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Interfacing the space of flows and the space of places in the platform society. Ten years of Airbnb in Florence[1]

Keywords: space of flows, space of places, digital platform, platform society, Airbnb, Florence.

Drawing on Manuel Castells' inspiring concepts of space of flows and space of places (1996), we argue that digital platforms play the key role of an interface, a medium, between the space of places and the space of flows. Indeed, digital platforms can be considered as network orchestrators, managing flows of data and information which are produced by users and distributed globally by means of the platform itself. In order to demonstrate how the interfacing process operates on urban space, we investigate the Airbnb platform by applying Castells' ideas. The contribution develops a spatio-temporal analysis of 12,126 georeferenced listings (accommodations) and 651,515 reviews left by Airbnb users on the platform from 2010 to 2019 in Florence (Italy). Listings and reviews act as an echo chamber for the space of flows and forge specific places that accommodate the requirements of the Airbnb community. Furthermore, the progressive transformation of private apartments into nodes of the global tourism network creates an increasingly fragmented spatial array combining globally connected portions of the city and geographically contiguous but unconnected spaces. Such a process is geographically uneven and reproduces well-known patterns of value concentration where symbols create a virtually-forged urban reality, destined to mimic the place projected in the platform.

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Interfacing the space of flows and the space of places in the platform society

Interfacciare lo spazio dei flussi e lo spazio dei luoghi nella società delle piattaforme. Dieci anni di Airbnb a Firenze

Parole chiave: spazio dei flussi, spazio dei luoghi, piattaforma digitale, società delle piattaforme, Airbnb, Firenze.

Questo articolo prende in prestito i concetti di spazio dei flussi e spazio dei luoghi avanzati da Castells (1996) per sostenere che le piattaforme digitali svolgono il ruolo chiave di interfaccia, di medium, tra lo spazio dei luoghi e lo spazio dei flussi. Le piattaforme digitali, come Airbnb, possono infatti essere considerate come 'orchestratori di reti' che gestiscono i flussi di dati e informazioni prodotti dagli utenti (ospiti e Host) attraverso la piattaforma stessa. Per dimostrare come la combinazione di reti e luoghi impatti lo spazio urbano, abbiamo analizzato Airbnb come "un'interfaccia tra comunicazione elettronica e interazione fisica" e dimostrato l'utilità delle idee di Castells per esplorare l'impatto della piattaforma alla scala intra-urbana. Il contributo sviluppa un'analisi spazio-temporale di 12.126 annunci georeferenziati e 651.515 recensioni lasciate dagli utenti di Airbnb sulla piattaforma dal 2010 al 2019 a Firenze (Italia). In questo contesto, le recensioni agiscono come una camera d'eco per lo spazio dei flussi, forgiando alcune aree specifiche della città che soddisfano i requisiti della comunità Airbnb. Inoltre, la progressiva trasformazione di appartamenti privati in nodi della rete turistica globale crea una divisione spaziale sempre più frammentata tra porzioni di città connesse a livello globale e altri spazi geograficamente contigui ma non connessi. Tale processo è geograficamente disomogeneo e riproduce modelli ben noti di concentrazione del valore, in cui i simboli creano una realtà urbana virtualmente contraffatta, destinata ad imitare il luogo proiettato nella piattaforma.

1. Introduction. – This paper will aim at two objectives. First, it will re-examine the concept of the space of flows and the space of places developed by Castells in 1996 in the light of the technological, social and economic changes that have traversed the network society (Castells, 1996) in the last 20 years and that have led some scholars to theorize the rise of platform society (Van Dijck *et al.*, 2018) and platform capitalism (Srnicek, 2017). Second, it will mobilize the concept of space of flows and space of places as an interpretative framework for understanding the performative power of digital platforms on the urban space. The technological and economic context has changed since Castells' trilogy coined these concepts, yet in this paper we will try to demonstrate how the articulation between space of flows and space of places is still a useful frame to understand the performative power of digital platforms on space and place and to give meaning to places immersed in the space of flows.

In order to achieve these aims, we use the Airbnb platform and develop an analysis of Florence (Italy). We chose Florence as case study because it is a city historically connected to global circuits, having been one of the capitals of the first waves of economic globalization (Arrighi, 1994) and of global tourism circuits

since the first Grand Tours. In 1982 it was the first Tuscan site to be declared a UNESCO World Heritage Site.

In the following sections, we will first (§ 1 and 2) describe our theoretical framework based on the tension between space of flows and space of places developed by Castells and we will show why these concepts can be revisited to better understand the effects of Airbnb on urban spaces. Next (§ 3), we will demonstrate how Airbnb's technological infrastructure embodies that interface Castells was talking about when he claimed that "cities are transformed by the interface between electronic communication and physical interaction, by the combination of networks and places" (2015, p. 233). The following sections (§ 4 and 5) provide evidence of the spatial effects at intra-urban scale orchestrated by Airbnb from 2009 to 2019 and show how Airbnb manages the flows of data and information which are produced by users (guests and hosts) through the platform itself, and how it switches information flows to places and transforms them into nodes of the global tourism network. In order to demonstrate how the combination of space of flows and space of place impact the urban space by means of the platforms' interface, the analysis is based on Airbnb data collected by insideairbnb. com. Within this framework, the contribution develops a spatio-temporal analysis of 12,126 georeferenced listings (proxy for the offers) and 651,515 reviews (proxy for the demand) left by Airbnb users on the platform from 2010 to 2019 in Florence (Italy). The distribution of listings represents the assets that go global, while the reviews can be considered as online word-of-mouth deriving from the interaction on the Airbnb platform within the space of flows. As demonstrated in the following sections, when the interfacing process is dynamically analysed in-between space and practices emerge: the 'interfacing process' is reinforcing a cumulative mechanism, where reviews act as an echo chamber for the space of flows, forging some specific areas in the space of places that meet the requirements of the Airbnb community.

2. From the network to the platform society. – When Manuel Castells wrote the first volume of his trilogy, *The rise of the network society* (1996)[2], the maturity of the information age was approaching and the effects in the economy, cultural and social realms were starting to be visible, together with their challenges and criticalities.

Between its publication and today, the network society envisioned by Castells has changed a lot, yet we believe that some fundamental concepts of that first interpretation are still valid and useful to capture more recent trends such as the rise of digital platforms.

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[2] The trilogy on the Information Age also includes *The Power of Identity* (1997) and *End of Millennium* (1998).

