Edited by Gillian Rose

Seeing the City Digitally

Processing Urban Space and Time

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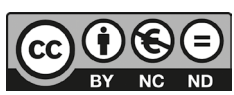

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1. Introduction: Seeing The City Digitally

Gillian Rose

Abstract
The argument that many cities are now digitally mediated is an increasingly familiar one. The social, experiential and physical spaces of a city are more and more often designed, defined, navigated and experienced with digital data shared with platforms. But from its app icon to its interface to its advertising campaigns, every platform deploys a wide range of imagery, and most successful social media platforms are based on sharing images. This book explores what's happening to ways of seeing urban spaces in the contemporary moment, when so many of the technologies through which cities are visualized are digital. The introduction explores how the processuality of digital images, and their near-ubiquitous circulation, are reconfiguring the spatial and temporal organization of urban life.

Keywords: mediation, platform, processuality, representation, animation

Introduction

This book explores what's happening to ways of seeing urban spaces in the contemporary moment, when so many of the technologies through which cities are visualized are digital. It is by no means comprehensive. Its chapters all explore specific examples of different kinds of digital technologies and examine different sorts of images in different cities: many other technologies, images and cities could have been their focus. However, cumulatively the chapters suggest some of the most important ways in which seeing urban spaces through digital devices is reconfiguring both how cities appear and what happens there.

The argument that many cities – perhaps all cities, in different ways – are now digitally mediated is an increasingly familiar one (early statements include Boyer 1996; Manovich 2006; Mitchell 2003). McQuire (2016, 1), for

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example, concludes his discussion by identifying the extension of digital networked media throughout urban space as "one of the key features distinguishing twenty-first-century urban experience from earlier modes of urban inhabitation". The social, experiential, and physical spaces of a city are more and more often defined, navigated, and experienced with data generated by digital devices. Software-enabled technologies work with digital data of many kinds, in a huge array of urban infrastructures and institutions. Data is generated, integrated, and analysed by various human and algorithmic agents, with consequences for things as diverse as the allocation of housing and healthcare, traffic management, policing, and the provision of infrastructure and services (see for example Anthopoulos 2017; Aurigi and Willis 2020; Eubanks 2017; Graham 2005; Marvin, Luque-Ayala, and McFarlane 2016; Willis and Aurigi 2018). Smartphones and their cameras and apps mediate more and more of everyday urban life, from socializing to travelling to eating. For Kitchin and Dodge, this means that cities must be understood in part at least through the organizational geometries of "code/space": "code/space occurs when software and the spatiality of everyday life become mutually constituted" (2011, 16).

Much recent discussion of code/space in urban studies has centred on the generation and integration of digital data for urban planning and city management. This was the focus of early accounts of "informational" and "intelligent" cities (see for example Batty 1990; Castells 1989) and it has remained central to much of the recent extensive discussion of the "smart city". In these discussions, a lot of attention has been given to how city authorities install and utilize digital infrastructure and data flows. The close relationship between digital infrastructure and the neoliberal privatization of city governance was noted early on and continues to be the focus of much criticism (Cardullo and Kitchin 2019; Hollands 2008). More recently, understanding the digital mediation of cities has had to engage with corporate digital platforms like AirBnB, Facebook, Instagram, and a plethora of ride-sharing and food-delivery apps, among many others. These platforms also do what smart cities purport to do: gather data, integrate data, and put data to use. However, while much smart city activity retains at least some relation to the forms and ideals of civic governance – even if only lip service – platform urbanism is largely driven by the search for profit (Cowley, Joss, and Dayot 2018; Sadowski 2020). Platforms are owned by companies making money from vast, globally-integrated data assets and their machine-learning algorithms (Barns 2020a; Hodson et al. 2020).

Most analyses of these infrastructures and platforms have focussed on their extraction and commodification of the data generated by the platforms'

users. However, some discussions have also begun to consider how platforms are also shifting the experiencing of urban life, as urban dwellers shop, play, eat, communicate, and work through them. "These platforms are, increasingly, the platforms many urban lives are increasingly constituted *by*" (Barns 2020a, 13). After all, a critical element in a platform's data infrastructure, and in many smart city projects, is a smartphone application, and apps are "functional and sensorial prostheses" for very many bodies (Srnicek 2014, 83). At the smartphone interface, platforms exert their pull, attuning users to their real-time, local connectedness; they are designed to be affectively trustworthy, seductive and effortless (Ash et al. 2017; Leszczynski 2019). Barns for example discusses the "intimate entanglements" between platforms and everyday urban life (2020a, 157).

