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Practice Theory and Media Infrastructures: "Infrastructural Disclosures" in Smartphone Use

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Abstract

The article concentrates on the contamination between practice theory and infrastructure studies by focussing on the routines and practices related to smartphone use. In order to address on an empirical ground the infrastructural implications of smartphone-based practices, the article presents the results of a qualitative research, based on a total of 26 qualitative interviews and one focus group with young smartphone users, residents of different cities of the Veneto Region in Italy. Theoretically, the article introduces the notion of *infrastructural disclosure*, which is adopted in the empirical analysis as an analytical tool to favour the visibility of infrastructural implications in smartphone practices. Infrastructural disclosures do not represent qualities of infrastructures but analytical strategies that bring to light the often "invisible" and "taken-for-granted" infrastructural qualities in smartphone use. On this basis, the article addresses five main dimensions of infrastructural disclosures in smartphone use: electricity, radio signal, data, operative systems and platforms. Finally, after the analysis of these five main infrastructural dimensions, the authors outline in the conclusion how a stronger emphasis on infrastructural relationships could improve our understanding of today's digital media practices.

Keywords: Practice theory; media infrastructure studies; smartphone; digital media; infrastructural disclosures.

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1 Introduction

This article explores the contamination between practice theory and infrastructure studies by focussing on practices and routines related with the use of smartphones. Theoretically, the practice-based approach elaborated by Shove and colleagues (Shove, Hand, Ingram & Watson, 2007; Shove, Pantzar & Watson, 2012) on the basis of theoretical work by Schatzki, Knorr Cetina and Von Savigny (2001) and Reckwitz (2002) had the merit — among other things — to integrate in a robust way the role of materiality and technology into the study of social practices, outlining how technological devices like the refrigerator (Shove & Southerton, 2000), consumer electronics (Gram-Hanssen, 2010) or the iPod (Magaudda, 2011) play a role in the "co-evolution" of social routines and activities. Only very recently have authors in practice theory (Shove, Watson & Spurling, 2015; Shove, 2016; Shove & Trentmann, 2019) started to explore more explicitly the idea that technologies are not just artefacts and devices, but they also exist in infrastructures and socio-technical relationships that occur at larger scales, arguing that different "forms of infrastructural provision co-constitute 'needs' and practices" and that "infrastructures and practices spurred each other on and become entangled in a dynamic that simultaneously constitutes particular ways of life and related patterns of consumption" (Shove, Trentmann & Watson, 2019, p. 4).

This article aims to advance this ongoing debate in practice theory that connects the study of social practices with the infrastructural quality of today's technologically-mediated social organization. To do this, we explore empirically the nexus between social practices and infrastructures by looking at the situated uses of mobile digital technologies and notably smartphones. Our starting reflection is that much work has yet to be done to explore how technologies are important not only for being isolate artefacts, carrying "scripts" and "configurations" (Woolgar, 1990; Akrich, 1992), but also how they are relevant for their "infrastructural qualities," as several everyday technologies have increasingly turned into complex interfaces through which people primarily interact with wider networks, platforms and services. This shift from *technology-as-material-artefacts* to *technology-as-infrastructural-interfaces* is particularly relevant in relation to digital media technologies and *in primis* smartphones, which are distinctively characterized by opening up the possibility to enact multiple activities.

In order to address on an empirical ground the infrastructural implications of smartphone-based practices, in this article we present the results of a qualitative research on young smartphone users we carried out in 2017–2018. The research data are based on a total of 26 qualitative interviews and one focus group with young smartphone users, residents in different cities of the Veneto Region in Italy (in the northeast of the country), between 18 and 30 years old. The research's goal was to collect narratives related to smartphone use in various dimensions of everyday life. In line with a grounded theory approach (Charmaz, 2006), a first round of data-coding process allowed to engender descriptive categories related to the smartphone use; then, on the basis of this work, a second coding process was performed to generate theory-laden labels, subsequently adopted in the discussion of research findings and to identify five infrastructural dimensions that, therefore, emerged as outcome of the interpretative process.