Castells has traced the rise of the information age which is characterized by communication networks. Indeed, networks have become the reference model and a fundamental tool – but also the metaphor – of the post-industrial and then of the information society. By focusing on communication networks and the advent of the Internet, Castells argued that "toward the end of the second millennium of the Christian era […] a technological revolution centred around information technologies, is reshaping, at accelerated pace, the material basis of society. Economies […] have become globally interdependent, introducing a new form of relationship between economy, state and society in a system of variable geometry" (Castells, 1996, p. 1).

The network society theorised by Castells consisted of a continuous tension between the space of flows and the space of places. The space of flows is defined as "the material organisation of time-sharing social practices that work through flows", which are "purposeful, repetitive, programmable sequences of exchange and interaction between physically disjointed positions held by social actors in the economic, political, symbolic structures of society" (Castells, 1996, p. 412). LeGates and Stout (2015, p. 229), in their reading of Castells, claimed that "city life and the work of the global economy take place more and more in the space of flows – the electronic, computerized network of telecommunications". This definition might suggest that the space of flows is similar to cyberspace. However, a few years later Castells clarifyied his concept, showing that in his intentions, the space of flows is more than just cyberspace: 'space of flows' means that the material arrangements allow for simultaneity of social practices without territorial contiguity. It is not a purely electronic space nor what Batty (1993, 1997) called a "cyberspace"[3], although cyberspace is a component of the space of flows. The networks Castells was referring to in the late 90s were what can be called first-generation telecommunication networks applied to increase productivity, efficiency and gains by "time and space compression" (Harvey, 1990, p. 147). This was a process in which advanced communication technologies enabled the expansion of production and markets at a global scale, across which information could be exchanged at unimagined speed and lower cost than ever previously thought possible.

This initial technological transformation was, in part, the response to intense price-based competition among producers of relatively similar products (Kenney & Zysman, 2016, p. 62); but since then the pursuit of digital transformation has been acknowledged as essential to the continuance of most sectors, from private to public ones. The strategically dominant activities were – and still are – operated

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[3] Batty (1997, p. 342) defines cyberspace as "the space within computers, cyberspace – the use of computers to communicate, and cyberplace – the infrastructure of the digital world, as key components of what Castells refers to as «real virtuality»".

primarily through the space of flows, and global élites ensured their domination in this process, bypassing segmented, isolated localities. Indeed, the dimension that Castells envisaged was that of the space of flows described as "circuits of impulses, nodes and hubs, a spatial organisation dominated by managerial élites" (Castells, 1996, pp. 412-415). But next to the space of flows, Castells distinguished the space of place in which people's experiences and activities *take place*. The space of place seems to resist the space of flows and to offer the opportunity for people to experience varied social interactions. However, when Castells introduced this concept, it was immediately clear that it would have been impossible to look at any place – urban contexts in particular – without considering the flows that were coursing through that locality and possibly transforming it.

Twenty years on, the Internet has evolved into something quite different from what it was at the time when Castells wrote his masterpiece. The Internet is no longer a network of networks (the super-highway defined by Al Gore) but has turned into a series of hubs or assemblages of networked platforms (Van Dijck *et al.*, 2018, p. 4) that are mediating most of the flows. The increasing spread of online platforms controlled and operated by a small group of corporations (the so-called *Big Five*: Google, Apple, Facebook, Amazon and Microsoft, altogether abbreviated as GAFAM) and the penetration of these companies in a growing number of areas of social and economic life, from cultural and creative industries to those of tourism, logistics, urban transport, information security, big data analysis and management, health and education (Srnicek, 2017) has led some scholars to focus their attention on the growing power of these platforms and their impact on society, through the processes of the platformization of society (Van Dijck *et al.*, 2018) and culture (Nieborg & Poell, 2018). In brief, the term platform society refers to a social life in which social and economic flows are increasingly modulated by a globalized ecosystem of online platforms that is driven by algorithms and sustained by data. The rise in "platform studies" (Plantin *et al.*, 2018) has critically interrogated the social and economic consequences of the increasing power of digital platforms (Moore & Tambini, 2018). It is worth noting that the term 'platform society' does not indicate a new kind of virtual public space that is separate and apart from the actual world we live in. On the contrary, platforms are now situated at the heart of our lives and we are increasingly feeling their impact on most everyday practices. In particular, Langlois and Elmer (2019) show that as social media platforms expand to reach a quasi-infrastructural scale, their realm of data capture expands. The process of 'datafication' refers to the capturing and circulation of data and to the ability of networked platforms to turn many aspects that have never been quantified before into data. At the same time the platforms' mechanism implies the 'commodification' of online and offline objects and activities, but also emotions and ideas which are transformed into tradable

commodities. This means that everyday life is more and more immersed in a media environment, an ecosystem within which different media, old and new, act as intermediaries for an increasing number of human activities, from the search for a partner to the need for a ride or a house to rent. In the meantime, theories of mediatization (Couldry & Hepp, 2013) and deep mediatization (Hepp & Hasebrink, 2018) have become established among media studies scholars, while other scholars like Deuze started talking about "media life" (2011).

When Castells proposed the distinction between the space of flows and the space of places, the Web was still in its early stages, but soon the author realised that "we are entering a built environment that is increasingly incorporating electronic communication devices everywhere. […] our urban life fabric becomes an e-topia in which we constantly interact, deliberately or automatically, with online information systems, increasingly in the wireless mode" (Castells, 2015, p. 264). In this definition, Castells distinguishes the space of flows from cyberspace and situates it in the technological infrastructures composed of digital networks that foster its expansion. As we can see from this excerpt, the concept of space of flows proposed by Castells has nothing to do with the immateriality of cyberspace, but anticipates the focus on infrastructure that would become central in media studies only a few years later. The space of flows originally described by Castells consists of both physical and media spaces, so the concept of the space of flows is even more topical today because the processes of mediatization and platformization of society have colonized, compared to twenty years ago, more and more portions of the urban space, enclosing them into the circuit of global flows of information and capital from which they were once disconnected. Such colonization does not mean, however, that there are no more disconnected places or places still mainly dominated by local identity logics, what Castells called "the space of places" (Castells, 1999, p. 294).

As Castells presciently recognized, even today most people live, work, and construct their meaning around places. He emphasized the persistence of the space of places as the most usual form of spatial existence for humankind. He developed his argument about place by describing the neighbourhood of Belleville in Paris: "I define a place as the locale whose form, function, and meaning are self-contained within the boundaries of territorial contiguity. People tend to construct their life in reference to places, such as their home, neighbourhood, city, region, or country" (Castells, 1996, p. 423).

