

Digitization processes at the neighborhood scale: Infrastructure, governance, community, and practices

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Tali Hatuka 

Laboratory for Contemporary Urban Design (LCUD), Porter School of the Environment and Earth Sciences, Tel Aviv University, Tel Aviv, Israel

Gal Elhanan

Laboratory for Contemporary Urban Design (LCUD), Porter School of the Environment and Earth Sciences, Tel Aviv University, Tel Aviv, Israel

Abstract

This paper links the discourse on neighborhoods with the discourse on digitization. From an analytical perspective, digitization is no longer viewed as an independent infrastructure but one that is physically located and affects materiality, sociability, and daily conduct. From the normative perspective, it is becoming clear how differences in digital infrastructure/services/use among and within neighborhoods influence social resiliency and access to resources. Exploring these ideas, this paper offers a thematic review of four key areas, infrastructure, governance, community, and practices, while addressing critical ideas in studies of neighborhoods pre-digitization and neighborhoods supported by digitization. This review is followed by an elaboration of the main shifts, open questions, and gaps in the literature. The paper concludes with a discussion on the neighborhood in the digital age, a much-needed lens for understanding both past and contemporary development, and a pathway leading to better neighborhood futures.

Keywords

neighborhoods studies, everyday life, digital experience, community, physical space/digital space, theory

Corresponding author:

Tali Hatuka, Laboratory for Contemporary Urban Design (LCUD), Porter School of the Environment and Earth Sciences, Tel Aviv University, P.O. Box 39040, Tel Aviv 6997801, Israel.

Email: hatuka@tauex.tau.ac.il

Introduction

The neighborhood is a key spatial unit for the analysis and development of urban study planning. It is a term found in many languages (Talen, 2018: 11) and has been a focus of study in multiple disciplines since the early 20th century (Kearns and Parkinson, 2001). The neighborhood's multidimensional characteristics—physical, demographic, economic, social, environmental, and institutional elements—(Galster, 2019: x-xi) have an enormous influence on everyday life. As seen during the COVID-19 pandemic (Hong et al., 2021; Hananel, Fishman, and Malovicki-Yaffe, 2022), the neighborhood is still an important and relevant unit for analysis and planning intervention.

There are multiple debates over the neighborhood concept in urban planning concerning physical design, planning, governance, social relevance, and segregation, as well as the right way to frame the path forward (Talen, 2018). However, the 'digital turn' (Ash, Kitchin and Leszczynski, 2018: 25) that has been acknowledged in various disciplines and from multiple angles has not been significantly recognized in the planning literature. Generally, the discourse over the implications and meaning of the digital turn, with a focus on cities, started in the late 20th century and is still evolving. Digitization processes were first studied mainly from a technological perspective, with a focus on aspects of communication systems and urban infrastructure. In the early 1990s, scholars such as Manuel Castells (Castells, 1992, 2010) in the social sciences and William Mitchell (Mitchell, 1999) in architecture emphasized the impact of these new systems and upgraded infrastructure on our daily lives, paying special attention to mobility, service systems, and civil participation (Jensen, 2009; Berry and Hamilton, 2010; Hampton, Livio and Sessions Goulet, 2010). Studies have explored the evolving relationship between residents and authority and promoted the idea of participatory governance (Almirall et al., 2016; Barns et al., 2017; Barns, 2018; Csukás, Bukovszki and Reith, 2020). Along with the fascination of 'the way technology liberates society,' other voices from the early 21st century have addressed how technology restructures space, time, and relations among activities, saturates and sustains contemporary capitalist societies, and deepens inequalities (Graham, 2011; Kitchin, 2014; Brannon, 2017; Allam and Dhunny, 2019; Bayat and Kawalek, 2023). In parallel, studies have started to explore the influence of digitization on residents and social groups. In urban studies, for example, attention is given to how digitization changes social life, how digital practices intersect with political interests (Elwood, 2021) and how digital technologies reshape social encounters and change the perceptions of social concepts, such as intimacy and connections between strangers (Koch and Miles, 2021). Scholars have also explored how the digital environment affects the spatial aspects of life as the mundane environment becomes embedded with digital artifacts (Leszczynski, 2020) and workspaces are in constant flux (Richardson, 2018).

This evolving discourse on digitization did not directly engage with the planning field. Most of these discussions have taken place in geography, sociology, law, and computation. To date, the evolving literature on digitization in planning theory has been discussed from two key perspectives. First, digitization is a *mechanism* that alters the planning system and influences regulatory practices and public participation (Potts, 2020;

Boland et al., 2022). This phase is titled the 'Planning 3.0 paradigm', pointing to the "shifting understanding of cities as the focus of planning, new methodologies, and knowledge systems that combine, analyze and interpret multiple streams of data in real-time" (Potts, 2020: 284). The second and least explored approach is digitization, which is an *experience* that alters social processes in cities and places. This approach acknowledges the power of technology as a control instrument while also aiming to avoid technological determinism. Indeed, data are collected vertically 'in the name of public safety' (i.e., top-down surveillance and 'smart' data centers) but also shared horizontally 'in the name of democracy' (i.e., through individuals' social networks). Importantly, this vertical-horizontal dynamic is not a dichotomist condition but should be seen as an ongoing social process that alters norms and conduct in daily life (Hatuka and Toch, 2017: 986).