Before focussing on the analysis of interviews, in section 2 we will discuss more broadly the theoretical background related to the relationship between infrastructures and practice theory; here we will also introduce the notion of *infrastructural disclosure*, which will be adopted in the empirical analysis as an analytical tool to let the infrastructural interactions between smartphones and their users emerge in a clear way. Infrastructural disclosures occur in moments in which routines and ordinary flows of the practices related to the smartphone (like messaging, calling, searching the web, listening to music and so on) are disrupted in a tangible way by the smartphone's infrastructural properties. These infrastructural disclosures do not represent qualities of the infrastructures but rather analytical strategies that bring to light in a manifest way the often "invisible" and "taken-for-grated" (Star & Ruhleder, 1996, p. 113) infrastructural qualities of smartphone practices and how these are fully embedded into multiple layers of socio-technical infrastructures. Then, moving from these theoretical premises, in the following sections (from 3 to 7), we will address five main dimensions of infrastructural disclosures in smartphone use. Finally, in the conclusion we will discuss more in depth how a deeper consideration of the infrastructural dimensions in mobile technology uses will improve our understanding of today's digital media practices.

2 Infrastructures, Practices and Infrastructural Disclosures

As previously mentioned, while practice theory has been crucial for advancing the understanding of materiality of artefacts and technologies for the studying of ordinary consumption, only very recently have scholars in this area started to look more directly at the intersection between infrastructure studies and practice theory (Shove, Watson & Spurling, 2015; Shove, 2016; Shove & Trentmann, 2019). In fact, early contributions in practice theory (Shove, Hand, Ingram & Watson, 2007; Shove, Pantzar & Watson, 2012) somehow shared some of the same limits that affected other nearby approaches to technology uses, notably the limit that technology is mostly understood in terms of a "user-device" relationship, without considering how today's technologies are increasingly embedded and nestled in wider sets of digital infrastructures. On the contrary, as it has been more recently outlined by Elizabeth Shove (2016), infrastructures and practices co-evolve, and a closer look at infrastructures can help to enlighten how distinctive social practices diffuse and how they can contribute to explaining practices' obduracy and flexibility.

Despite this recent interest in infrastructures among practice theory practitioners, at least two paths need to be further explored in this direction. The first path to be further explored is thematic, as the ongoing work in practice theory about infrastructures is mainly focussed on issues related to the sectors of environment, energy consumption and mobility, and is only marginally (with the exception of Morley 2019) focussed on mobile communication technologies platforms and, in general, how people are imbricated in digital data flows in their everyday practices. To enrich the debate, the present article contributes to expanding the nexus between social practices and infrastructures by focussing directly on the practices related to the smartphone, the most common mobile digital technology in today's ordinary life.

Moreover, as a second path, we also argue that broader theoretical and conceptual work has to be done to expand the intersections between practices and infrastructures. Indeed, while works from Thomas Hughes (1983) or Graham and Marvin (2001) are relevant points of departure, as Shove and Trentmann (2019) outlined in their introduction to a recent book on practices and infrastructure, what remains to be highlighted in a clearer way is the contribution from the field of "infrastructure studies." This scholarship departed from the work of Susan Leigh Star and other colleagues (Star & Ruhleder, 1996; Star & Bowker, 1999), gaining substantial interest in *Science & Technology Studies* in the last decade (i.e., Edwards, 2003; Bowker, Baker, Millerand & Ribes, 2009; Mongili & Pellegrino, 2014) as well as in liminal fields like participatory design (i.e. Egyedi & Mehos, 2012; Dantec & DiSalvo, 2013; Pipek & Wulf, 2009). In Star and Ruledher's work we can already recognize a robust nexus between practices and infrastructures, where the latter are seen as immanently linked "with conventions of practice" (Star & Ruhleder, 1996, p. 113), thus explicitly highlighting the mutual shaping between infrastructures and practices, as — as they outlined — an "infrastructure occurs when local practices are afforded by a larger-scale technology" (*ibidem*, p. 114).

Moreover, the need to take into account more closely the theoretical intersections between practices and infrastructures also requires that we include in the framework the ongoing debate on the role of infrastructures in media and communication studies. Indeed, in the last few years the infrastructural qualities of digital media have been underlined by several media scholars, who converged toward what can be addressed as an "infrastructural turn" in the study of digital media (i.e. Larkin, 2008; Peters, 2015; Parks & Starosielski, 2015; Musiani, Cogburn, DeNardis & Levinson, 2016; Balbi, Delfanti & Magaudda, 2016). As a result, the notion of infrastructure has influenced several media and communication scholars, who adopted an infrastructural perspective to disentangle the complex intersection of media materiality, dematerialized digital content, data organization and collective media practices. For instance, media theorist Benjamin Peters has proposed an *infrastructuralist approach*, which is "a way of understanding the work of media as fundamentally logistical," in the sense that "the job of logistical media is to organize and orient, to arrange people and property, often into grids. They both coordinate and subordinate, arranging relationships among people and things" (Peters, 2015, p. 37). As Lisa Parks remarked

> since infrastructures cannot be captured in a single frame, we must read media with an *infrastructural disposition* — that is, when viewing/consuming media we must think not only about what they represent and how they relate to a history of style, genre, or meanings, but

> also think more *elementally* about what they are made of and how they arrived (Parks, 2015, p. 357).