In the emerging platform society, what Castells called the space of places has not disappeared but has undoubtedly changed. Now, the tension between space of flows and places is much more blurred than it used to be: the space of places is augmented and even mirrored in the space of flows thanks to the interaction between users – and even communities – engineered by the digital platforms. The

space of flows today interacts with the space of place by trading local assets (e.g., accommodations, cultural resources, practices, etc.) and feeding value creation circuits.

The relationship between space of flows and space of place expresses an ongoing tension between globalization and localization, whose outcomes "are not predetermined" (Castells, 1996, p. 425) and may lead to a "structural schizo-phrenia" (Castells, 1996, p. 428) between the two spatial logics. In other words, if communication networks fostered the emergence of delocalized social activities and their separation from 'place', then the effect would be the emergence of deter-ritorialized and ubiquitous subjects/activities that operate physically in one place and virtually in another, weakening social relations. However, the advent of digital platform does not imply the 'annihilation' of space of place; rather, its spatial logic is deeply influenced, or rephrased, by the logic of information flows which may alter the meanings and dynamics of places. This ongoing process of mutual struc-turation and influence between the space of places and the space of flows has been highlighted by Castells when he wrote that "our cities are made up, at the same time, of flows and places, and of their relationships […] Cities are structured, and destructured simultaneously by the competing logics of the space of flows and the space of places. Cities do not disappear in virtual networks. But they are trans-formed by the interface between electronic communication and physical interac-tion, by the combination of networks and places" (Castells, 2015, p. 233). This last step is extremely relevant to our research: the following case study will try to demonstrate how the mechanism of the Airbnb digital platform works as an inter-face between the space of flows and the space of place in the context of the city of Florence.

3. Airbnb as an interfacing orchestrator. – As Kenney and Zysman (2015) have argued, we are entering a Platform Economy; one in which tools and frameworks based upon the power of the internet will frame and channel our economic and social lives. The algorithmic revolution, an application of an array of computable algorithms to a myriad of activities from consumption and leisure to services and manufacturing, is the foundation of this digital transformation. Now algorithms live in the cloud and form the basis of digital platforms. For our purposes, platforms are frameworks that permit collaborators – users, peers, providers – to undertake a range of activities, often creating de facto standards, forming entire ecosystems for value creation and capture (Kenney & Zysman, 2015, p. 2).

A platform can indeed be defined as digital infrastructure fuelled by data, organized by algorithm and interfaces, formalized through ownership relations driven by business models, and governed through user agreements (Van Dijck

et al., 2018). The innovation power of a digital platform usually depends on its dependence on the platform at different levels of technical architecture (De Reuver *et al.*, 2018). Moreover, platforms come with a series of tools that enable their users to build their product, services and marketplaces (Srnicek, 2017, p. 43). In this sense, digital platforms increasingly dictate the way the economy and urban life are organized (Hardaker, 2021, p. 1).

In order to show how the platform works as an interface between space of flows and space of place, its elements must be taken into consideration. The Airbnb platform consists of several elements: the platform provider, here Airbnb, a private company founded in 2008, which orchestrates and manages the platform, sets its rules and deals with monetary transactions; Airbnb leads the platform primarily through socializing its participants on how to be hospitable and, only to a lesser degree, through algorithms (like Uber) or top-down rules[4]; the hosts who own the place-based assets and provide rental services; the guests, who are the users of the assets; the information commons (hosts' descriptions of the accommodation and personal profile, guests' reviews and rankings) which populate the platform's website; the monetary transactions between the hosts and the guests mediated by the platform.
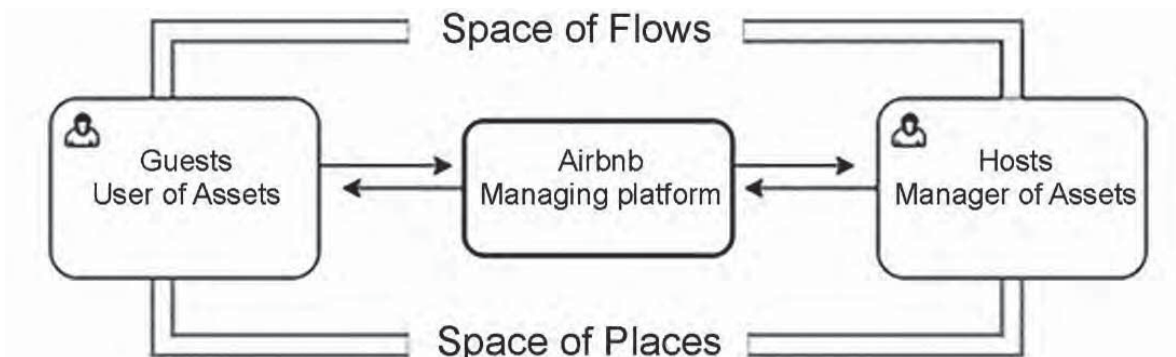
Source: Author's elaboration.

Fig. 1 - The platform mechanism: the interface between electronic communication and physical interaction

The interfacing role played by the platform can be explained as follows. The Airbnb platform is a hyperconnected and globally distributed network with a commercial aim that functions as the interface between the actors – the hosts

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[4] For instance, Airbnb tends to make recommendations rather than provide codified rules (e.g. price, safety standards, etc.).

and the guests – coordinating supply and demand of accommodations that were previously unavailable on the market by disintermediating traditional commercial channels (Rossi, 2019; Capineri & Romano, 2021). Airbnb's coordination mechanism relies on the standardization of norms for hospitality, which encourages hosts to provide value-added services and to "behave well" (Capineri & Romano, 2021). Indeed, this mechanism is based on recommendations rather than codified rules (e.g. hosts are informed about rental prices, but they are free to set their own) and on rewards for appropriate behaviour: the more a host adheres to the norms and values, the more likely he/she will succeed in the marketplace (e.g. getting a Superhost status) (Roelofsen & Minca, 2018). Hence, the relationship between platform owner and platform participants is more like a partnership. The value of the Airbnb platform is not only based on providing access to low-cost accommodation but on offering a large variety of accommodations and local assets that the traditional services cannot offer and by encouraging hosts to become self-entrepreneurs.