Many of those entanglements are experienced visually. From its app icon to its interface to its advertising campaigns, every platform deploys a wide range of imagery. Indeed, the most successful social media platforms are based on sharing images: Whatsapp, Instagram, TikTok, Snapchat, even Facebook, and of course Pinterest. Intelligent and smart cities too rely on many kinds of visualizations, from the screens of smart city operations centres to online data dashboards to publicity displaying the benefits of going smart to their own smartphone applications (Luque-Ayala and Marvin 2016; Rose 2018; Rose et al. 2020).

And there are many other kinds of digital images in cities that picture urban spaces. Having been designed onscreen, new buildings are visualized in photorealistic detail in computer generated images, which appear on billboards and magazine advertisements, as well as on websites. Movies and computer games show cities that burn and fold and glow and float, cities that trundle along on huge caterpillar tracks, and cities that are flooded or frozen and sometimes both – or in ruins and inhabited by zombies or aliens. More prosaically, streets and cities are navigated using Google Maps (Wilmott 2016), and augmented reality apps – from games to local history projects – overlay smartphone cameras' view of roads and parks with other imagery (Uricchio 2011). Genres and purposes mix and blur as images circulate through any number of forms and places of display. Images of urban spaces are pasted or printed onto billboards and hoardings, flyers and brochures, magazines and newspapers; and urban spaces have been filling with screens large and small for some time (Manovich 2006). These extensive and diverse forms of digital imagery have been given relatively little attention in the work on digitally mediated cities. But they are central to how cities are changing now, and to how contemporary urban life is imagined. This book explores how digital images constitute urban code/spaces.

How do images of cities matter?

The argument that images of cities shape how cities are experienced is well established (Lindner and Meissner 2019). "The city is both the actual physical environment and the space we experience in novels, films, poetry, architectural design, political government, and ideology", notes Prakash (2008, 7), and to that list we could add photographs and maps and many other kinds of images. There is a productive "traffic between" cultural texts, everyday experiences and the urban built environment (Donald 1999, 27), so that the city becomes "the cognitive and somatic image we carry within us of the places where we live, work and play" (Huyssen 2008, 3). These arguments often emphasize the visual impact and discursive meaning of images. Images, it is argued, provide particular symbolic and affective co-ordinates for the experiencing of urban space. Images thus have their own liveliness.

But this argument must be pushed further. The mediation of urban life by images is not shaped simply by the visual content of the image and its impact on the imagination of its spectator. Images are never just visual content, whether symbolic or affective. Images take form as objects, and as objects they have material qualities (Rose and Tolia-Kelly 2012). As all of the chapters in this book point out, those qualities are variously mobilized, or not, by the socio-technical relations enacted as images are produced, reproduced, displayed, transported, modified, stored, and destroyed. Different kinds of images are made using different technologies in different ways; they are assembled and interpreted with other objects; and are seen, shared, and done other things with in various ways, with various effects (Clark 2018; Packer and Wiley 2012; Parks and Starosielski 2015; Pinney and Peterson 2003; Rose 2010). These makings and doings are routinized as social practices. As well as their visual content, these material affordances and practices are also part of an image.

The relation between an image – or imagery more generally – and urban space thus has a number of different elements. There are the visualizing technologies and the material affordances of image-objects, including what they picture of cities and how. There are the technologies of their distribution and the situations of their display. There are the social relations and institutions in which all of these are embedded, including how they are seen. There are the cultural meanings and significance on which they draw, or resist, and there are the affects that linger through all of these. There are thus co-constitutive relations between cities as sites of symbolic and affective images, and cities as sites of social practices and technologies.

There is a reciprocity between the material, social and symbolic forms of urban visualization and the visual perception of a city (Gordon 2010).

What then makes *digital* visualizations of urban spaces distinctive? After all, many digitally-produced images of cities look very similar to analogue images. Very many digital photographs look more or less the same as an analogue snap; for example, part of Instagram's early appeal was its ability to make a digital photograph look like a Polaroid. Much of the post-production work of big budget films now entails inserting the visual elements of analogue film into the digital movie (Murphy and Walker 2019). However, if we think of a digital visualization not simply as an image but as a lively socio-technical object embedded in socio-technical networks, as just described, then particular qualities of digital visualizations become evident, and their somewhat specific forms of configuring cities become more obvious. As the chapters in this collection propose, digital visualizations are doing something distinctive in their mediation of city space.

Visual technologies, practices, spaces

According to Besse (2013), by the end of the nineteenth century, in Europe for sure, visual culture was thoroughly urban. Cities were the sites of all sorts of innovations in visual technologies: balloon flights, panoramas, electric billboards, films, dioramas, photography, gas lighting. City dwellers bought new visual objects like daguerrotypes, postcards, tourist guides, and cartes de visite, and encountered new visual experiences in cinemas, arcades, expositions, and department stores.