The notion of infrastructure allows us to recognize some important characteristics of digital media and communication: from the changing relevance of technical materiality in communication processes to the shift from the use of single artefacts to interconnected artefacts, up to the increasing importance of being always connected for our "deeply mediated" society (Couldry & Hepp, 2017). A specific emphasis has been recently put on the relationship between media infrastructures and platforms (Plantin, Lagoze, Edwards & Sandvig, 2018; Plantin & Punathambekar, 2019; Helmond, Nieborg & van der Vlist, 2019), by examining the convergence of the infrastructural nature of many internet-based services and the emerging role of platforms in different kinds of media and communication domains (van Dijck, Poell & de Waal, 2018; Gillespie, 2018). Looking at the nexus between platforms and infrastructures means considering not only issues like the way the stakeholder–user relationship is mediated by platforms and infrastructures at different scales but also the ideological ground on which social practices take form through these platforms. Concerning more specifically smartphone practices, recently Maren Hartmann (2017) adopted the notion of infrastructure by taking into consideration the role of electricity in relation to smartphone use. Electricity undoubtedly is a fundamental infrastructural dimension in shaping smartphone practices, even though the infrastructural qualities of these devices go well beyond this dimension and include a wider set of stratified infrastructural dimensions overlapping each other.

Hence, to unfold these multiple and stratified infrastructural layers that contribute to the co-shaping of smartphone-related practices, in the following pages we present five main dimensions of *infrastructural disclosures*. These infrastructural disclosures are analytical tools allowing us to manifest how the practices related to smartphones are fully embedded in multiple layers of socio-technical infrastructures and how, therefore, these also evolve and change as a consequence of how users adapt their activities to the limitations and opportunities produced by a smartphone's infrastructural qualities. Thus, the notion of infrastructural disclosure is in line to that of *infrastructural inversion*, a methodological strategy introduced by Geoff Bowker (1994) and subsequently developed further by Bowker and Star (1999) to foreground the invisible work that underlies information infrastructures, focussing on those activities that warrant the functioning of infrastructure, like maintenance, upgrade and repair. Infrastructural inversions consist, indeed, in disclosing infrastructure's routines to expose taken-for-granted practices as well as the standards and the invisible labour required for make them working and — as the authors wrote — in "learning to look closely at technologies and arrangements that, by design and by habit, tend to fade into the woodwork" (Bowker & Star, 1999, p. 34). We will present several examples of *infrastructural disclosures*, which empirically correspond to moments or situations when the ordinary flow of smartphone practices is interrupted by some kind of issue, failure or limitations directly connected with the smartphone's infrastructural nature. More specifically, in the following sections we will address five main dimensions of infrastructural disclosures that emerged from the interviews with smartphone users and are related to electricity, radio signal, data, operative systems and platforms.

3 Electricity: "Obviously, the Battery Does Not Last at All"

The first dimension of infrastructural disclosures related to smartphone use is a quite fundamental one, being related to the smartphone's dependence on battery operation and, therefore, on the electrical grid. In fact, although over the years the batteries of these devices perform increasingly better, their duration, especially in the case of more intensive uses (for example browsing online, using streaming services or navigation apps), remains a highly problematic issue.

The dependence of the smartphone on electricity and battery life is reflected in different forms in the co-shaping of smartphone practices. First, the need to carefully adapt smartphone usage to battery constraints is recurrent, for instance limiting some of the functions of the device, especially in the last portion of the day, when it is common to find the battery low. The need to reduce the use of some applications ("apps") is so important that a specific feature to perform this task has been incorporated by manufacturers into the smartphone software, by including automated restrictions provided by the op-

erating system. Let us consider, for example, the experience of Alberto, who told us about his advanced system of battery savings, which directly decides which app can be used at certain times of the day:

> So, basically I have this app, which I use relatively rarely, that has mostly the purpose of "hibernating" applications and therefore to reduce its use, to reduce [the consumption of] the battery. Basically, the applications, even if disabled, are active in the background, and therefore by using this app in theory you should save some battery. Then, my phone is always in "energy saving mode" and in extreme cases I switch on the "advanced energy saving," which essentially turns the phone to black and white, to disable all applications, basically allowing me to use just five or six main applications: phone, messaging, Facebook, all in black and white, and even the camera is not available. WhatsApp is available, the calculator is available, the clock, but that's enough (Alberto, 19).