The hosts and the guests are not only the providers, managers and owners of the assets that are traded on the platform, but are also crucial for regulating the market. Ratings and reviews perform such functions. Through ratings, guests can provide a score (up to 5 stars) for the accommodation and service according to several predefined criteria defined by the platform (Overall experience, Cleanliness, Accuracy of description, Value, Communication, Arrival, Location). Hosts need star ratings from at least 3 guests before their overall, aggregated score appears publicly. Listings with high star ratings indicates high performance over time, that is, performance persistence (Teubner & Glaser, 2018) fostered by the logic of the algorithm's reward. Reviews are short written commentaries of no more than 1,000 words submitted within an average of four days after checkout (Fradkin *et al.*, 2018) which provide feedback on how well the listings measured up to the expectations based on the description provided by the host. The primary aim of this information is to build trust, provide guarantees, enforce quality standards indirectly, and assist other guests in deciding whether or not to make a transaction (Celata *et al.*, 2017). As such, the review system is not harmless: it influences decisions, impacts prices, provides signals to the platforms' matching and search algorithms, creates value and distributes such value unevenly with remarkable consequences for individuals and place (Celata, Capineri & Romano, 2020).

Recent literature has extensively shown the uneven socio-spatial effects produced by digital accommodation platforms (for a review see Guttentag, 2019). Like other platforms such as Uber, Airbnb has spread unchecked and unregulated for more than ten years. Protests and criticism arose worldwide, especially on the part of residents and conventional businesses in the hospitality industry.

Short-term rentals platforms such as Airbnb are highly debated because of the effects (Sans & Quaglieri, 2016; Picascia *et al.*, 2017; Zervas *et al.*, 2017; Wachsmuth *et al.*, 2017; Dudás *et al.*, 2017; Benìtez-Aurioles, 2018; Alizadeh *et al.*, 2018; Artioli, 2018; Celata, Capineri e Romano, 2020) produced in the most affected neighbourhoods (e.g. overtourism, gentrification, rent unaffordability, unfair competition, lack of regulation).

As regards the interfacing between the space of flows and the space of place, the platform mechanism builds an ongoing relationship between the two dimensions. On the one hand listings, descriptions and reviews conveyed by hosts and guests (and the monetary transactions) travel in the space of flows managed by the platform as a sort of digital word of mouth which has a potentially global reach and an endless quantitative dimension. On the other, these interactions concern places where listings are located in the urban fabric. These places are digitally augmented by adding information on place attributes which are then diffused by the platform and finally acquire value thanks to the transactions they are able to attract. The relationship is reciprocal: a location goes global but it receives feedback through valence (positive or negative attributes) and volume of reviews and ratings (Floyd *et al.*, 2014) which in turn affect the location, that is, place. Reviews embed another type of tension between the specific properties of the accommodation which make it 'unique' and other attributes which are conveyed by guests through their narratives which become collective and converging on specific features (such as position in town, distance from travel services and attractions).

These features are quite limited in number and typology as previous research has shown (Celata, Capineri & Romano, 2020): indeed, they are partly engineered by the platform standard requirements and partly produced inter-subjectively by the 'community' of users. In this regard, individual and collective representations of place coexist and are negotiated by the platform. Castells would have described it as the combination of individualism and communalism, of a communication exchange which is local and global at the same time. Individualism, in this context, refers to the information that is produced by each person according to her/his personal characteristics and then distributed through the platform; while communalism refers to the collective construction of meaning around a set of values or properties defined by the platform itself (for example in Airbnb's motto "live like a local") which is then internalized by the community members.

4. Data and methodology. – In order to demonstrate how the combination of space of flows and space of place impacts the urban space by means of the platforms' interface, the analysis is based on Airbnb data collected by insideairbnb.com. In detail, we analysed 12,126 georeferenced listings (accom-

modations) that were active in November 2019 in the municipality of Florence[5] and 651,515 reviews released by guests since 2010. The distribution of listings represents the assets that go global, while the reviews can be considered as online word-of-mouth deriving from the interaction on the Airbnb platform. The dataset includes all listings that were active at the time of the data scraping, and of all the reviews posted on those listings from 2010 to 2019. Each review is attached to a unit of accommodation that is spatially located. Reviews are user-generated content (also defined as volunteered geographic information): data produced voluntarily by platform users. As in the case of any user-generated source, the creation of information takes place through a collaborative and collective process, which tends to produce more timely and richer data than that produced in the traditional way by individual institutions and bodies (Capineri *et al.*, 2016). Within such a framework, the analysis included the following steps: A) we first mapped the distribution of listings (a proxy of the offer for short-term accommodation) and reviews (a proxy of demand for short-term accommodation); B) we analysed the spatial distribution of listings and reviews at census tract scale with a focus on centre-periphery dynamics (fig. 3 and 4). Furthermore, based on the review's density C) we created the 'Airbnbscapes diagram' (fig. 2), where the city skyline has been built on the basis of the number of reviews received for each specific area (census tract). We looked at the spatio-temporal distribution of the reviews in order to investigate their dynamics (2010-2019) in the space of place. In pursuit of this, D) we mapped the distribution of the reviews in space and time (fig. 5); then E) we performed an emerging hot-spot analysis[6] of the reviews by using the Mann-Kendall statistic (fig. 6). The space-time analysis allows us to visualize and analyse spatio-temporal data, in the form of time-series analysis, integrating spatial and temporal pattern analysis. When this process is dynamically analysed since the foundation of the platform (2008), 'in-between space and practices' emerge: the 'interfacing process' is reinforcing the cumulative mechanism, where reviews act as an echo chamber for the space of flows, forging some specific areas in the space of places that meet the requirements of the Airbnb community.

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[5] Florence (Italy) is one of the world's main tourist cities, with 10 million arrivals per year and 379,000 inhabitants. Source: www.cittametropolitana.fi.it/turismo; http://opendata.comune.fi.it.