This paper focuses on digitization as an *experience* in the context of place and, more specifically, in neighborhoods. Numerous studies have explored digitization at the city scale, but far fewer have addressed the longer-run effects of digital technology on neighborhoods' daily lives, i.e., infrastructure (e.g., transportation), governance (e.g., local and municipal platforms that provide services and information), and community dynamics. Moreover, no studies have explored how digital turns alter the experience of people in neighborhoods. In addressing this gap, this paper links two rich bodies of research, neighborhoods and digitization. Linking these discourses is a daunting task and faces the risk of oversimplification. However, this approach can help respond to one key question: What are the issues on which digitization has an impact on everyday life in the neighborhood? In response to this question, the framework of the paper focuses on four key themes—infrastructure, governance, community, and practices—exploring the way they have been conceptualized and studied in neighborhoods 'predigitization' and in neighborhoods that are "supported by digitization". This framework allows us to avoid clear cuts before and after, indicating that we are just beginning the technological penetration processes; however, at the same time, there is enough evidence that can help us construct a place-based approach to digitization at the neighborhood scale. Furthermore, this framework suggests that digitization is not an autonomous layer but rather a process that alters many aspects of daily conduct in neighborhoods. A better understanding of how neighborhood development affects neighborhoods might influence how neighborhood development is considered.

The significance of developing this analytical framework is based on the premise that digitization has different impacts on different locales, allowing new patterns and practices in the virtual sphere and altering (yet not eliminating) the role of physical spaces. This approach differs from the methods used in papers that focus on digital/smart cities, often based on the techno-utopian belief that the use of IT is imperative in confronting the challenges of urbanization and sustainable development (Buck & While, 2015; Gabrys, 2014; Townsend, 2014; Watson, 2015). However, "while the literature extensively addresses the implications of smart cities and their technological innovations that support governance and citizen services, the topics of local neighborhood-level developments and their impacts remain among the least explored" (Nath et al., 2023: 2). Moreover, we argue that the relevant scale for understanding digitization processes is the neighborhood scale,

as this scale allows us to understand differences among places in the city, to question differences in local resident dynamics in adapting to digital processes, and, as such, to reflect the conceptualization of the neighborhood in the 21st century.

As such, the motivation for addressing digitization at the neighborhood scale is both analytical and normative. From an analytical perspective, digitization is no longer viewed as an independent infrastructure but rather as one that is physically located and affects materiality, sociability and daily conduct (Hatuka, Zur and Mendoza, 2021). Recent studies have explored the role of social media in neighborhood perception, indicating the presence of shifting and evolving sentiments (Kontokosta, Freeman and Lai, 2021; Park et al., 2021). Others have suggested that neighborhood-oriented online social networks can strengthen community connections and resilience (Vogel et al., 2021), especially when addressing the risk of exclusion and surveillance (Kurwa, 2019; Lambright, 2019). From the normative perspective, it is becoming clear that digitization infrastructures are not distributed evenly across cities and regions, generating gaps that might influence local resiliency and access to resources (Hatuka and Zur, 2020; Hatuka, Zur and Mendoza, 2021). This argument gained salience during the pandemic, when neighborhood “Streets proved very important in setting a cognitive, emotional, and organizational framework inside which conviviality and collaboration among neighbors could find greater plausibility” (Introini, Morelli and Pasqualini, 2021: 302).

Following these ideas and motivations, this paper starts with a thematic review of the role digitization plays in contemporary neighborhoods, followed by a discussion of the key shifts and gaps in research on neighborhoods in the digital age. The paper concludes with a reflection on how we need to address and analyze neighborhoods in the digital age.

Neighborhoods predigitization and neighborhoods “supported by digitization”

What is a neighborhood? What is a neighborhood in the digital age? In the context of the contemporary configurations of regions, defined as networks of economic, social and political powers (Healey, 2006; Hall, 2009; Turok, 2009), responding to this question is not easy. The current ambiguity of neighborhood definitions can be seen in the context of contemporary urban life, which has become less about localized relationships that require physical contact, and the idea of a neighborhood has become open to wider interpretation. This interpretation led to the observation that “hundreds of definitions now ascribed to neighborhood vary by how and whether people, home, place, morphology, territory, behavior, perception, or governance is prioritized” (Talen, 2018: 60). In addition, spatial changes in recent decades have accelerated the theoretical debate over distinct spatial lexicons and the definitions of territory, place, scale, and network (Jessop, Brenner and Jones, 2008). Scholars argue that contemporary social and economic processes take place beyond the geographic boundaries of a city and we should view separate metropolitan areas as connected, polycentric regions (Burger, Meijers and van Oort, 2014). This contested approach is based on the assumption that the traditional Christallerian central-place conceptualization of urban systems is outdated and thus should be replaced by a network view of urban systems without an urban

hierarchy (Burger, Meijers and van Oort, 2014: 1921). However, this idea of the network as the organizing logic of contemporary global environments is not embraced by all, and scholars suggest that networks indeed reinforce the dispersion of urban-regional activities and at the same time foster their concentration in specific locales (Albrechts and Mandelbaum, 2007). Furthermore, digital platforms are often designed to support daily needs (e.g., shopping, transportation, payments, social needs) and are responsive to daily patterns and the immediate environment. However, while information and communications technologies (ICTs) produce space-time compression, geography remains critical (Ash, Kitchin and Leszczynski, 2018). Small city size, location, quality, accessibility (shops, schools, and public transport), safety, and neighborhood design enable (although they do not always determine) social interactions and cohesion at the neighborhood level (Gutman, 1976; Pojani and Buka, 2015). Furthermore, other aspects of the urban sociospatial environment, such as “geo-ethnicity”, spatial segregation and concentrated poverty, influence technology use (Jung, Kim and Ball-Rokeach, 2007; Mossberger et al., 2012).