The problems related to electricity and battery life in smartphone practices assumed a material form in a distinct accessory, the *powerbank*, which has become quite common in the last decade, following the transition from traditional mobile phones to smartphones. The powerbank is a portable battery charged through the electrical grid and then used as a portable power supply when the smartphone's batteries run out. The powerbank helps reveal the smartphone infrastructural dependence by the electric infrastructure and, at the same time, it also represents a technical resource allowing new and distinctive uses of the smartphone. This last possibility emerged from the account by Elisa, who described that she bought one of these portable batteries after the transition from a traditional mobile phone to a smartphone, at first just to use it while traveling abroad; however, rather surprisingly, the powerbank turned out to be a strategic accessory in domestic practices:

> In the beginning, when I made the transition from an old-fashioned phone to a smartphone, the battery obviously did not last at all compared to the Nokia 2210 phone, which lasted as long as two or three days. The smartphone [lasts] one day and "bye bye." I was prepared, in the sense that I saw reviews before buying it and I understood that I had to [accept it]. I adapted and soon I bought a battery, what's the name? A powerbank! [...] I bought it more than anything else for my travels, in the sense that when you're abroad it is much more difficult to find a socket, so I bought that especially for this reason. Then sometimes I use it at home, because maybe you get home after a day out, you need to use WhatsApp with your friends, the phone is already discharged, because you spent a day out, so I plug the powerbank in and can still chat around home (Elisa, 25).

These examples reveal a distinctive level — that of the electric infrastructure — where infrastructural disclosures in smartphone practices become manifest. These disclosures show us that, although smartphones allow diversified practices in mobility, the dependence on the electrical infrastructure contributes to shape users' practices in different forms. First, many users should adapt their practices to the constraint coming from their battery's limitation, reducing some kinds of uses, especially in the second part of the day. Second, the same smartphone manufacturers included in their devices automated features to cope with battery limitations, moulding these devices on the basis of their infrastructural qualities. Finally, a series of specific accessories, primarily the powerbank, deriving from the smartphone's dependence on the electricity infrastructure, have become more widespread, expanding the set of uses and practices.

4 The Signal: "It is More a Problem of Connecting to the Network"

A second dimension of infrastructural disclosures in smartphone practices is represented by the need for mobile devices to be connected to a cellular network and to physical wireless towers. In recent years, the signal coverage by the major mobile phone carriers has improved in many countries, including Italy, where, according to data from the European Commission, phone carriers offer coverage in 3G (HSPA technology) to 99.4% of residents in the national territory (IHS Markit, 2018, p. 126). However, in practice, especially (but not only) outside urban areas, the signal is sometimes absent or the signal strength is

not good enough to use more advanced features, like streaming content or accessing cloud storage. This is not so much because the official coverage does not correspond to the real service offered but rather because daily usage conditions can introduce specific issues. For example, a building's architectural structure affects the signal, as well as the physical distance from the towers that actually transmit the signal or the number of users connected simultaneously to a specific tower. In addition, the technical quality of the reception is also important, as more intensive activities with the smartphone require not only the presence of a signal but also of an advanced communication standard (3G or 4G) that is able to allow activities based on demanding data use, like music listening and multimedia streaming services. For this reason, a recurring thread in the narratives produced by the interviewees is that sometimes it is not possible to be connected, as for instance Elisa has told us:

> Sometimes Facebook runs slowly or things like that, but this is more about a problem of connecting to the network, so I cannot say that it is a fault of the smartphone (Elisa, 25).

The most emblematic example of situated infrastructural disclosure related to the smartphone's dependence on the cellular network emerged in an exchange with Enrica during the interview. We asked her which app she had recently uninstalled from her smartphone in order to explore challenging aspects in smartphone practice. Not remembering which app had been uninstalled, Enrica decided to check the list of these apps directly through her account on the Play Store, the Android app-distribution platform. However, probably due to the building structure of the venue where we were doing the interview, it was not possible to access Enrica's list:

> Maybe, on the Play Store there should be a list of applications that have been installed [and then removed]. There should be all of them. Now... I do not know why... it does not even... it does not even connect! [...] I do not like this connection issue! It happens sometimes, I do not know if it's the operator's fault or the phone's fault, but I think it's the operator, because other people have these same problems, the internet connection does not start (Enrica, 19).