[6] The emerging Hot Spot Analysis is an implementation of the more traditional Getis-Ord Gi* statistic for each feature in a dataset. The resultant z-scores and p-values show where features with either high (hot) or low (cold) values cluster spatially. The Emerging Hot Spot Analysis identifies trends in data, such as new, intensifying, diminishing, and sporadic hot and cold spots.
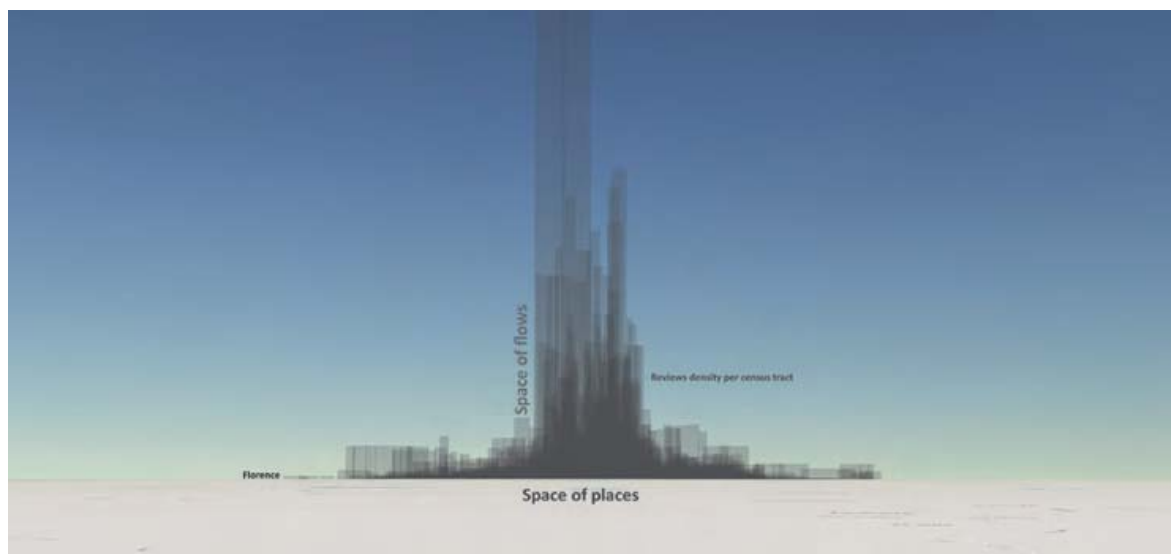
Source: Romano A. (2022). *La geografia delle piattaforme digitali. Mappe, spazi e dati dell'interme-diazione digitale*. Florence University Press.

Fig. 2 - Airbnbscapes: the city's skyline is based on the proportion of the Airbnb reviews per each census tract; Florence

5. Results: interfacing flows and space. – The platform plays a fundamental role in the process of interfacing between the space of flows and the space of places. In particular, the mechanism of reviews is crucial for Airbnb in the contribution they make, by fostering trust, to the so-called network-effect (Srnicek, 2017), one of the pillars of digital platforms. The reviews themselves can be considered as online word-of-mouth, proxy of the demand; the guests leave them only after the end of the stay. In this sense, the spatial distribution of supply and demand shows that most of the listings and reviews of Airbnb are concentrated within the historic centre of the municipality. In particular, the UNESCO area (5 km², equivalent to 4.8% of the total municipal area) accommodates 62% of supply (listings) and 70.3% of demand (reviews) for short-term accommodation (figg. 3-4). Thus the first result we obtained is that the much-praised pervasiveness of the platform takes place and expresses its performative power mainly in this minimal area. In this context, the spatio-temporal analysis shows that over ten years (figg. 5-6) a cumulative process has taken place by also creating:

1. persistent hot-spots (locations statistically significant for ninety percent of the time-step intervals with no discernible trend indicating an increase or decrease in the intensity of clustering over time);
2. consecutive hot-spots (locations with a single uninterrupted run of statistically significant hot-spot bins in the final time-step intervals) in the centre;

3. intensifying hot-spots (locations that have been statistically significant hot-spots for ninety per cent of the time-step intervals, including the final time step) in the historic centre;
4. consecutive 'black holes' (cold-spots) in the periphery;
5. sporadic hot-spots (locations that have been irregularly statistically significant but never statistically significant cold-spots).
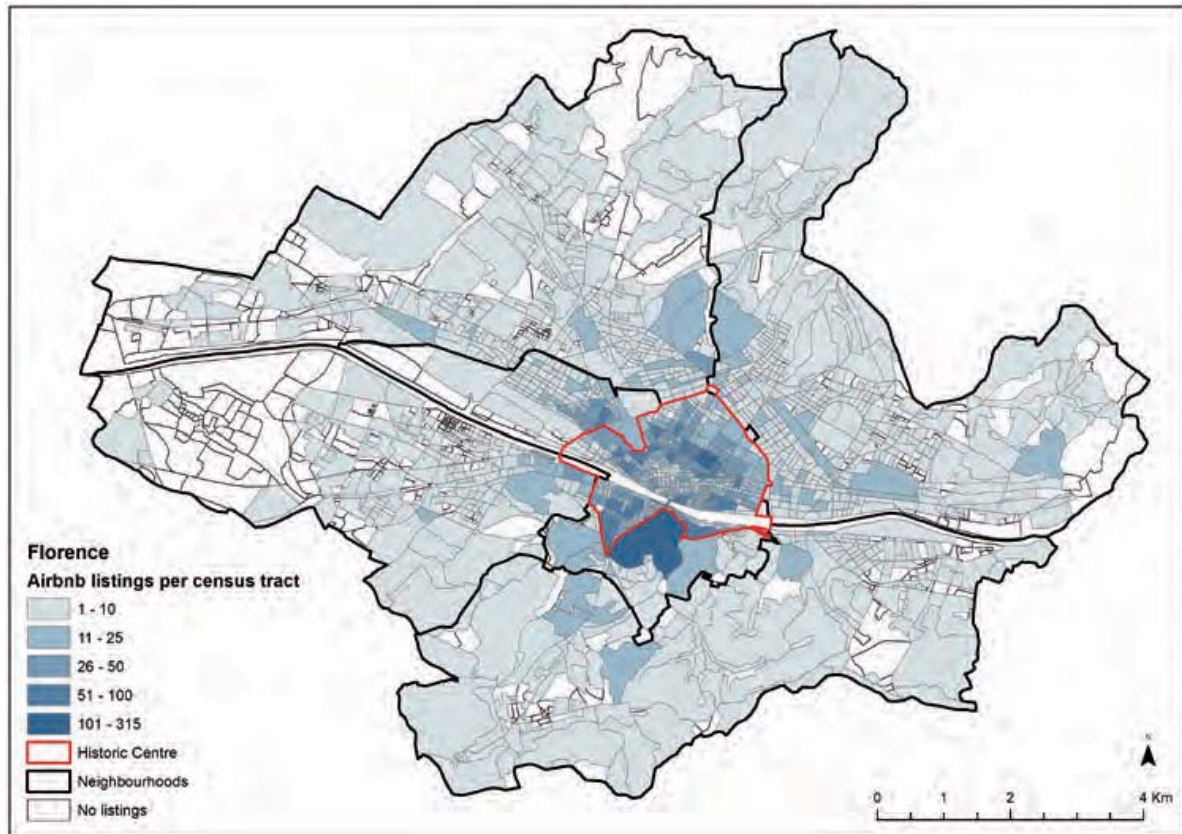
Source: Author's elaboration on insideairbnb.com data.