As cities grew through the nineteenth and early twentieth centuries, various visualization techniques were also central to how cities were planned and managed. By the 1880s, there was a widespread assumption that the city must be made visible in order to be understood and managed. It had to be legible and "inspectable" (Otter 2008, 109). Otter (2008) traces the multiple, diverse, often hesitant, and indeed ineffective forms taken by practices of inspectability in European cities, from gas lighting to labelling to portable measurement devices. Many of these practices entailed creating images. Planners and social campaigners mapped, filmed, photographed and diagrammed both what needed improving as well as their ideal models for houses, neighbourhoods and cities. Much of this visualizing work was an effort to produce accurate evidence on which urban reform could be predicated (Barns 2020b; Boyer 1994; Clark 2018), and asserted an "absolute correspondence between the exterior city reality and its truthful

and purified representation" (Boyer 1994, 19–21). Tagg (1988) explores the enrolment of photography into this project, as a mode of generating apparently reliable evidence about the need to improve urban housing, for example, and photographic technologies were used extensively in projects of urban planning and reform: with their technological indexicality and the assumption that they pictured the world objectively, "photographs seem to bond image to referent with superglue" (Mitchell 1992, 28). Entertainment technologies also trained their gaze at cities, as early filmmakers set up cameras in streets or on rooftops. The city – actual, desired and feared – thus became thoroughly visualized, and through these various forms of imagery, the urban environment was produced in particular ways. As Barns concludes:

> Through its entanglements with the evolution of urban planning, we can see the role of urban media as not simply representing the diverse conditions of urban transformation, but as helping to constitute the very production of urban space. This history sheds a different light on the nature of urban media technologies, suggesting it is not so much that urban media – whether those of historical eras or the smart technologies of more recent times – finally capture the true complexity of cities, but rather that they recalibrate urban knowledge and expertise in their own image. (2020b, 236–37)

Barns emphasizes in particular the importance of representational correspondence between the image and the real, in much of the imagery that was part of nineteenth and twentieth century urban management and planning. Projects to modernize cities took images of cities as imprints or traces of actual urban spaces.

Many of these sociotechnical practices of visually representing cities were challenged from the 1970s onwards. In part this was because planning itself was increasingly criticized as the best tool for managing urban life. However, the 1970s also saw the first sustained efforts at developing intelligent cities, based on a cybernetic understanding of a city not as one thing to be mapped, photographed and managed as a whole, but rather as a set of system of interconnected systems (Halpern 2015). This was the predecessor of the smart city. In it, subsystems, networks, and flow seemed to replace the visual insight of both the cartographic overview and more local practices of inspection. For some commentators, this made the intelligent city hard to see. Although total inspectability was a goal never successfully achieved (Flint 2000; Otter 2008), the intelligent city seemed especially difficult to visualize. An early commentary by Boyer

on what she called "cybercities" suggested that this was because of what she considered the immateriality, incoherence, and extensivity of digital networks: "the whole has gone to pieces and no longer has imageable form" (1996, 175). Like Boyer, Barns (2020b) too suggests that cities have now reached some kind of limit of visibility, though she attributes this to the opacity of platforms' data harvesting and processing procedures to their users (Barns 2020a).

What the chapters in this collection contend, however, is that imagery still matters to urban code/space – but it is now often a different kind of imagery, with different consequences for the mediation of urban knowledge and experience. The materiality of this imagery is no longer analogue but digital, and its institutional context is less civic urban planning and management – though that remains important in many versions of smart cities – and more the "smart" platform urbanisms briefly described at the start of this introduction. In other words, dominant forms of urban imagery are now produced in the context of the material and corporate infrastructures of platform urbanism. To understand the implications of this shift, I suggest we need to turn away from urban planning as the context for understanding how cities are seen digitally, and towards recent discussions of digital cinema, digital photography, and even digital data visualization.