Although infrequent, the cases when the smartphone does not work properly because it does not receive the carrier's signal is not only a common problem in smartphone practices but also one in which users experience what has been referred to as a feeling of impotence. As Rino described during the interview, "people go out of their mind" when their device no longer has a signal:

> I'll give you an example. When I'm watching a football match or a music concert, I see this compulsive tendency [to constantly check their smartphone]. And then some people go crazy if the phone suddenly does not receive a signal or it turns off (Rino, 29).

In short, although it is infrequent to lack a carrier signal, these cases represent eloquent infrastructural disclosures in smartphone practices, reminding us that the smartphone can be used suitably as long as it remains physically connected, via radio waves, to a tower that manages the connections to the cellular network. As we have seen, the disconnection from the cellular infrastructure is not an aspect with merely technical consequences; these infrastructural issues have a direct impact on people's practices and even on the ways they experience their existential condition based on being always connected.

5 Data: "Clearly it Consumed my Gigabytes"

The need for a smartphone to have access to digital data constitutes the third dimension of infrastructural disclosures we will now outline. A permanent connection, in fact, distinguishes the smartphone from traditional mobile phones, introducing a further infrastructural level in smartphone-based practices. The clearest aspect regards, on the one hand, the amount of gigabytes available to users, generally established in the contract with a telephone carrier, and on the other hand, how these gigabytes are managed, especially in relation to those services that are demanding in terms of data, such as watching videos on YouTube or listening to music on *Spotify*. At the time of the interviews in 2017, most commercial offers in Italy did not include more than 2 gigabytes for standard contracts.

Our respondents often outlined that the limitations related to data management were very relevant for their smartphone practices, as they had to develop routines compatible with keeping their data consumption under control and pay attention to their activities online. A common practice is using specific online services only when a Wi-Fi network is available, in order not to affect the amount of data made available by the carrier. This is, for example, what Simone told us in this regard:

> Well, to download applications or photos on my Google account [I use Wi-Fi], otherwise for normal use I also use the data network. I am a cautious person, in the sense that I don't watch videos on Facebook on YouTube. Or, if I watch them, I watch only one or two of them, because I really want to, but I know what I'm going to do, so I know more or less how much I consume, I know how much it [data] remains. I am very careful, personally. But so many times my girlfriend will say to me, "I've finished the internet! How is it possible?!" And I tell her, "Take a look at the settings of the data network, see what you have consumed and limit yourself in consumption" (Simone, 20).

The management of the limited data available is an example of how smartphone's infrastructural implications significantly contribute to shaping users' practices related to accessing online content. Data management participates in shaping several practices, especially in terms of their distribution over time and space. To save data, users can choose to take advantage of Wi-Fi coverage when they are in places where this option is available, and they can decide to use certain services only when connected to a Wi-Fi network. The following experience described by Elisa, in fact, shows us how the rhythms of everyday life can be retraced on the basis of the transitions from one Wi-Fi network to another, for example from the home network to the one available at the workplace:

> I almost always connect to Wi-Fi. If there is one, I do it very willingly, of course. The rest of the time, let's say this: I'm at work for eight hours and I have Wi-Fi; then, if I go out and, basically, I easily turn on the data connection. So I do not have many problems, because I know that when I go home, I'll have the Wi-Fi again, so I feel pretty safe [...]. [Consuming all data] was common with me at the beginning, because during the early period with my phone I started to watch a lot of videos on YouTube with my friends and I didn't have a Wi-Fi connection and clearly this consumed all gigabytes, so I realized it and said to myself, "Okay, it's something I do not have to do anymore!" (Elisa, 25).

As seen in several interviews, the early stages in a smartphone's use have been characterized by "wrong" uses — especially characterised by "things that should not be done" in relation to infrastructural constraints linked to data consumption. Thus, during the "domestication" process of this media technology (Silverstone & Hirsh, 1992), users like Elisa and Simone also learned to limit themselves, to "not consume all the gigabytes" and, consequently, adopted everyday practices more compatible with the prudential management of available data.