Fig. 3 - Spatial distribution of listings at census tract scale. Florence, 2019

Many locations, defined as consecutive hot-spots, with a single uninterrupted run of statistically significant hot-spot bins emerges exactly within the historic centre. Although such locations have never been statistically significant hot-spots prior to the final hot-spot run (2018), such *loci* are the ones with the greatest increase in the number of reviews that generate statistically significant clusters of spatial contiguity. On the contrary, the presence consecutive cold-spots in more peripheral areas confirms that, outside the core area, where the number of reviews is present but lower, the pervasiveness of the platform is weaker and has not
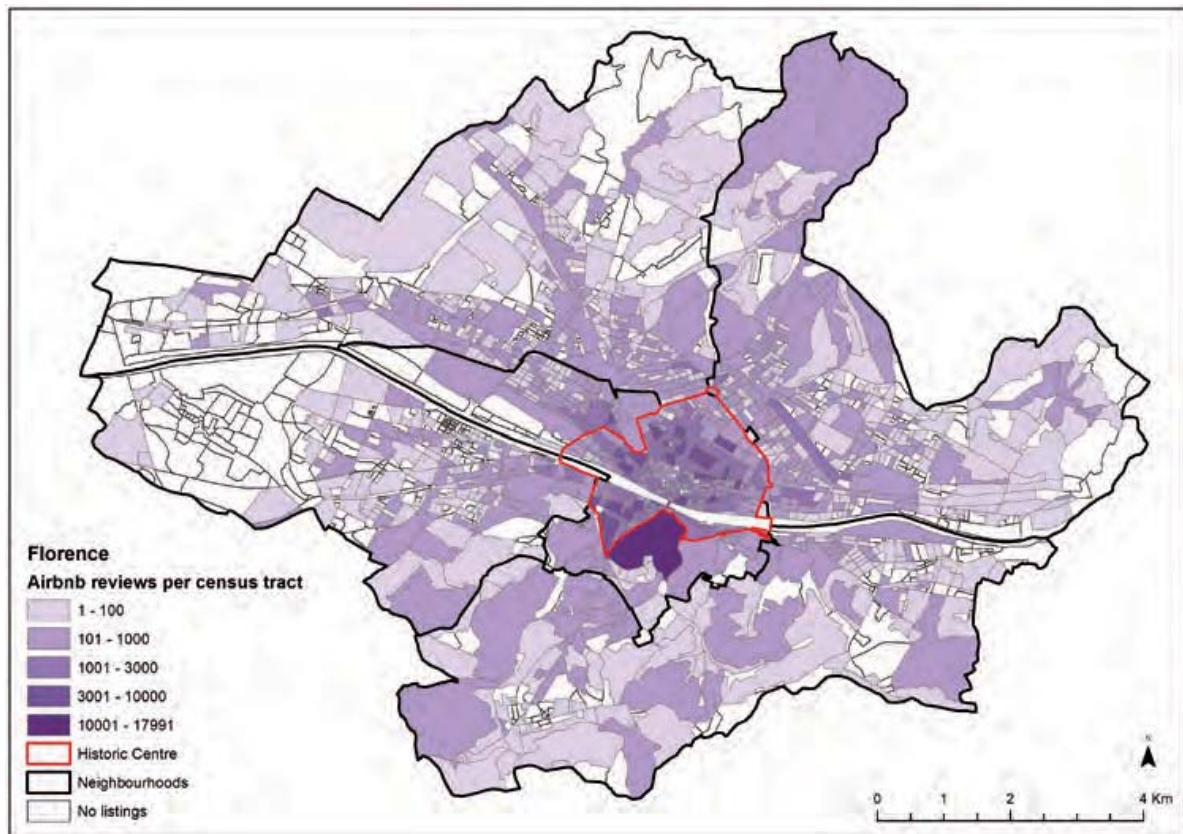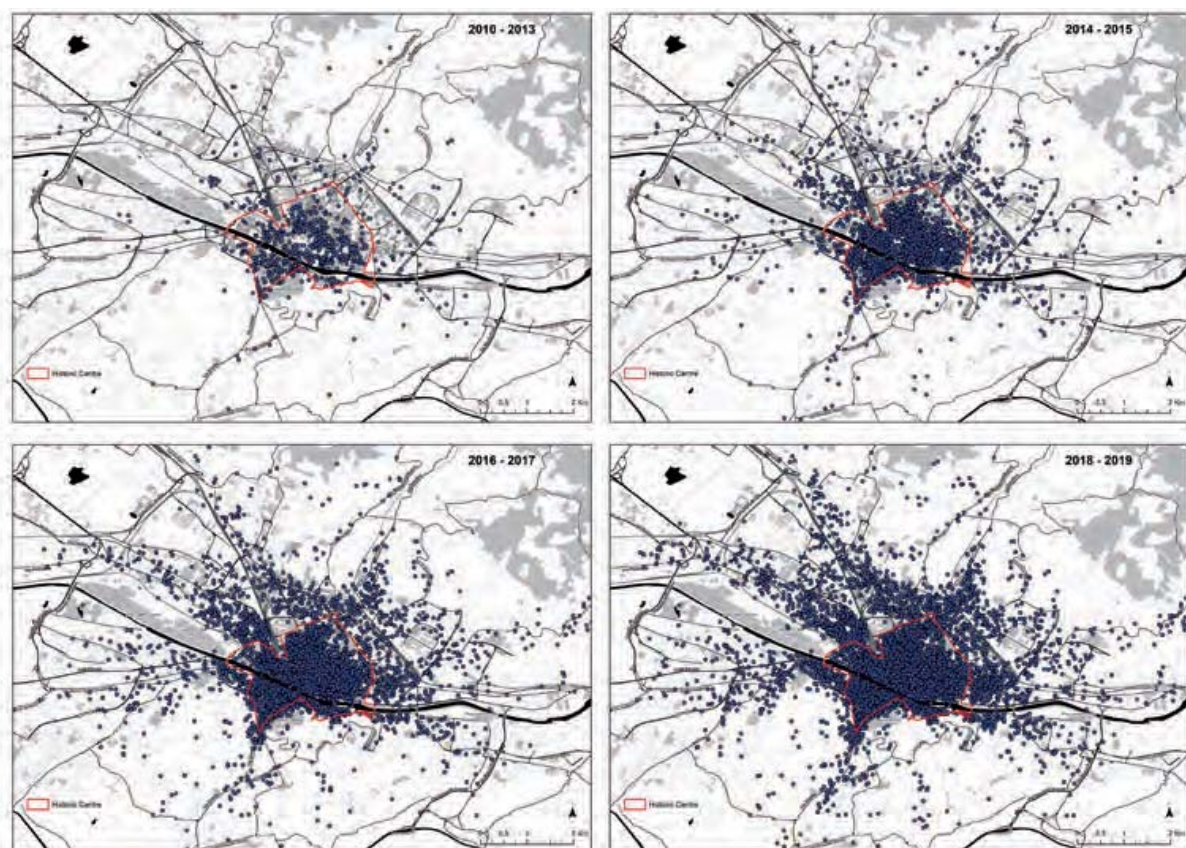
Source: Author's elaboration on insideairbnb.com data.

