, however, points to urban features that seem to facilitate the creation, uptake and problematization of apps like WADA. These include profound inequalities and social divisions, manifested in segregated residential patterns. In all case studies, class, racial and ethnic identities interlock to shape these patterns, but do so in distinct ways. Clearly, features like WADA also thrive on high rates of violence, real or perceived, and on a general sense that the state struggles to exert sovereignty on certain pockets of territory. Finally, one could speculate that WADA has more chances to succeed when public transport is inefficient, unaffordable, segregated, unsafe or has negative class connotations.

Against prevalent characterisations of users as passive or complicit (Leszczynski 2016; Sadowski and Bendor 2019), I have also emphasised the heterogeneity of public responses to these apps. In doing so, I do not mean to romanticise them, or deny that many recent technological developments are worrisome. However, I believe there is much to be gained from taking a more curious and sympathetic stands towards the adopters of these technologies. It is clear that risk is socially

produced, even when it is measured and communicated through seemingly ‘neutral’ datasets, algorithms and interfaces. Yet, it will not do to dismiss out of hands people’s experiences and anxieties as unreasonable, racist or naïve. By taking users - and non-users (Carraro and Wissink 2018; Güiza and Stuart 2018) - seriously we can illuminate important facets of digital phenomena, starting by the multiple logics that make apps successful or unpopular. Just as importantly, this strategy will help counter the prevailing defeatism of much digital geographic scholarship, which locates all the power in code and the companies that produce it, showing what we say and do makes a difference, in ways that are limited but not meaningless.

The study also raises the question of how software intervenes on knowledge of risk. So far, scholars have implicitly divided applications according to the type of hazards they record: crime (Leszczynski 2016; Thatcher 2013), but also pollution (Xu et al. 2019), socio-natural disasters (Crawford and Finn 2015) or health threats (Goodyear and Armour 2018). Yet, some applications, starting from Waze (Puleo 2018), are starting to offer a more integrated approach to risk monitoring, providing users with warnings about traffic, extreme weather conditions, disaster hazards and crime within the same screen. How do they conceptualise, measure and analyse different sources of risks? What do their data models and algorithms reveal about the social production of risk across domains? How do they differ from place to place?

Admittedly, this study’s emphasis on uncertainty and contestation closely relates to the use of controversy analysis as a methodology. Since the research relies on media coverage and public discussions, and I specifically selected sources expressing worry or disagreement, it was clear from the start that I would come across conflicting opinions. On the other hand, the existence of controversies in all countries where WADA is available is in itself significant. With these considerations in mind, I see the study not as a rebuttal but as a complement to existing research

that focuses on the everyday, unnoticed workings of these apps. Another limitation linked to the methodology is that I have not been able to include the perspectives of those living in what Waze defines as dangerous areas, since their voices were not represented online. In the case of Jerusalem, I was partially able to mitigate this problem, thanks to greater familiarity with the city and the possibility to conduct ethnographic research offline. While I discuss the issue of marginal voices and Palestinian views on WADA elsewhere (*reference removed for peer-review*), these additional sources have certainly informed the interpretation of WADA in Jerusalem that I propose here. I am certain that the perspectives of favela residents and US inner-neighbourhood residents would likewise raise problems and questions that are not covered in this study, but that would be important to investigate.

To conclude, I would like to reiterate the importance of grounded, comparative studies for unpacking many concepts heralded as emblematic of the digital era, from crowdsourcing to digitally augmented realities, from the smart city to data colonialism. Considered through a comparative lens, these phenomena are likely to reveal themselves more complex and unstable than it is generally assumed. The point is not to dissolve all attempts at theorising the digital into a myriad of isolated case studies, but to test our concepts through empirical investigations in a variety of settings, lest they become totalising discourses or ‘god tricks’ (Haraway 1988) claiming to see everything from nowhere.