Infrastructural disclosures based on data management in smartphone use helps demonstrate how the dependence by a data infrastructure is not only able to disrupt the flow of practices but also to discipline along the time how people develop their overall smartphone use. Moreover, data-related infrastructural disclosures, more strikingly than, for instance, the dependence on electricity or the availability of the signal, show how smartphone practices significantly depend not just on infrastructures' technical features but also on how these infrastructural features are embedded both in commercial offers by carriers and domestication processes performed by their customers.

6 Operating Systems: "... and Then It Started to Get Stuck on Updates"

A fourth dimension of infrastructural disclosures in smartphone practices concerns the role of operating systems, that is, the software that allows these devices to behave more like miniature computers than as traditional telephones. Taking into account operating systems in smartphone practices is essential to grasp another crucial infrastructural quality of smartphones, as well as to understand how smartphones

fit into a wider stratification of practices, especially when compared to previous, mostly voice-based mobile phones. First of all, the presence of an operating system in the device implies, in fact, the possibility of installing apps that offer additional features not available with traditional mobile phones, enabling a virtually endless set of other practices.

However, as we will see, operating systems also constrain users within distinctive paths of smartphone ownership. Indeed, some operating systems can work only with specific devices and not with others, as iOS is installed only on Apple's iPhone, while Google's Android operating system can be installed on all smartphones except those produced by Apple. Operating systems must be constantly updated to work with the new versions of apps that are frequently released by their developers; moreover, operating systems must be learned by their users, who can easily feel compelled, when they have to choose a new smartphone, to buy a device with the same operating system as their previous device.

Choosing between the two most widespread operating systems — Apple iOS or Google Android — is a frequent theme in the dialogues with our interviewees. Several of them often feel compelled to buy a device that has the same operating system as the last device that they owned. This issue can be appreciated, for example, in the story of Elisa, who had recently moved from an Android smartphone to an Apple one:

> The iPhone has always caused some doubt in me, because it is a different operating system [...] Those concerns that I had were actually prejudices; namely, I was afraid of not being able to get used to it [...]. Instead, they are just prejudices, as it was more the lack of confidence in myself, and in reality I got used to it quite quickly [...]. However, the fact that I never had an Apple smartphone before made me somewhat reserved. I said: "Hmm, it is an operating system that I'm not used to, and moreover I've always had a Windows computer and so I would be more relaxed with an Android" (Elisa, 25).

When infrastructural disclosures connected to the role of operating systems become apparent, they bring to users' attention those infrastructural aspects that are often taken for granted. In this regard, a crucial stage occurs when an update of the operating system becomes required. In fact, on the one hand software producers (both Apple and Google) regularly release new updated versions of their operating systems; on the other hand, companies that produce apps also distribute new iterations of their software, which often is not compatible with older versions of the operating system. Hence, one of the shared experiences among smartphone users is related to compatibility issues between older smartphone models, new versions of operating systems and new releases of apps. This infrastructural interweaving of smartphone elements emerged clearly from the story of Antonio, who described his experience with an iPhone 4 (a model produced in 2010), which was still working, but was no longer able to receive updates from Apple:

> Then I bought the iPhone, the 4 series, and it lasted a long time, lasted three or four years and then started to get stuck on updates [...] it could not install them [...]. I have been lucky, because I didn't install the last available update, the iOS 7 was the update, one of the first major updates they did. And the iPhone 4 could be rather impaired, because it did not support it and therefore used to crash (Antonio, 19).

Moreover, this fourth infrastructural disclosure is connected with the fact that users are pressed to remain tied to a specific operating system: on the one hand because, as described by Elisa, the owned operating system's features are already familiar, and on the other hand, due to the need to constantly follow software updates released by software producers, as described by Antonio. This situation outlines one of the issues most often raised by smartphone users: the pressure to change smartphones not because they break down but because the device does no longer fits into the wider infrastructural alignment between operating systems, software and apps. This situation has been experienced as a sort of "cage" into which the user has the perception of being somehow harnessed, as in the following story told by Fabio:

> I don't have real problems with the smartphone, but if I have to choose one I would say the issue of updates. Producers are constantly updating the iOS. So far [my smartphone] is

> updated, it supports everything, but they force you a little to stay with their product. This is a negative aspect, in my opinion, because, for example, I have decided to stay with that brand, since it is a decision already made, [but] obviously when it will not update anymore, I will understand that there is a problem and I will get another one. So in my opinion Apple has developed an exceptional [...] system in terms of marketing, because they actually bind the customer (Fabio, 30).