*Fig. 4 - Spatial distribution of reviews at census tract scale. Florence, 2019*

changed in ten years. The result is that the 'interfacing process' is enforcing a selective cumulative mechanism as the presence of intensifying hot-spots within the UNESCO area. These locations are enriched or augmented by hosts' descriptions and then by guests reviews which refer strictly to local assets (position, services, etc.). In fact, although the listings are spatially distributed even beyond the historic centre, the spatial model is polarized and decreases as the distance from the historical centre of the city increases. The analysis of review contents shows that attributes of 'distance' and 'proximity' from and to the city centre are fundamentals and overtake other concerns about the characteristics of the apartment, such as the host and even the price (Celata, Capineri & Romano, 2020; Benìtez-Aurioles, 2018; Cheng & Jin, 2019). This evidence is exactly the result of the selective interface between the space of flows and that of places: the distribution of listings represents how place goes global while the distribution of reviews portrays the global feedback to the local scale, namely place. In this sense, reviews in the space of flows act as a catalyst in the space of places, generating cumulative polarization that fosters circular mechanisms (Celata, Capineri & Romano,

2021) in very specific areas of the space of places. We are aware of the platform's contribution to the over-touristification of already highly touristified city centres (Sans & Quaglieri, 2016; Picascia *et al.*, 2017; Benìtez-Aurioles, 2018; Alizadeh *et al.*, 2018, Celata *et al.*, 2020) and therefore that the concentration of supply and demand within the UNESCO historic centre is determined by multiple factors (see Celata & Romano, 2022; Picascia *et al.*, 2017). The fact that we are dealing with big user-generated data makes these convergences on a few attributes even more marked and worthy of attention, leading us to observe in general a 'void at the heart' of the representation of place where only few features and qualities fulfil the crucial function of connecting the sense of place and the pleasure of experience, while at the same time showing how artificial this connection is. In this sense, the advent of technological infrastructures such as Airbnb has considerably accelerated and amplified the connection of some portions of the city of Florence to global flows of capital, goods and people, leaving behind other more peripheral portions of the city, historically less connected to the global tourism market.

Source: Author's elaboration on insideairbnb.com data.

Fig. 5 - Spatio-temporal distribution of reviews (2010-2019), 1 dot = 1 listing with reviews; Florence
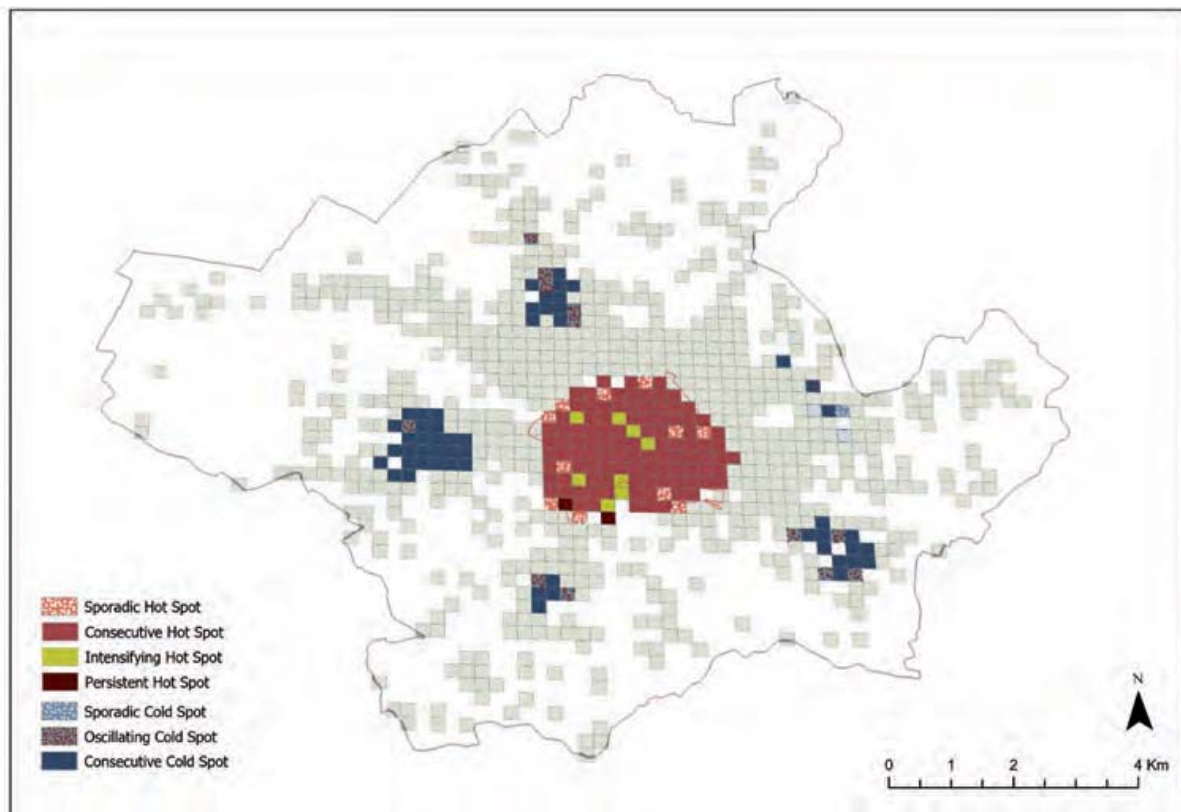
Source: Author's elaboration on insideairbnb.com data.