Discussions of digital cinema, digital photography, and digital data visualization clarify the distinctiveness of digital imagery by comparing it to analogue film, photography and data visualization (while being careful to avoid positing wholesale change driven by technological innovation) (see for example Casetti 2015; Elsaesser 2013a; 2013b; Denson and Leyda 2016; Halpern 2015; Levitt 2018). This comparison helps to specify how, although digital data in smart and platform cities continues to claim a certain verisimilitude to city spaces and urban life (Halpern 2015), there are nonetheless significant differences between the visual regimes through which nineteenth and twentieth century cities were seen and how intelligent, smart, and platform cities are visualized now. At the considerable risk of over-generalizing, for much of the nineteenth and twentieth centuries, urban imagery such as film, photography, maps, and diagrams was seen and deployed as representational. Representationalism is the conviction that what is represented exists independent of all practices of representation (Kember and Zylinska 2012, 31). Representational ways of seeing assume that there is a real that images – no matter how selective and distorted – re-present to the viewer. In film scholarship, this representationalist visual culture centred on lens-based recording has been called "cinematic". Those discussions focus on movies but could also refer to much urban photography

as well as the visual tools of the planning profession as discussed by Barns (2020b). As for the effects of representational cinematic films:

> [O]ne would first list the *impression of reality*, that is to say, the high iconic fidelity that the photographic image carries. The 'reality-effect' is also a consequence of the *impression of movement*, which, in turn, is complemented by the *impression of presence*, strengthened by sound, but also providing one of the typical subject effects of cinema; namely, the impression of being included in the image and endowed with a special kind of *ocular-sensory, embodied identity*. (Elsaesser 2013a, 32)

What we see when we see cities cinematically, therefore, are representational images taken to refer to an external reality. It is true that describing this as cinematic conflates "the cinema as an audiovisual storage medium for motion pictures with the cinema as a projection-based spectacle in a public space" (Elsaesser 2013a, 26) – but given the importance of an image's materialization in socio-technical settings, this is a conflation that makes sense.

Thus defined, the cinematic is the dominant visual regime of modern city planning. It is a way of seeing "what happens" in urban spaces, and Asli Duru's chapter here is written against that grain. Duru's discussion also emphasizes that representationalist ways of seeing cities do not only constitute what the city is seen to be, but they also constitute particular kinds of observers. "Though obviously one who sees, an observer is more importantly one who sees with a prescribed set of possibilities, one who is embedded in a system of conventions and limitations" (Crary 1990, 6). As noted, Elsaesser describes the observer of film as endowed with "a special kind of *ocular-sensory, embodied identity*" (2013a, 32). The observer constituted by the films, photographs and maps and diagrams of planners tends to analyse. Their professional vision focusses on what needs managing and improving: it thus is always a powerful gaze that differentiates between good and bad kinds of urban spaces. As Otter (2008) discusses, inspectability was a visual regime trained much more comprehensively (though never anywhere near completely) on the poorest parts of nineteenth-century urban agglomerations. Particular bodies came under more scrutiny than others too: women's bodies and black bodies especially (for example, Browne discusses the eighteenth-century "lantern laws" in US cities which forced black, mixed-race and indigenous people to carry lights after dark, thus marking them as "security risks in need of supervision" [2015, 78]).

In contrast, many images in the twenty-first century neither depend on representationalism nor assume an analytic or supervisory eye. These images and their viewers have been described as "post-cinematic" by film scholars. Elsaesser makes this comparison, again in the context of movies:

> The key *digital effects* [are] the *impression of hyper-reality*, which would lead to an *impression* not of movement but *of metamorphosis*; that is, not only in the form of morphing and shape-shifting, but also as a constitutive instability of scale, mobility of point of view, and inherent 'liquidity' of the (visual) representation. Second, instead of giving an impression of identity and presence, provided in the cinema by the stable configuration of projection, frame, and linear fictional narrative, the subject effect typical of the digital would be the *impression of agency, tactility, and interactivity*. [...] In each case and on both sides of the divide, these effects are 'illusory'. (2013a, 33)

Various accounts of post-cinema concur (see for example the position statements gathered by Denson and Leyda [2016]). Mitchell (1992) describes post-photography in similar terms: post-photographs no longer imply presence. And while these analyses focus primarily on the visual or aesthetic effects of digital images, it is important also to acknowledge that these are entangled with – though not reducible to – distinctively digital forms of distribution and viewing as well as (post)production processing. Post-cinematic films and post-photographic photos – as well as all sorts of other images – are viewed on all sorts of screens and in all sorts of situations (Casetti 2015), many of them circulating from platform to platform as they are distributed by their makers, users, fans, modders, doomscrollers, producers, likers, and retweeters among others.