Again, this constrictive experience characterizing the relationship between operating systems and smartphone practices is not purely a matter of technical limitations: once the user is harnessed in these infrastructural paths, in fact, he easily ends up chasing the cycles of models' renewal and software updates sustained by manufactures' strategies. In short, this fourth infrastructural level of disclosures highlights how smartphone practices are co-shaped by an operating system's infrastructural nature.

7 Platforms: "It's Like an Indelible Memory"

The fifth and final dimension of infrastructural disclosures is related to digital platforms, understood as those distinctive corporate entities that increasingly organize our experience in the digital world (van Dijck et al., 2018) and that, consequently, are fundamental in the shaping of smartphone practices. In fact, services like *Facebook*, *Google* and *YouTube*, but also *DropBox*, *Spotify* and *AirBnB*, are not just apps contained within our smartphone, nor are they just companies that offer a service; rather, they are complex and multifaceted entities, increasingly central in the new digital capitalism (Srnicek, 2017). Looking at these entities as "platforms" and not just as apps highlights their ability to reconfigure relationships, practices and activities, and to emphasise how people's activities are soundly dependent on the technological, economic and political choices by particular companies (Gillespie, 2018).

Among the many relevant platforms, Google is one of the most obvious subjects of examination, as it articulates in a more or less integrated umbrella a series of services ranging from email to address books, photo storing to web searching, maps to shopping choices (Plantin et al., 2018). For these reasons, Google (together with Amazon, Apple, Facebook and Microsoft) has been defined as an "infrastructural platform," as it "form[s] the heart of the ecosystem upon which many other platforms and apps can be built" and plays the role of "gatekeeper" for other different digital activities (van Dijck, Poell & de Waal, 2018, pp. 12–13). It is not surprising, therefore, that smartphone narratives are relentlessly characterized by their reference to the role of Google. The following words extrapolated from Sandro's story exemplify, for instance, how the logic and constraints of the Google platform directly influence the management of online photo storage, through the cloud services made available on a free basis but with options and limitations:

> In my Google account, there is the Google Photo option, which you can allow to back up with the function "only in charge," so I leave it at night with the Wi-Fi on, I plug it in to charge, it uploads the photos and I know that they will not be lost in the unfortunate event something happened to the phone [...]. It is free up to 15 gigabytes. But there are limitations too, in the sense that Google makes available in the cloud 15 gigabytes, but the photo uploading can take place with two possibilities: the first is in low resolution or, better, it is not a bad resolution, but it lowers the quality of the photos, and this does not affect the amount of memory you use in the cloud; if you load them at the maximum resolution, this easily it counts against your storage limit and, once the 15 gigabytes are exceeded, you have to pay to get more space (Sandro, 26).

Another example of infrastructural disclosure related to the role of platforms regards *Spotify*, one of the most popular music streaming services, which provided at the beginning of 2019 a catalogue of about 40 million songs listened to by almost 200 million users. Half of these users are paying subscribers of a premium service, which gives them options not available with the free version. With a paid *Spotify* subscription, music can be browsed or searched through within various parameters, such as the artist's name, the album title or the genre. Users can create and edit playlists, possibly sharing them with other users on social media. Unlike the listening model based on mp3 files, the streaming service of *Spotify*

makes partially obsolete the need to download and own music files and it is a tangible example of cloud computing, when data and services are no longer contained on a device but are managed by data centres from which listeners receive content when they need it. *Spotify* represents a very clear example of how music listening practices are channelled through the platform's logics and its commercial framework, as clearly emerges again from Sandro's description of the difference between the premium and the free version of the service:

> The difference is huge, because with the free version you can have your play list, but you have only a random selection; you can't choose the song to play and you have advertising every thirty minutes. Whereas with the paid version of *Spotify*, you can make your play list, choose the order you want, have no advertising and can download the songs onto your phone, so that if you are in a place and there is no cell reception, you can continue to listen to music, whereas with the free version you can't (Sandro, 26).

From this example we can appreciate how the choices made by some of the most important platforms directly affect the way users perform distinctive practices connected in these cases with photography and music. Moreover, it is worth noting that the distinctive infrastructural dimensions involved in these relationships with platforms are constantly intertwined with other infrastructural levels, as occurs in the case of *Spotify Premium*, which allows subscribers to listen to music even when their smartphone is not connected to internet, while the free version does not provide this service. In sum, these concise examples outline the active role of platforms' infrastructural logic in shaping user practices and how platforms contribute to the construction of a specific framework within which smartphone practices are actually articulated by users.