In addressing the idea of the neighborhood in the digital age, this section focuses on four themes in neighborhood studies: infrastructure, governance, community, and practices. In infrastructure, the focus is on changes in physical development; in governance, the focus is on local organization; in community, the discussion is on social dynamics; and in practice, the discussion is on daily activities. In the following, each area is briefly introduced with a focus on the ideas and concepts associated with it before digitization and during contemporary times.

Infrastructure

Infrastructure and physical principles have been viewed as the basic foundations of a neighborhood. *Predigitization*, Perry’s historical and influential concept of the neighborhood unit, is based on various principles, including population size, school, the local shopping array of traffic, and open spaces. These principles, supported by physical infrastructure, define neighborhood boundaries as distinct units in a city (Cheng, 2021: 52-53) and contribute to a sense of belonging. However, the approach to the infrastructure of neighborhoods is dynamic and expanding. Before the 1960s, “neighborhoods were routinely defined on the basis of their physicality, delineated by ‘physiographic spaces’ like roads and topography, or on the basis of service areas that related population to service needs” (Talen, 2018: 245). Over the last two decades, the issue of mobility in all forms has been viewed as a significant factor in neighborhoods, with a major influence on health and well-being (Wang and Wen, 2017: 1) for various age groups (Rosso et al., 2013: 761). Furthermore, attention has been given to the relationships between open spaces and mobility (Sugiyama et al., 2010: 1752). The public amenities and spaces of neighborhood streets, sidewalks, parks, and squares also play a social role and have been viewed as supporting social mixing. Public spaces in particular have been perceived as having an important role in neighbors’ outdoor interactions, building the neighborhood’s sense of community (Al-Hagla, 2008: 162) and enhancing content and trust among residents (Cox and Streeter, 2019: 1).

In neighborhoods supported by digitization, infrastructure refers to different initiatives developed at different scales: the city scale with generic projects, the local scale with place-based initiatives, and the microscale of private individual projects. The aim in advancing most of these initiatives is to enhance the efficient provision of city services through surveillance and data collection. Infrastructures developed by municipalities often include high-speed broadband and Wi-Fi networks, communication hubs, and CCTVs (Kumar et al., 2018: 217), as well as upgrading online services and developing urban infrastructure in issues involving transportation and sanitation. However, different neighborhoods in a city are affected by these infrastructures differently (Popiel and Pickard, 2022), and “while infrastructure can change urban landscapes, it is also shaped by and through the forces that act upon it” (Steele and Legacy, 2017: 1). This is why it is important to explore the way infrastructure developed by the municipality supports local initiatives and products such as waste disposal, water or parking management, which are sometimes more local, relating to the design guidelines of the neighborhood or initiatives of the community. Some neighborhoods in cities benefit from digitally supported renewable energy sources, waste drainage and recycling advanced systems (Jansen, Mohammadi and Bokel, 2021). Finally, there are individual interventions, such as smart homes, that also alter neighborhood morphology “to adopt and operate new technologies” (Nath et al., 2023: 8). Although there are vast differences in the way digital infrastructures and products are being integrated into cities and regions, there have not yet been studies on resident-centered infrastructure requirements and use (Nath et al., 2023: 2) at the neighborhood scale.

Governance

Locality has been viewed as enabling participatory governance. *Predigitization* neighborhoods functioned as an intersection between formal and informal politics (Cheng, 2021: 28). Encouraging local governance has been viewed as leading to “better calibrated policies and improve the public’s confidence in local government” (Collins, 2021: 3), as well as improving urban service delivery. Local governance bodies are placed between the municipality and the community and are “uniquely positioned to influence city policies on a neighborhood scale” (Rosen and Avni, 2019: 2). The advantages of local governance are numerous and include efficiency (because of decentralization and subsidiarity), accountability (via greater transparency since local residents are closer to the issues), familiarity (which improves resident interaction and effectiveness at getting things done), and convenience (thus giving neighborhoods instant relevance) (Talen, 2018: 160). Indeed, neighborhood governance systems vary greatly; some are initiated by the municipality with the purpose of developing local partnerships, others are more formalized, followed by public elections and support from resources in the municipality, and another path is developing a network of overlapping neighborhood associations (Collins, 2021: 3). However, scholars argue that neighborhood governance is limited and that actions are often limited to “small-scale beautification projects rather than engaging in broader social justice issues”

(Collins, 2021: 3-4); however, these organizations often support a sense of belonging. Indeed, neighborhood governance has never been viewed as utopian, as it often replicates existing power relations (Rosen and Avni, 2019: 2) or structural inequity. However, “the aftermath of decades of urban renewal and urban divestment has led planners to adopt a discourse of resident engagement and empowerment that reassures urbanites that they can and should have a say over local decision making” (Collins, 2021: 10-11).