References

- Adey, P., & Anderson, B. (2011). Event and Anticipation: UK Civil Contingencies and the Space—Times of Decision. *Environment and Planning A: Economy and Space*, 43(12), 2878–2899.
<https://doi.org/10.1068/a43576>

- Amnesty International. (2015, August 3). Brazil: 'Trigger happy' military police kill hundreds as Rio prepares for Olympic countdown. *Amnesty International*.
<https://www.amnesty.org/en/latest/news/2015/08/brazil-trigger-happy-military-police-kill-hundreds-as-rio-prepares-for-olympic-countdown/>. Accessed 30 November 2017
- Amoore, L. (2009). Algorithmic War: Everyday Geographies of the War on Terror. *Antipode*, 41(1), 49–69. <https://doi.org/10.1111/j.1467-8330.2008.00655.x>
- Anderson, W., & Adams, V. (2008). Pramoedya's chickens: Postcolonial studies of technoscience. In E. J. Hackett, O. Amsterdamska, M. Lynch, & J. Wajcman (Eds.), *The handbook of science and technology studies* (Vol. 3, pp. 181–204). MIT Press.
- Andrade, H. (2016, December 17). No Rio, errar o caminho e cair em uma favela pode ser fatal para motoristas. *Cotidiano*. <https://noticias.uol.com.br/cotidiano/ultimas-noticias/2016/12/17/no-rio-errar-o-caminho-e-cair-em-uma-favela-pode-ser-fatal-para-motoristas.htm>. Accessed 14 December 2017
- AndyPoms. (2015, August 10). Identificar áreas de risco de assalto. *Waze App Feature Requests*.
<https://www.waze.com/forum/viewtopic.php?f=657&t=153847&sid=5ef6197e18b9be364249eb21b1a08d21>. Accessed 17 December 2017
- Ash, J., Kitchin, R., & Leszczynski, A. (2016). Digital turn, digital geographies? *Progress in Human Geography*, 0309132516664800. <https://doi.org/10.1177/0309132516664800>
- Badger, E. (2013, September 4). Enough Already With the Avoid-The-Ghetto Apps. *CityLab*.
<http://www.theatlanticcities.com/neighborhoods/2013/09/enough-already-avoid-ghetto-apps/6776/>. Accessed 14 December 2017
- Barnes, T. J., & Wilson, M. W. (2014). Big data, social physics, and spatial analysis: The early years. *Big Data & Society*, 1(1), 2053951714535365.

- Barreto-Filho, H. (2016, March 8). Waze mapeia 25 áreas com risco de crime no Rio - Rio. *O Dia*.
<http://odia.ig.com.br/rio-de-janeiro/2016-08-03/waze-mapeia-25-areas-com-risco-de-crime-no-rio.html>. Accessed 14 December 2017
- Beaumont, P. (2016, March 1). Israeli soldiers' app use leads to deadly fight in West Bank camp. *The Guardian*. <https://www.theguardian.com/world/2016/mar/01/israeli-soldiers-waze-app-use-leads-to-deadly-fight-in-palestinian-west-bank-camp>. Accessed 15 May 2017
- Bittner, C. (2016a). Diversity in volunteered geographic information: comparing OpenStreetMap and Wikimapia in Jerusalem. *GeoJournal*. <https://doi.org/10.1007/s10708-016-9721-3>
- Bittner, C. (2016b). OpenStreetMap in Israel and Palestine—'Game changer' or reproducer of contested cartographies? *Political Geography*.
<http://www.sciencedirect.com/science/article/pii/S096262981630035X>. Accessed 27 December 2016
- Bridle, J. (2018). *New dark age: technology and the end of the future*. London Brooklyn, NY: Verso.
- Burns, R., & Meek, D. (2015). The Politics of Knowledge Production in the Geoweb. *ACME: An International E-Journal for Critical Geographies*, 14(3), 786–790.
- Caplan, N. (2010). *The Israel-Palestine conflict: contested histories*. Chichester, U.K. ; Malden, MA: Wiley-Blackwell.
- Carraro, V., & Wissink, B. (2018). Participation and marginality on the geoweb: The politics of non-mapping on OpenStreetMap Jerusalem. *Geoforum*, 90, 64–73.
<https://doi.org/10.1016/j.geoforum.2018.02.001>
- Chandler, A. (2015, February 23). Jerusalem's Mayor Subdues Knife-Wielding Attacker. *The Atlantic*.
<https://www.theatlantic.com/international/archive/2015/02/jerusalem-mayor-Nir-Barkat-subdues-kife-wielding-attacker/385795/>. Accessed 4 November 2018