8 Conclusions: Multiple Scales and Multi-Layered Configurations in the Practices-Infrastructures Relationship

The current debate on the role in society of platforms, datafication, algorithms and other crucial digital entities (Kitchin, 2014; Couldry & Hepp, 2017; van Dijk, Poell & de Waal, 2018) has deeply refocussed the issues at stake in the integration of digital infrastructures in social practices. Departing from this debate, one of the new directions of inquiry to be further explored is the way in which digital infrastructures are directly intertwined with people's ordinary practices, routines and ordinary everyday rhythms. In this article, we aimed to contribute to this issues by exploring further the relationship between practice theory and the infrastructural qualities of social practices, especially looking to the role of infrastructural dimensions in the shaping of digital media practices connected with the smartphone. Our work explored primarily the influence exerted by smartphone's infrastructural qualities on practices, trying to unfold how smartphone infrastructural qualities contribute in the shaping of common uses of this mobile device that is increasingly important in our everyday life.

To do this, we proposed to adopt a novel analytical tool, the *infrastructural disclosure*, which was used to shed light on particular situations in which a specific infrastructural dimension emerged as clearly co-constitutive of users' practices. In particular, our contribution investigated such a complex interweaving of artefacts, infrastructures and practices on the basis of empirical data made up of 26 in-depth interviews and a focus group with young smartphone users. On the basis of this empirical evidence, we identified five infrastructural dimensions in smartphone practices, illustrating each of them with accounts extracted from user interviews. For instance, we saw how electrical energy could be a fundamental influence on smartphone practices, inducing users to modulate their activities on the basis of this infrastructural constraint; we also saw that infrastructural disclosures can bring to the foreground the relationship between smartphone practices and the network signal, as well as the relevance of the data available with the smartphone contract, as the limited amount of available data directly fosters the adoption of distinctive activities shaping smartphone use. Finally, we focussed on the crucial role of operating systems and the framework of use posed by platform, their mechanism on strategies.

More generally, our analysis of infrastructural disclosures in smartphone use invite to explore more robustly the infrastructural qualities of our technological life, increasingly dependent on infrastructures

digital communication tools. At this regard, in the final remarks of this conclusion we want to quickly address two wider implications of our findings for the study of the relationship between practices and infrastructures.

The first implication regards the *multiple scales* (see Parks & Starosielski, 2015, pp. 7–8) at which digital infrastructures unfold their consequences on people's practices and activities. Indeed, the crucial shift to a situation in which mobile personal devices are complex interfaces to interact with large and complex technical infrastructures should push scholars to multiply the perspectives from which the consequences of digital technologies ought to be addressed. In this sense, while the current debate on digital platforms has largely focussed on macro scales (i.e. their political economies, their wider consequences on contents circulation, their impacts on shared values), much theoretical and empirical work requires to be done to understand how people's situated experiences and practices are actually reshaped and co-evolve together with these processes, occurring at larger scales. In this regard, this work aimed at offering a way to explore the rather micro scale on which infrastructures and practices intersect, outlining some of the distinctive moments when infrastructures emerge from the background in users' experience and lose their typical take-for-granted-ness.

Second, our analysis raises an issue related to the how people's everyday practices based on technological devices are characterised not by the dependence upon *one* crucial digital infrastructure, by rather by their embeddedness into a *multi-layered set* of infrastructures, whose mutual interactions are sometimes more relevant than the singular distinctive features of each of them. Indeed, while we isolated analytically different infrastructural dimensions relevant for the shaping of smartphone practices, we also recognized that practice's features can be understood only as the outcome of the interaction of affordances and constraints pertaining to different, but interrelated infrastructures. Hence, we have seen for instance that platforms' constraints make sense only if we understood them in relation to the limits of data usage posed by mobile carriers; or that the issues related to electricity and battery consumption participate directly to the usability of operating systems and software; or again that the possibility to consume a YouTube video also depends upon the way personal life is arranged on the basis of movements between different Wi-FI spots between home and workplace.

The *multiple scales* relevant in the use of current everyday technologies and the *multi-layered configuration* of digital infrastructures are two major issues raised by this work and that ought to be explored in further research, in order both to expand the contamination of practice theory with other theoretical traditions and to enrich the current debate on the reconfiguration of everyday life in an age of infrastructured digital media.

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