In neighborhoods supported by digitization, governance has been supported by ICTs. Social networks have become valuable mediums for neighborhood planning—cultivating bottom-up engagement in local communities, building trust (Rhoads, 2010), and providing opportunities to achieve more efficient neighborhood development (Renyi et al., 2022: 3). For example, in some communities, COVID-19 lockdown digital platforms were often considered important sources of information. “Authorities could use them to provide updates in real time and were able to respond very quickly to questions from the citizens who therefore felt better informed than through the newspaper or other social media. Activities such as sewing masks were also organized via the neighborhood platform, and restaurants could publish their takeaway and delivery services (Renyi et al., 2022: 13). Access and representation are still viewed as both challenges and opportunities for more inclusive representation (Afzalan and Evans-Cowley, 2015: 281). Scholars point out that technology is a means and does not replace active governance of the neighborhood “but [ensures that it is] systematically coordinated and supported by institutional arrangements” (Grotherr, Vogel and Semmann, 2020: 2303). The success of implementing technology in neighborhood governance “depends not only on the technical functionality of such tools but also strongly on the characteristics of the neighborhood (e.g., social and technological infrastructure) and the potential users (e.g., differences in digital skills)” (Renyi et al., 2022: 3-4). In addition, social media should be viewed as a supplement to other forms of communication, including face-to-face interactions and events. Top-down and bottom-up approaches are viewed as effective when integrated (Nakano and Washizu, 2021: 10). However, the integration process is complex, and the differences between neighborhoods contribute to this complexity. It is clear that “actors, resources, infrastructures, and institutions should be integrated while considering institutional arrangements, trust, and privacy issues. However, knowledge of how to manage such a complex undertaking is scarce” (Grotherr, Vogel and Semmann, 2020: 2310). Likewise, “the implementation and use of digital neighborhood platforms and other digital tools for neighborhood social networking are still insufficiently researched” (Renyi et al., 2022: 2–3). Furthermore, concerns have been raised regarding digital exclusion “as new technologies are inaccessible to some groups of people in society, that is, relating to class, race, age, gender, etc.” (Boland et al., 2022: 166). Clearly, digitization has changed the communication experience and form of information flow between residents and governance; however, this topic has been understudied, and there is a need to “expand research on the interrelationship between the penetration of various smart technologies to citizens, smart city-oriented area management, and social capital indicators” (Nakano and Washizu, 2021: 10).

Community

A neighborhood is often conceptualized as a form of community (Flint, 2009: 354). Although related to governance, the community is a more general and elusive category. *Predigitization* mainly refers to the everyday opportunities for urban inhabitants to ‘informally’ engage and form sites of social solidarity and protection (Flint, 2009: 355–356). Scholars agree that attachment to local places enhances a sense of belonging: “feelings combine in various quantities and qualities to influence how we think and experience certain neighborhood places, and perhaps attach to them, or not” (Drozdowski & Webster, 2021: 6). This also has several limitations: the community might enhance exclusion and segregation dynamics when avenues of spatial assimilation are systematically blocked by prejudice and discrimination, often when “new minorities arrive in the city and settle within enclaves, but their subsequent spatial mobility is stymied” (Massey, 2001: 392). Racial segregation also occurs in neighborhood schools and remains a highly prominent phenomenon in the twenty-first century (Owens, 2020: 29). In the cases of neighborhoods with different social groups, this dynamic can also be directed inward. The segregation dynamic often goes beyond those who feel segregated, “conditions conducive to higher levels of violence in local communities of all colors and compositions” (Krivo, Peterson and Kuhl, 2009: 1766). “While research on racial segregation in cities has grown rapidly over the last several decades, its foundation remains the analysis of the neighborhoods where people reside” (Candipan et al., 2021: 3095). Segregation can also be related to education and socioeconomic status. Studies show that “the income and wealth resources that a family is able to draw on influence its access to a high-opportunity neighborhood” (Thomas, Mann and Meschede, 2018: 1107). Furthermore, although education is often considered linked to poverty, “the role of neighborhood context in education remains understudied” (Wei et al., 2018: 1). Together, these processes have been viewed as having crucial impacts on the community.

In neighborhoods supported by digitization, social media platforms have become an important tool in the interplay between digital and face-to-face neighborhoods (Stevens et al., 2017; Lane, 2018), transforming the way people cultivate a sense of neighborhood community (Gibbons, 2020: 1274). Online social relationships have been found to sustain offline neighborhood relationships (Lane, 2018; Gibbons, 2020; Tai, Porumbescu and Shon, 2020). Additionally, social media facilitates “the involvement of people in their neighborhoods who may not have been involved otherwise” (Gibbons, 2020: 1263–1264). For example, Hoplr (<https://www.hoplr.com>) is a Belgian social networking service (SNS) designed for neighborhoods that is actively used in Belgium, the Netherlands, and Luxembourg. “Hoplr has many parallels with Facebook groups, in that they both have a central newsfeed and allow users to identify other users through profiles and their real names. However, Hoplr differs from Facebook in that users can only be members of their ONN and are unable to develop a personal list of “friends” on the network” (Robaeyst et al., 2022: 109). Indeed, online neighborhood social networks (ONNs) do not differ significantly from traditional systems, and their key value lies in “the formation of a community of trust among neighbors of a particular neighborhood, enabled by neighborhood delimitation and identity verification mechanisms”