- CNN, S. D. (2015, August 10). Brazil: Slain woman followed Waze app to wrong street. *CNN*.
<http://www.cnn.com/2015/10/05/americas/brazil-wrong-directions-death/index.html>.
Accessed 14 December 2017
- Collins, H. M. (1981). *Knowledge and controversy: Studies of modern natural science*. Sage.
- Crampton, J. W. (2015). Collect it all: national security, Big Data and governance. *GeoJournal; Dordrecht*, 80(4), 519–531. <http://dx.doi.org.ezproxy.cityu.edu.hk/10.1007/s10708-014-9598-y>
- Crawford, K., & Finn, M. (2015). The limits of crisis data: analytical and ethical challenges of using social and mobile data to understand disasters. *GeoJournal*, 80(4), 491–502.
<https://doi.org/10.1007/s10708-014-9597-z>
- Datta, A. (2015). New urban utopias of postcolonial India: ‘Entrepreneurial urbanization’ in Dholera smart city, Gujarat. *Dialogues in Human Geography*, 5(1), 3–22.
<https://doi.org/10.1177/2043820614565748>
- Datta, A. (2018, May 11). *Fast Urbanism: Speed, scale and the city from the margins of India’s urban age*.
Keynote Lecture presented at the Conference of Irish Geographers, Maynooth.
- Del Casino, V., & Hanna, S. (2005). Beyond The ‘Binaries’: A Methodological Intervention for Interrogating Maps as Representational Practices. *ACME*, 4(1), 34–56.
- Dumper, M. (2014). *Jerusalem unbound: geography, history, and the future of the holy city*. New York: Columbia University Press.
- Dvir, N. (2014, September 12). Stones thrown against a family that entered Wadi Joz instead of the Western Wall because of a navigation mistake. *Ynet*.
<http://www.ynet.co.il/articles/0,7340,L-4570236,00.html>. Accessed 7 December 2017

- Elwood, S., & Leszczynski, A. (2013). New spatial media, new knowledge politics. *Transactions of the Institute of British Geographers*, 38(4), 544–559. <https://doi.org/10.1111/j.1475-5661.2012.00543.x>
- EricE27. (2016, April 24). Avoid Areas (High Crime/Bad Roads/School Zones). *Waze App Feature Requests*.
<https://www.waze.com/forum/viewtopic.php?f=657&t=57730&sk=t&sid=0443eb4f79e2b2bd2221952ce72c0b38>. Accessed 17 December 2017
- Ericson, R., & Doyle, A. (2004). Catastrophe risk, insurance and terrorism. *Economy and Society*, 33(2), 135–173. <https://doi.org/10.1080/03085140410001677102>
- Euronews. (2016, December 10). Italian tourist killed after GPS system leads him into Rio favela. *euronews*. <https://www.euronews.com/2016/12/10/italian-tourist-killed-after-gps-system-leads-him-into-rio-favela>. Accessed 6 November 2018
- Fariás, I., & Widmer, S. (2018). Ordinary Smart Cities. How Calculated Users, Professional Citizens, Technology Companies and City Administrations Engage in a More-than-digital Politics. *TECNOSCIENZA: Italian Journal of Science & Technology Studies*, 8(2), 43–60.
- Farman, J. (2013). *Mobile Interface Theory : Embodied Space and Locative Media*. Routledge.
<https://doi.org/10.4324/9780203847664>
- Ferrari, B. (2015, October 24). A culpa não foi do Waze. *Epoca*.
<http://epoca.globo.com/vida/experiencias-digitais/noticia/2015/10/culpa-nao-foi-do-waze.html>. Accessed 14 December 2017
- Fox News. (2016, December 5). Woman shot, killed after Waze GPS sends her into dangerous Brazilian favela. *Fox News*. InteractiveResource. <https://www.foxnews.com/world/woman-shot-killed-after-waze-gps-sends-her-into-dangerous-brazilian-favela>. Accessed 6 November 2018