Fig. 6 - Emerging Hot & Cold Spot Analysis (Space-Time Pattern Mining), Florence

6. Discussion and conclusions. – Our exploration started by discussing how the concepts of space of flows and the space of place introduced by Castells in 1996 could accommodate the shift from the network society to the platform society. In the network society, Castells distinguishes two types of space: "the space of flows" (the electronic, computerized networks of telecommunication flows from one place to another) and the "the space of places" (the physical world of neighbourhoods and localities where people's experiences and activities take place). Our exploration has shown how this distinction has become more intertwined with the emergence of digital platforms. The advent of the platform society can be seen as a progression of the network society, as the networks that underpin it provide the foundation for the development of platforms and their effects on the ways in which society is organised (Comunello & Mulargia, 2022).

First, by exploring the working principles of platforms, it has become impossible to look at places without considering the implications of the space of flows that are coursing through the locality. To this end, the article has developed an analysis of the socio-spatial effects of a digital platform like Airbnb, the leader in

the short-term rental market, over ten years in Florence (Italy), demonstrating how this digital actor is affecting and performing on the urban space.

Secondly, Airbnb's intermediation mechanism relies crucially on digital reputation systems based on ratings and reviews voluntarily contributed by users. Such intermediation reveals the interfacing role of the platform between the space of flows and the space of places. In this sense, as highlighted by the Italian sociologist Michele Sorice (2021, p. 2), "the platform society represents a more critical (and certainly less optimistic) situation than the previous theorizations: here, in fact, […] the asymmetrical power relations between the owners of the platforms and the users appear in all their evidence"[7].

Indeed, the analysis of Airbnb as a technological infrastructure has highlighted how the economic value is extracted and distributed from the exploitation of certain assets (apartments) located in an urban space. These assets acquire value only when they are connected to the global circuit of potential visitors orchestrated and managed by Airbnb: the space of place (i.e. an apartment located in a street in the historic centre of Florence) is mutually connected, through Airbnb's technological infrastructure, to the space of flows carried by the platform itself. Airbnb is thus the intermediary that allows a place to interlink with the space of flows. This connection between the space of place and the space of flows ensures that the economic value that resides in the apartment can be extracted from that specific place and its unique location and transferred into the space of flows and back.

Thirdly, this interfacing role occurs in a non-homogenous way throughout the urban space. We have shown that this unevenness is due both to factors exogenous to the platform (location of the assets) and factors endogenous to the platform (the logic of Airbnb's algorithms that foster visibility of some listings over others). Airbnb's logic amplifies inequality between the predictable centre and the periphery axis (Picascia *et al.*, 2017), with the result that, thanks to Airbnb's intermediary work, some places (the historical centre of Florence, in our case study) will increase their connections to the space of flows (i.e. to the global financial circuits), while other places, the more peripheral ones, will be loosely connected to these circuits. As fig. 6 shows, the friction between progressively connected portions of the urban space and other proportionately less connected portions grows in the long term (the 10 years examined by this article). Thus, the result is a widening gap between some increasingly globalized parts of a city and other disconnected ones. The distribution of both listings and reviews reveals a persistent centre vs. periphery pattern, which is exacerbating inequalities and reinforcing cumulative mechanisms: the higher the value people attribute to places, the more

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[7] "La platform society si colloca come momento più critico (e certamente meno ottimistico) delle teorizzazioni precedenti: qui, infatti, […] le relazioni asimmetriche di potere fra i proprietari delle piattaforme e i soggetti appaiono in tutta la loro evidenza" (Sorice, 2021, p. 2).

the latter are connected into interactive networks. The lower their value, the lower their connection in the space of flows. Our results empirically contest the heralded pervasive performance of communication networks.

With respect to previous research, the paper provides a better understanding of the tension Castells described as follows: "cities are structured, and destructured simultaneously by the competing logics of the space of flows and the space of places" (2002, p. 14). The novelty lies in highlighting how the reviewing mechanism affects the space of places, while the space of flows performs in a very selective way when encapsulated in the space of place. In addition, the analysis added a temporal dimension to reinforce the idea of both the spatially selective mechanism and the persistent cumulative and uneven process of value creation at urban level over a decade. The case study concerns an urban environment, the quintessential arena for network manifestations: cities are communication systems that link up the local and the global scales.

Last but not least, the analysis shows how the reviewing system is fundamental since it engineers the interfacing process between the space of flows and the space of places. Although reviews are all very similar (Bridges & Vasquez, 2018, p. 2057), their contents pivot on a few features where the choice of the accommodation is driven by minimising travel times from the access point (e.g. the main railway station) and from a very small set of 'top' attractions (Celata, Capineri & Romano, 2020): place is reduced to an absolute minimum, deprived of the variety of any local dimensions and of its distinctiveness. In doing this, reviews embed another type of tension between space of flows and space of places: the properties of the accommodation which make it 'unique' (such as the position in town) and the perceived attributes which are conveyed by guests through their reviews carried by the platform (Celata, Capineri & Romano, 2020). These attributes are partly induced by the platform standard requirements (cleanliness, security, equipment, etc.) and partly produced inter-subjectively by the 'community' of users. Thus, the continuum between the space of places and the space of flows takes place as it is moulded by the 'competing logics' of the space of flows and the space of places, that is standardization vs differentiation.

This tension is amplified by Airbnb via its mission of 'living like a local': an attempt at mimicking local urban life where symbols build a virtually-created urban reality, destined to mimic place mirrored in the platform. Although the space of flows seems to 'suck the life' out of the space of places, other features cannot be mobilized by the platform model. As in the neighbourhood of Belleville described by Castells, Airbnb has enhanced conflicting appropriation of the meaning of place by different groups and individuals (residents vs tourists) and regulatory issues. These forms of digital hybridization escape traditional administrative control and are transforming the city into a place increasingly inhabited by a 'non-resident population' and managed by digital infrastructures that use it

economically without residing there (Martinotti, 2011, 2017). This paper provides data and evidence to demonstrate how the concepts expressed by Castells in the network society are still useful for addressing the spatial effects of the platformisation of society. Nevertheless, further research is still needed to fully explore the platformisation of space through the lenses of Castells' work, initially by increasing the number of case studies and the type of spatial effects which may be produced by platforms' interfacing mechanism in the long run.

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