(Vogel, Grotherr and Böhmman, 2020: 14). One of the issues missing from the discussion is how social media participation and neighborhood community connections are related to the physicality of neighborhoods (Gibbons, 2020: 1263) and whether social media diminishes the importance of a place (Hampton, Lee and Her, 2011; Stevens et al., 2017). Advocates for digital platforms argue that online neighborhood networks act as digital facilitators to improve physical interventions in the public domain by facilitating the communication and participation practices of inhabitants (Robaeyst et al., 2022: 109). During the pandemic, social media was proven to be a powerful tool (Introini, Morelli and Pasqualini, 2021: 302) that maintained “social connections and a sense of belonging, via the distribution of locally relevant information, by establishing a peer support network and by improving access to local service providers” (Vogel et al., 2021: 3043). However, scholars reveal a dynamic and “somewhat concerning interplay between the geographic neighborhood and the digital neighborhood, whereby negative social interactions in the geographic neighborhood are reproduced and amplified on social media” (Stevens et al., 2017: 950). Although scholars view digital platforms as novel solutions for social resilience (Vogel et al., 2021: 3043), patterns of usage require further research exploring the extent to which neighborhoods can benefit from the usage of ONNs within a neighborhood (Robaeyst et al., 2022: 115–116). Furthermore, individuals’ digital involvement and digital capital are central to their participation achievements (Gunkel, 2003; van Dijk, 2006; Min, 2010; Nemer, 2015; van Deursen and van Dijk, 2019). Similarly, inequality in digital access between neighborhoods can enhance educational and economic segregation, especially during crises, when there is a more excessive reliance on digital communications (McCall et al., 2022). Finally, digitization has also supported the evolution of subcommunities at the street level or of groups of buildings, which raises multiple questions regarding the parallelism often perceived between a neighborhood and a community. This becomes especially significant in new developments of residential towers, as the intensive use of digital communication “unfolds new neighborly practices and, eventually, new forms of neighborly relations” (Gershon-Conael, Eizenberg and Jabareen, 2024: 15).

Practices

Most people conduct their daily affairs and receive services in everyday places. *Pre-digitization* practices mainly refer to daily, leisure and recreation activities in specific physical spaces. Studies have explored public spaces where public services such as policing and education are provided. Practices are often viewed as the lived space, the subjective experience of space, shaped by symbols, images, and personal emotions, in contrast with the conceive space created by an urban planner and an expert (Lefebvre, 1991). Daily practices have been viewed in recent decades as important political sites where one explores questions of rights (Beebejaun, 2017: 330-331) and “processes of inclusion and belonging” (Kalandides and Vaiou, 2012: 264). In that sense, the interlinks between daily practices and the physical array of the neighborhood define particular constellations of social relations, “with local and supralocal determinants, meeting and weaving together at a particular locus” (Vaiou and Lykogianni, 2006: 731). Importantly,

practices are viewed as experiences in the lived space and where residents meet “with others whom they perceive as sharing their destiny. The neighborhood is where the residents face on a daily basis both the presence and absence of the state” (Fernández, Martí and Farchi, 2017: 220).

In neighborhoods supported by digitization, digital platforms sometimes compete with daily needs that are used to take in the neighborhood. Shopping, payments, or leisure activities also occur in the virtual sphere. However, this shift has not been spatially or socially even. Some residents tend to adopt digital practices, while others prefer to use commercial centers and shops. The physical space of a neighborhood is important in this decision and in what it offers to its residents. However, practices such as shopping habits are related to community socioeconomic status; shopping among people in low socioeconomic groups exhibits different patterns, such as buying groceries in small amounts and in nearby shops. Moreover, living in a neighborhood dominated by high rises with one shopping center, as opposed to living in a neighborhood dominated by detached housing and small shops, might have an effect on individuals’ familiarity with people and places, daily practices and digital consumption. In that respect, neighborhood design influences digital practices, and digitization does not alter practices but expands their repertoire (Hatuka, Zur and Mendoza, 2021). For example, digital communications allow greater exposure of residents to maintenance problems and other hazards in their environment, which can be addressed by digital means (Gershon-Coneal, Eizenberg and Jabareen, 2024). Clearly, mobile technology use complicates traditional understandings of what it means to live in a neighborhood, allowing people to bring previously private practices (chatting, reading, listening to music) into public spaces (de Souza e Silva and Frith, 2012: 51) and vice versa, taking public practices (shopping, entertainment) to the private space. Practices matter as they change norms and social dynamics and, in turn, the need for some physical amenities.

Figure 1 summarizes the key ideas in the discussion and shows that in the predigitization age and in the contemporary age, it is difficult to separate infrastructure, governance, community, and practices as they codefine one another. The physical infrastructure influences daily practices and thus sociability and thus the community and its ability to lead strong leadership. Thus, it can be argued that upon exploring any of the themes as a key subject, the others must be considered, especially in the age of digitization, which is based on a synchronized holistic approach to data. Land use, social practices, governance tools, and our habits are all taking place in the physical and virtual world and are constantly being monitored and adjusted accordingly.

Furthermore, the figure shows a few interesting insights. First, digitization is not autonomous but rather an added layer on the four themes explored. It penetrates the neighborhood on specific issues and impacts social dynamics, the division of resources and power relations, especially considering digital access and digital skills. Second, digitization altered the focus on neighborhood development, with an emphasis on efficiency and information flow. Third, digitization adds another sphere to our life and creates a new interplay between digital and face-to-face neighborhoods. To date, there are few neighborhood studies on digitization or studies that explore the interlinks between infrastructure, governance, community, and practices in the digital age. However, it is agreed upon and clear that digitization influences our neighborhood experiences. In advancing a new research agenda on neighborhoods in the digital age, it is important to explore the debates and open questions raised in relation to digitization processes.