- G1. (2015, March 17). “Achei que fosse morrer”, diz ator sobre assalto em favela no Rio. *Rio de Janeiro*. <http://g1.globo.com/rio-de-janeiro/noticia/2015/03/achei-que-fose-morrer-diz-ator-sobre-assalto-em-favela-no-rio.html>. Accessed 14 December 2017
- Gibson, O., & Watts, J. (2013, December 5). World Cup: Rio favelas being “socially cleansed” in runup to sporting events. *The Guardian*.
<http://www.theguardian.com/world/2013/dec/05/world-cup-favelas-socially-cleansed-olympics>. Accessed 30 November 2017
- Goodyear, V. A., & Armour, K. M. (2018). Young people’s perspectives on and experiences of health-related social media, apps, and wearable health devices. *Social Sciences*, 7(8).
<https://doi.org/10.3390/socsci7080137>
- Güiza, F., & Stuart, N. (2018). When citizens choose not to participate in volunteering geographic information to e-governance: a case study from Mexico. *GeoJournal*, 83(5), 1151–1167.
<https://doi.org/10.1007/s10708-017-9820-9>
- Gutierrez, M. (2018). Maputopias: cartographies of communication, coordination and action—the cases of Ushahidi and InfoAmazonia. *GeoJournal*, *in press*. <https://doi.org/10.1007/s10708-018-9853-8>
- Haggerty, K. D., & Ericson, R. V. (2000). The surveillant assemblage. *The British Journal of Sociology*, 51(4), 605–622. <https://doi.org/10.1080/00071310020015280>
- Halford, S., & Savage, M. (2010). Reconceptualizing Digital Social Inequality. *Information, Communication & Society*, 13(7), 937–955. <https://doi.org/10.1080/1369118X.2010.499956>
- Haraway, D. (1988). Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. *Feminist Studies*, 14(3), 575–599. <https://doi.org/10.2307/3178066>

- Har-Zahav, H. (2016, February 29). A few months ago, when the current intifada began... *Facebook*.
<https://www.facebook.com/haimhz/posts/10153927372701505>. Accessed 16 December 2017
- hatzemberg. (2015, March 17). Waze HAVE TO pay attention to dangerous area. *Waze App Feature Requests*.
<https://www.waze.com/forum/viewtopic.php?f=657&t=133149&sid=2f86b52b78865939fe48a7bc1cc74748>. Accessed 6 November 2018
- Holmes, D. (2013, March 9). Pando: GhettoTracker is the worst site on the Internet. *Pando News*.
<https://pando.com/2013/09/03/ghettotracker-is-the-worst-site-on-the-internet/>. Accessed 14 December 2017
- Huggins, C., & Frosina, N. (2017). ICT-driven projects for land governance in Kenya: disruption and e-government frameworks. *GeoJournal*, 82(4), 643–663. <https://doi.org/10.1007/s10708-016-9710-6>
- Introna, L. D., & Nissenbaum, H. (2000). Shaping the Web: Why the politics of search engines matters. *The information society*, 16(3), 169–185.
- joaotavolaro. (2015, August 10). Identificar áreas de risco de assalto. *Waze App Feature Requests*.
<https://www.waze.com/forum/viewtopic.php?f=657&t=153847&sid=5ef6197e18b9be364249eb21b1a08d21>. Accessed 6 November 2018
- Kaiser, A. J., & Jacobs, A. (2016, August 7). Security Force of 85,000 Fills Rio, Unsettling Rights Activists. *The New York Times*. <https://www.nytimes.com/2016/08/08/world/americas/rio-olympics-crime.html>. Accessed 6 November 2018
- Kaufmann, M., & Jeandesboz, J. (2017). Politics and ‘the digital’: From singularity to specificity. *European Journal of Social Theory*, 20(3), 309–328. <https://doi.org/10.1177/1368431016677976>

- Kinsley, S. (2014). The matter of 'virtual' geographies. *Progress in Human Geography*, 38(3), 364–384.
<https://doi.org/10.1177/0309132513506270>
- Kitchin, R. (2014). The real-time city? Big data and smart urbanism. *GeoJournal*, 79(1), 1–14.
<https://doi.org/10.1007/s10708-013-9516-8>
- Kitchin, R., & Dodge, M. (2005). Code and the Transduction of Space. *Annals of the Association of American Geographers*, 95(1), 162–180. <https://doi.org/10.1111/j.1467-8306.2005.00454.x>
- Klawiter, M. (2002). Risk, prevention and the breast cancer continuum: The NCI, the FDA, health activism and the pharmaceutical industry. *History and Technology*, 18(4), 309–353.
<https://doi.org/10.1080/0734151022000023785>
- Kumar, S. (2017). A river by any other name: Ganga/Ganges and the postcolonial politics of knowledge on Wikipedia. *Information, Communication & Society*, 20(6), 809–824.
<https://doi.org/10.1080/1369118X.2017.1293709>
- Kwan, M.-P. (2016). Algorithmic Geographies: Big Data, Algorithmic Uncertainty, and the Production of Geographic Knowledge. *Annals of the American Association of Geographers*, 106(2), 274–282. <https://doi.org/10.1080/00045608.2015.1117937>
- Landström, C., Whatmore, S. J., Lane, S. N., Odoni, N. A., Ward, N., & Bradley, S. (2011). Coproducing Flood Risk Knowledge: Redistributing Expertise in Critical 'Participatory Modelling.' *Environment and Planning A: Economy and Space*, 43(7), 1617–1633.
<https://doi.org/10.1068/a43482>
- Latour, B., & Woolgar, S. (1979). *Laboratory life: The social construction of scientific facts*. Beverly Hills, Ca: Sage.
- Law, J. (2015). What's wrong with a one-world world? *Distinktion: Journal of Social Theory*, 16(1), 126–139. <https://doi.org/10.1080/1600910X.2015.1020066>