NEIGHBORHOODS STUDIES				
	INFRASTRUCTURE	GOVERNANCE	COMMUNITY	PRACTICES
Pre digitization				
» Premise	Infrastructure as “supporting neighborhood identification”.	Local governance energizes residents to be more proactive about participatory engagement.	Physical structure and community codefine one another, enhance attachment to local place and a sense of belonging.	Daily leisure, commercial and health practices are neighborhood based.
» Focus	Physical development: transportation, open spaces, public amenities, connectivity.	Participation: developing local partnerships, calibrating policies, improving the public’s confidence in local government, and improving urban service delivery.	Community dynamics contribute to differentiation among social groups in the neighborhood based on race, education and socioeconomic status, which exclusion, and segregation.	Everyday life supported by amenities arranged in well-connected place, which increases socialization processes.
Supported by digitization				
» Premise	Digital initiatives as a mean to enhance efficient provision of city services by using surveillance tools and data collection.	Digitization as cultivating bottom-up engagement in local communities, trust building, and opportunities to achieve more efficient neighborhood development.	Digitization tools as expanding the scale and type of communication and the physical boundaries of the neighborhood.	Digital tools expand the geographic boundaries of the neighborhood, creating an interplay between the concrete and virtual.
» Focus	On multiple scales. City scale: high-speed broadband network, Wi-Fi network, city cloud, communication hub, CCTVs and sensor network. Local initiatives and products: waste disposal, renewable energy sources, water management, parking. Microscale: individual initiatives, smart homes.	Digital communication experience and real-time information flow, systemizing institutional conduct and communication with residents.	Developing an interplay between digital and face-to-face neighborhoods as a means to enhance social resiliency.	Supporting practices (e.g., shopping, transportation, payments, social needs) digitally alter the offline services sites. However, uneven digital skills may affect participation in digital practices.

Figure 1. Neighborhoods predigitization and neighborhoods supported by digitization: infrastructure, governance, community, and practices.

A research agenda for neighborhoods supported by digitization

In the daily life of neighborhoods, the four themes discussed above—infrastructure, governance, community, and practices—are related and influence one another. The mutual influence of these themes raises multiple questions and debates over the process of digitization, which has still not been thoroughly acknowledged, studied, or analyzed in planning theory. However, although there are many unknowns, there are many changes that could be noted as shown in [Figure 2](#).

NEIGHBORHOODS SUPPORTED BY DIGITIZATION DEBATES & QUESTIONS				
	INFRASTRUCTURE	GOVERNANCE	COMMUNITY	PRACTICES
» Debates	Suitability of technological infrastructure to local needs and physical context; High digital investment may come first over physical development. Uneven digital infrastructure in cities, developing new hierarchies.	Digital skills and inclusive participation; the role of social networks enhancing or hindering informal local initiatives.	Relationships between the physical sense of community and the online community; the extent to which the online network enhances social dynamics (i.e., inclusion/exclusion). Online connections vs. the gaps in digital access; online networks and community participation.	The extent to which the digital influence or should influence physical design. The role and significance of the neighborhood for daily practices in the digital age.
» Open Questions	What is the motivation for technological development? Who are the advocates of the technological initiatives in the neighborhoods? Does technology support other major challenges such as energy, sustainability, health? Do these types of infrastructure affect the design of the neighborhood?	Do digital platforms lead to greater and more diverse participation in neighborhood affairs? Does this process enhance informal, bottom-up initiatives? Does it solve issues of inequality?	Does digitization enhance/reduce inclusiveness and support specific residents and needs? How does digitization influence the neighborhood's community practices? What is the interplay between the online community and the specific physical characteristics of a given neighborhood?	Is the new neighborhood design based on new principles? What should be the relationship between the physical and the digital neighborhoods? Is design at the hand of the professionals, designers, or technological experts?

Figure 2. Studying neighborhoods supported by digitization: debates, and questions.

In *infrastructure*, technologies change the focus of neighborhood infrastructure from physical and social aspects to digital aspects (Kumar et al., 2018). Services are supported by digital technology, and technological companies are interested in solving wider issues such as sustainability, energy, mobility, and health. Digital infrastructure, a name given to many technologies, has shifted into one holistic system (Kumar et al., 2018; Caglioni, Fusco and Venerandi, 2020).

Debates evolve around the following: the suitability of technological infrastructure for local needs and physical context, budgets and the fact that digital investment may come first over physical development and uneven digital infrastructure among neighborhoods in cities, which might contribute to the development of new hierarchies. Thus, key questions in addressing digital infrastructure in neighborhoods include the following: *what are the interests in developing digital infrastructure? Who are the actors that support the implementation of technological initiatives in neighborhoods? Does technology support major contemporary challenges, such as energy, sustainability, and health? Do these types of infrastructure affect neighborhood design? Why do neighborhoods gain more technological support than others? To what extent are digital initiatives adjusted to the local context? Can neighborhoods advocate for the implementation of some forms of technology and argue against others? Do residents have a voice, and if so, how does this approach create uneven sociogeographical hierarchies in cities?* These emerging

questions are the tip of the ice in addressing the tension between private companies who advocate generic technological infrastructures and the inhabitants and their daily needs.

Related unknowns can be found with digitally supported *governance*. In the past, although systems and local roles varied, governance was based on the physical participation of residents (Collins, 2021). Criticism of predigitization governance systems notes their inefficiency and replication of social inequalities, with groups from higher socioeconomic backgrounds being more involved, resulting in the lack of representation of less privileged groups in the neighborhood (Rosen and Avni, 2019). Digitization may bypass some of these shortcomings, may allow greater efficiency and may support flexible options for participation (Afzalan and Evans-Cowley, 2015; Grotherr, Vogel and Semmann, 2020; Renyi et al., 2022), enabling more diverse representations (Afzalan and Evans-Cowley, 2015). However, digitization may cause another form of inequality, as residents without digital access, digital knowledge, and/or the will to be active digitally cannot participate in local governance (Afzalan and Evans-Cowley, 2015). Therefore, debates evolve around the following: digital skills and inclusive participation; the role of social networks in enhancing or hindering informal local initiatives; representation; and lack of organizational focus and clear direction for action. Thus, the key questions in addressing digital governance infrastructure in neighborhoods include the following: *Do digital platforms lead to greater and more diverse participation in neighborhood affairs? Does this process enhance informal, bottom-up initiatives? How do these processes affect inequality?* These questions are part of the emerging discussion on factors such as population composition and diversity, residents' digital proficiency and the physical environment affecting residents' needs that impact contemporary local governance.

Digital communications often change the relations between what is defined as the *community* and the neighborhood. Scholars have shown that online neighborhood networks cultivate the neighborhood community (Robaeyst et al., 2022), creating a new medium of engagement in local issues, providing neighborly help and support (De Meulenaere et al., 2021), deepening social ties (Nakano and Washizu, 2021), and reinforcing the interplay between digital and face-to-face connections (Gibbons, 2020). Debates on these issues evolve around the relationships between the physical sense of community and an online communities, the extent to which the online networks enhance social dynamics (i.e., inclusion/exclusion), online connections vs. gaps in digital access and online networks and community participation. Thus, the key questions are as follows: *Does digitization enhance or reduce inclusiveness and support specific local residents' needs? Does digitization enhance or diminish processes of exclusion, such as segregation? How does digitization influence neighborhood community practices? Do different neighborhood types nurture a particular set of digital practices? What is the interplay between the online community and the specific physical characteristics of a given neighborhood? Does the idea of community expand beyond the geographical boundaries of the neighborhood?* These questions are part of the ongoing debates on the tensions between digital communities and physical communities and the growing influence of digital access and skills.

The everyday neighborhood, based on mundane practices bound together in a specific physical place, is changing. Digital usage adds another layer of possibilities to mundane practices, which are not implemented as they used to be. However, some argue that geography remains critical to our daily digital-oriented lives and practices (Hatuka, Zur and Mendoza, 2021). Discussions evolve around the extent to which digitization should influence physical design and the role and significance of the neighborhood for daily parties in the digital age. The key questions are as follows: *Is the new neighborhood design based on new principles? What should be the relationship between physical and digital neighborhoods? Is design at the hands of professionals, designers, or technological experts?* To date, most studies on digitization have not addressed the physical features of the built environment or their effect on digitization. However, the digital space influences the physical space of the neighborhood (Rosendal et al., 2022) and leads to different patterns of usage in both commercial streets and neighborhood public spaces. In parallel, the specific physical configurations of a neighborhood may influence the digital practices of its residents (Hatuka and Zur, 2020; Hatuka, Zur and Mendoza, 2021). Thus, a unique reciprocal relationship is created, as the digital and the physical are interrelated.

The shifts and questions illuminate the fact that we are experiencing a gradual process that changes our experiences and daily lives. Today, neighborhoods are digital-physical hybrid realities pointing to a shift from *traditional neighborhoods to entities supported by digitization*. Locality, especially at the neighborhood scale, continues to structure many aspects of daily life that may even be enhanced by new patterns of digital usage (e.g., from the circumstances by which people meet their neighbors to the way they engage in local governance efforts to achieve change). Thus, the shift is more than a new phase; it is a condition where both physical spaces and digital spaces can be seen as social territories composed of multiple locations and places simultaneously. Contemporary mobile technologies support the ability of individuals to participate simultaneously in multiple spheres of action and communication. This condition has had an enormous influence on both participation and locality and should be viewed as part of the “relatively slow-paced adoption of digital technologies in planning since the year 2000, alongside the fast-paced emergency transformation to online planning pursued since March 2020” (Wilson and Tewdwr-Jones, 2022: 513). The above planning 3.0 (i.e., planning that uses digital technologies as a mechanism) complex questions are not about “how many people are involved in the planning process, how speedily they are involved, or even how easy they find it to become involved. Rather, going back to an earlier point, it should also be about the quality of engagement and the level of empowerment to shape planning decisions that lead to outcomes that are more equitable” (Boland et al., 2022: 167).

As such, in addressing contemporary neighborhoods, planners face three key related challenges (Figure 3).

- *Conceptual*. The challenge of developing a new conceptualization that conceives the neighborhood as a hybrid, real-virtual space. This implies studying the interface between the digital and the real and developing a new understanding of city sociogeography in the digital age. Approaching neighborhoods at the urban scale

from a digital perspective might produce new scales of geographical hierarchies and relationships within a city.

- *Epistemological.* The challenge of transcending the technological determinism approach and focusing on resident agency. In addressing the digital experience, we should view the city as an array of neighborhoods that are supported by digitization in diverse ways that allow residents to choose (or not) their digital lifestyle. This approach of placing digital practices in spatial and cultural contexts is crucial for understanding digital practices and digital divides. Furthermore, when digital usage is viewed as an additional layer in the complex configuration of the spatial and social fabric, the focus is not on a cause-and-effect relationship (i.e., which variable is the decisive factor) between digital usage and spatial patterns but rather on how both variables contribute to shaping our contemporary lives.
- *Methodological.* The challenge is to develop new methods to assess the adaptation of neighborhoods to the digital age. The digital field, as a nonmaterial realm, is not always visible, but it has an effect on management and everyday life. Finding new methods to assess neighborhoods might support communities during times of crisis, as was evident during the COVID-19 period, as well as understanding the readiness of locales for the next crisis.