- Leszczynski, A. (2015). Spatial media/ation. *Progress in Human Geography*, 39(6), 729–751.
<https://doi.org/10.1177/0309132514558443>
- Leszczynski, A. (2016). Speculative futures: Cities, data, and governance beyond smart urbanism. *Environment and Planning A*, 48(9), 1691–1708. <https://doi.org/10.1177/0308518X16651445>
- Leszczynski, A., & Elwood, S. (2015). Feminist geographies of new spatial media. *The Canadian Geographer / Le Géographe canadien*, 59(1), 12–28. <https://doi.org/10.1111/cag.12093>
- Lin, W. (2013). Digitizing the Dragon Head, Geo-Coding the Urban Landscape: GIS and the Transformation of China's Urban Governance. *Urban Geography*, 34(7), 901–922.
<https://doi.org/10.1080/02723638.2013.812389>
- Lunenfeld, P. (Ed.). (1999). *The digital dialectic: new essays on new media*. Cambridge, Mass: MIT Press.
- Marantz, A. (2015, July 29). When an App Is Called Racist. *The New Yorker*.
<https://www.newyorker.com/business/currency/what-to-do-when-your-app-is-racist>.
Accessed 30 November 2017
- Marshall, A. (2016, July 31). Crime Alerts Come to Brazilian Waze, Just in Time for the Olympics. *WIRED*. <https://www.wired.com/2016/07/crime-alerts-come-brazilian-waze-just-time-olympics/>. Accessed 24 June 2017
- Martín, M. (2015, October 6). Mulher morre baleada ao entrar por engano em uma favela no Rio. *EL PAÍS*.
https://brasil.elpais.com/brasil/2015/10/05/actualidad/1444062892_524126.html.
Accessed 14 December 2017
- McFarlane, C., & Söderström, O. (2017). On alternative smart cities. *City*, 21(3–4), 312–328.
<https://doi.org/10.1080/13604813.2017.1327166>

- mchibly. (2014, January 23). How about include Crime Reports ? *Waze App Feature Requests*.
<https://www.waze.com/forum/viewtopic.php?f=657&t=78771&sid=5776d53c0e39ae429f406cf18a3f583c>. Accessed 6 November 2018
- Moffett, M. (2016, August 23). Waze can now warn you about high-crime neighborhoods in cities. But is that a good idea? *Quartz*. <https://qz.com/764036/waze-can-now-warn-you-about-high-crime-neighborhoods-in-cities-but-is-that-a-good-idea/>. Accessed 30 November 2017
- Morgan, T. (2016, August 4). Why Rio Olympics is on course to be most crime-ridden games. *The Telegraph*. <https://www.telegraph.co.uk/news/2016/08/04/why-rio-olympics-is-on-course-to-be-most-crime-ridden-games/>. Accessed 6 November 2018
- Ong, A. (2007). Neoliberalism as a mobile technology. *Transactions of the Institute of British Geographers*, 32(1), 3–8. <https://doi.org/10.1111/j.1475-5661.2007.00234.x>
- Otioma, C., Madureira, A. M., & Martinez, J. (2019). Spatial analysis of urban digital divide in Kigali, Rwanda. *GeoJournal*, 84(3), 719–741. <https://doi.org/10.1007/s10708-018-9882-3>
- Parsons, N., & Salter, M. B. (2008). Israeli Biopolitics: Closure, Territorialisation and Governmentality in the Occupied Palestinian Territories. *Geopolitics*, 13(4), 701–723. <https://doi.org/10.1080/14650040802275511>
- network. (2014, May 27). Dangerous Zones Reports. *Waze App Feature Requests*.
<https://www.waze.com/forum/viewtopic.php?f=657&t=94017&p=820011&hilit=dangerous&sid=114aa6e2a4d7db7ce54c706800175848#p820011>. Accessed 6 November 2018
- Phillips, D. (2015, October 5). How directions on the Waze app led to death in Brazil's favelas. *Washington Post*.
<https://www.washingtonpost.com/news/worldviews/wp/2015/10/05/how-directions-on-the-waze-app-led-to-death-in-brazils-favelas/>. Accessed 14 December 2017