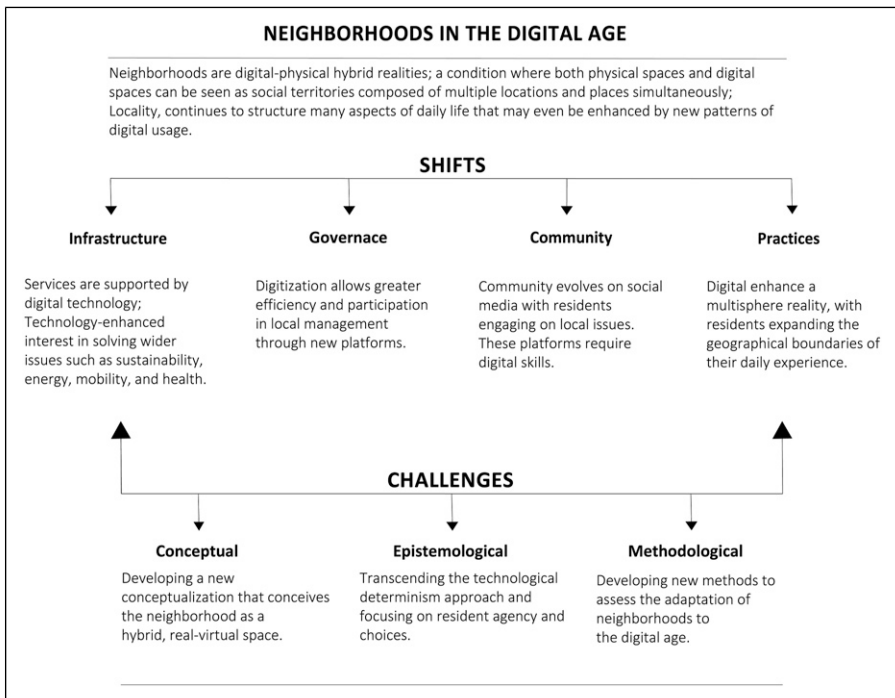


Figure 3. Neighborhood in the digital age: shifts and challenges.

Conclusions: Experiences of digitization at the neighborhood scale

The development of neighborhoods has always been viewed as a fundamental theme in planning theory and practice. It powerfully affects children, youth, and adults, “while neighborhood contexts are extremely unequal across economic and racial groups—space becomes a way of perpetuating inequality of opportunity for social advancement” (Galster, 2019: xi). This statement is even more crucial in the digital age, an era characterized by an ongoing merger of physical and digital information. Indeed, the neighborhood is the basic spatial unit to which people relate and organize their everyday lives based on physical qualities, such as boundaries and connectivity; however, digitization also expands residents’ behavior and experiences beyond geographical boundaries.

The contribution of this paper is in showing how digitization is not an abrupt change; rather, it is an ongoing process that needs to be studied. Today, the research and discussion on digitization in planning primarily focuses on digitalization as a mechanism that affects participation, democracy and control strengthened by centralized government. However, to date, the *digital experience in neighborhoods* has remained a blind spot in the urban planning literature and thus has also not been directly addressed in practice. As discussed, the effect of digitization on neighborhoods is apparent in the infrastructure, governance, community, and practices of any neighborhood. However, studies that address the interplay between multiple themes are lacking. The novelty of this paper is juxtaposing various themes of studies, pointing to the gradual digital penetration in every dimension of our lives and suggesting that, together, in a gradual process, it alters the neighborhood experience. This holistic approach is needed for the planning field, which is based on integrating data to define the design of neighborhoods. The analysis offered is but a first step in reassessing the components of neighborhood design, including public amenities, local shopping, and even housing typologies that might support the new digital age.

Importantly, despite the tendency to see the digital dimension as a neutral element, it is not. The digital penetration into neighborhoods and its adoption (or not) by residents are not uniform throughout a city or among cities. Neighborhoods embrace digitization differently. Therefore, it is important to analyze digitization in the neighborhood context. It is also important to determine which platforms and digital tools are developed and by whom are they developed, whether they are top-down or bottom-up by the community or by whom they are adopted in the neighborhood. Adaptation to the digital age has a dramatic effect on vulnerable populations associated with low socioeconomic status or neighborhoods with a high percentage of immigrants whose relations with authorities are more complex and tend to be suspicious.

Furthermore, this reassessment of neighborhood theory and design in the context of digitization is important in times of multiple challenges related to climate, health, immigration, and demographic growth. Neighborhoods are becoming important spatial organizations that mediate the physical environment and the social community. The neighborhood in the digital age is a much-needed lens and scale for tackling contemporary challenges. However, as noted, digitization in planning should not be solely about

“creating the most efficient and cost-effective way for local authorities to undertake planning. It has to be rooted in local democracy and place management, creating ways to bring together disparate data and intelligence about how places are performing, overcoming institutional fragmentation and agency duplication, while informing pathways to set out visions for the future and plan for them” (Wilson and Tewdwr-Jones, 2022: 514).

Finally, from a historical perspective, city and neighborhood development has always been influenced by industrial revolution innovations. This is expected to be the same in the context of the fourth industrial revolution, which will promote enhanced digitization processes. This interplay between the physical and digital is reshaping human connections, enhancing new forms of exchange, and reshaping our neighborhood daily experiences. This recognition is an important phase in the task that might occupy planners in the next decade: addressing digitization in future neighborhood planning and ensuring that policy guidelines might lead to more just and equal environments.

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ORCID iD

Tali Hatuka  <https://orcid.org/0000-0001-9738-1708>

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