- Poveda, S., & Roberts, T. (2018). Critical agency and development: applying Freire and Sen to ICT4D in Zambia and Brazil. *Information Technology for Development*, 24(1), 119–137.
<https://doi.org/10.1080/02681102.2017.1328656>
- Pow, C. P. (2015). Urban dystopia and epistemologies of hope. *Progress in Human Geography*, 39(4), 464–485. <https://doi.org/10.1177/0309132514544805>
- Puleo, M. (2018, September 14). Esri mapping, Waze partner to aid emergency responders, residents navigate amid Hurricane Florence. *AccuWeather*.
<https://www.accuweather.com/en/weather-news/esri-mapping-and-waze-navigation-have-combined-to-assist-emergency-responders-and-residents-during-hurricane-florence/70006063>. Accessed 11 June 2019
- Ramalho, G. (2015, October 16). Waze faz marcação de perigo em rua de Niterói. *Extra Online*.
<https://extra.globo.com/noticias/rio/waze-faz-marcacao-de-perigo-em-rua-de-niteroi-17793136.html>. Accessed 14 December 2017
- Rieder, B., & Sire, G. (2014). Conflicts of interest and incentives to bias: A microeconomic critique of Google's tangled position on the Web. *New Media & Society*, 16(2), 195–211.
<https://doi.org/10.1177/1461444813481195>
- Robinson, J. (2011). Cities in a World of Cities: The Comparative Gesture: Cities in a world of cities compared. *International Journal of Urban and Regional Research*, 35(1), 1–23.
<https://doi.org/10.1111/j.1468-2427.2010.00982.x>
- Robinson, J. (2016a). Thinking cities through elsewhere: Comparative tactics for a more global urban studies. *Progress in Human Geography*, 40(1), 3–29.
<https://doi.org/10.1177/0309132515598025>

- Robinson, J. (2016b). Comparative Urbanism: New Geographies and Cultures of Theorizing the Urban. *International Journal of Urban and Regional Research*, 40(1), 187–199.
<https://doi.org/10.1111/1468-2427.12273>
- Rogers, R. (2014, November 3). *Search as Research - Repurposing Google: Query Design*.
https://www.youtube.com/watch?v=oxfykoCKgz0&list=PLKzQwIKtJvv_E4x-lbcxVIOYmNEZUTDi0&index=1. Accessed 15 October 2019
- Rose, G. (2017). Posthuman Agency in the Digitally Mediated City: Exteriorization, Individuation, Reinvention. *Annals of the American Association of Geographers*, 107(4), 779–793.
<https://doi.org/10.1080/24694452.2016.1270195>
- Roy, A. (2015). Who's Afraid of Postcolonial Theory? *International Journal of Urban and Regional Research*, n/a-n/a. <https://doi.org/10.1111/1468-2427.12274>
- Sadowski, J., & Bendor, R. (2019). Selling Smartness: Corporate Narratives and the Smart City as a Sociotechnical Imaginary. *Science, Technology, & Human Values*, 44(3), 540–563.
<https://doi.org/10.1177/0162243918806061>
- Sadowski, J., & Pasquale, F. A. (2015). *The Spectrum of Control: A Social Theory of the Smart City* (SSRN Scholarly Paper No. ID 2653860). Rochester, NY: Social Science Research Network.
<https://papers.ssrn.com/abstract=2653860>. Accessed 7 May 2018
- Sansone, L. (2003). *Blackness without ethnicity: constructing race in Brazil* (1st ed.). New York: Palgrave MacMillan.
- Savage, M. (2013). Digital fields, networks and capital: Sociology beyond structures and fluids. In *Digital Sociology* (pp. 139–147). Springer.
- Schechter, A. (2014, September 19). Guided by Waze Into the Heart of the Palestinian-Israeli Conflict. *Haaretz*. <http://www.haaretz.com/israel-news/.premium-1.616596>. Accessed 22 May 2017

- Schmid, C., Karaman, O., Hanakata, N. C., Kallenberger, P., Kockelkorn, A., Sawyer, L., et al. (2018). Towards a new vocabulary of urbanisation processes: A comparative approach. *Urban Studies*, 55(1), 19–52. <https://doi.org/10.1177/0042098017739750>
- Shelton, T., Zook, M., & Wiig, A. (2015). The ‘actually existing smart city.’ *Cambridge Journal of Regions, Economy and Society*, 8(1), 13–25. <https://doi.org/10.1093/cjres/rsu026>
- Silver, J. (2013, February 10). Is Your Turn-By-Turn Navigation Application Racist? *American Civil Liberties Union*. <https://www.aclu.org/blog/national-security/your-turn-turn-navigation-application-racist>. Accessed 14 December 2017
- Soprana, P. (2016, July 30). Waze indicará locais perigosos no Rio de Janeiro. *revistaepoca.globo.com*. <http://epoca.globo.com/vida/experiencias-digitais/noticia/2016/07/waze-indicara-locais-perigosos-no-rio-de-janeiro.html>. Accessed 14 December 2017
- Stengers, I. (2005). The cosmopolitical proposal. In B. Latour & P. Weibel (Eds.), L. Carey-Libbrecht (Trans.), *Making things public: atmospheres of democracy* (pp. 994–1003). Cambridge, Mass.: [Karlsruhe, Germany]: MIT Press ; ZKM/Center for Art and Media in Karlsruhe.
- Stengers, I. (2011). Comparison as a Matter of Concern. *Common Knowledge*, 17(1), 48–63. <https://doi.org/10.1215/0961754X-2010-035>
- Tawil-Souri, H. (2012). Uneven Borders, Coloured (Im)mobilities: ID Cards in Palestine/Israel. *Geopolitics*, 17(1), 153–176. <https://doi.org/10.1080/14650045.2011.562944>
- Thatcher, J. (2013). Avoiding the Ghetto through hope and fear: an analysis of immanent technology using ideal types. *GeoJournal*, 78(6), 967–980. <https://doi.org/10.1007/s10708-013-9491-0>
- Thatcher, J. (2017). You are where you go, the commodification of daily life through ‘location.’ *Environment and Planning A: Economy and Space*, 49(12), 2702–2717. <https://doi.org/10.1177/0308518X17730580>

- Veracini, L. (2013). The Other Shift: Settler Colonialism, Israel, and the Occupation. *Journal of Palestine Studies*, 42(2), 26–42.
- Waze. (2016). *Driver Satisfaction Index 2016* (p. 24). Waze. <https://inbox-static.waze.com/driverindex.pdf>. Accessed 18 November 2017
- Whatmore, S. J. (2009). Mapping knowledge controversies: science, democracy and the redistribution of expertise. *Progress in Human Geography*, 33(5), 587–598.
<https://doi.org/10.1177/0309132509339841>
- Wilson, M. W. (2014). Continuous connectivity, handheld computers, and mobile spatial knowledge. *Environment and Planning D: Society and Space*, 32(3), 535–555.
- Wood, A. (2019). Tracing urbanism: methods of actually doing comparative studies in Johannesburg. *Urban Geography*, 0(0), 1–19. <https://doi.org/10.1080/02723638.2019.1659072>
- Xu, Y., Jiang, S., Li, R., Zhang, J., Zhao, J., Abbar, S., & González, M. C. (2019). Unraveling environmental justice in ambient PM 2.5 exposure in Beijing: A big data approach. *Computers, Environment and Urban Systems*, 75, 12–21.
<https://doi.org/10.1016/j.compenvurbsys.2018.12.006>
- Yanovsky, R. (2015, August 8). Waze directing users away from “PA controlled” East Jerusalem. *Ynetnews*. <http://www.ynetnews.com/articles/0,7340,L-4695380,00.html>. Accessed 15 December 2017
- zeo_hound. (2012, March 27). Danger Routes. *Waze App Feature Requests*.
<https://www.waze.com/forum/viewtopic.php?f=16&t=17784&p=159469&hilit=ghetto#p159469>. Accessed 6 November 2018
- Zwick, A. (2018). Welcome to the Gig Economy: neoliberal industrial relations and the case of Uber. *GeoJournal*, 83(4), 679–691. <https://doi.org/10.1007/s10708-017-9793-8>