This broad-brush account of cinematic and post-cinematic ways of seeing cities obviously glosses over any number of nuances and complexities (many are explored in relation to film and cinema by Elsaesser [2013a]). The reality effect of photographs could be put to work to challenge the aerial viewpoint of the planner, for example, as strong traditions of documentary and community photography attest (see for example Stacey 2020). As for moving urban images, McQuire reminds us that "for Benjamin, film assumed epochal significance insofar as its characteristic organizing logic – based on fragmentation and reassemblage of appearances through montage – might enable citizen-viewers to grasp patterns of urban life that otherwise resisted embodied experience" (2020, 17). Post-cinematic effects can be achieved using analogue technologies, and analogue technologies mimicked by

digital. Nonetheless, as Boyer (1996) and Barns (2020a) indicate, the visual mediation of digitally-saturated cities does not seem to have developed from the visualizations of nineteenth and twentieth century cities by planners and architects: "contemporary developments are contributing to the undermining of the representational paradigm" (McQuire 2016, 5), even if partially in all sorts of ways. So the comparison between cinema and post-cinema (or photography and post-photography) is a useful one, if only heuristically. Accounts of post-cinema and post-photography allow us to think about how digital images of cities look different, feel different, and organize urban space and time differently. The next section explores how the chapters in this book specify that difference.

Digital visual processing of urban space and time

So how might discussions of post-cinema help to understand how contemporary cities are being visualized in distinctively digital ways? The chapters in this book all explore the implications of digital images of cities' two key socio-technical affordances: they are *processed* data, and that processing creates images that *circulate*. Both those affordances create particular ways of seeing urban space and time.

Digital images are assembled from various combinations of data, software and hardware. The (nearly) infinite adaptability of digital images – the modifiability of their data and their ability to materialize in different forms – is a quite different visual affordance from analogue images. Elsaesser (2013a, 36–37) describes how digital images emerge from data that is harvested from the world and then manipulated by combinations of hardware and software, and suggests that this shifts digital images away from cinematic notions of representational capture, in which the image is seen as a trace or an imprint of the world, into something more akin to an ongoing process of extraction from and sculpting of the world. Rather than a representational *trace*, digital images are more like ongoing *events* (McQuire 2016, 5). Thus "post-cinematic images are thoroughly *processual* in nature, from their digital inception and delivery to their real-time processing in computational playback apparatuses" (Denson 2016, 194). Mitchell (1992, 7) similarly emphasizes the processing of data in his account of post-photography, and Halpern's (2015) account of the constitution of "beautiful data" in post-war cybernetics also describes the importance of dynamic interactions with data.

This account of post-cinema in particular has encouraged some scholars to point to animation as a visualizing technique which has historically used

analogue tools but is in many ways a precursor of post-cinematic effects (and whose long history has been ignored in many classic accounts of cinema that define the cinematic as representational [Ristola 2017]). Animation moves imagery from "questions about ontology, category, and being to ones of appearance, metamorphosis, and affect" (Levitt 2018, 2). While not directly determined by technological changes, animated imagery is particularly enabled by the software that processes digital images, especially moving images. In animations, things are erased or mutated or resurrected; things are not categorized but transformed. Levitt thus argues that animation is "the dominant medium of our time" (2018, 1; and see Manovich 2016).

These discussions of post-cinematic animation are of particular interest to the visualization of urban spaces, because in animated post-cinematic images Cartesian notions of space and time – central to the planner's analytic eye and to cinematic forms of representation – no longer apply. Objects can morph and viewers no longer necessarily inhabit "a kind of ocular-sensory, embodied identity" (Elsaesser 2013a, 32; and see Denson 2016; 2020; Rose 2021). Observers can fly and zoom, and/or be in multiple times and spaces at once. Digital images often suspend the human point of view and human scale (Denson 2016; Elsaesser 2013a, 33); spatial and temporal continuity is "fractured, devalued, fragmented, and reduced to incoherence" (Shaviro 2016, 55). Images are no longer representational but resemble more the artifice of hand-drawn cartoons or paintings (Manovich 2016). All this may also contribute to Boyer's sense that cities are no longer imageable: the overview based on visualizing Cartesian space no longer grips in digitally mediated cities.

None of the chapters in this collection address the most spectacular examples of post-cinematic urban animations, which tend to be Hollywood blockbusters or Netflix series about superheroes, alien invasions, or climate catastrophes, or indeed combinations of all three. In those movies, digitally-created visual special effects often picture extraordinary cities, cities which morph and are folded into one another, cities being overwhelmed by fire or tsunami or meteor strike, city buildings dwarfed by space ships or saturated by apocalyptic rain. These cities are pictured from any and all angles and scales. No longer a single point of view framed by perspectival techniques, the spectator becomes a constantly mobile point of view, decentred, zooming and hovering through an environment that seems to have no frame. Elsaesser describes this unanchored viewing, tracking seamlessly through spaces from the nano to the planetary, as "the default value of digital vision" (2013b, 240), and points to its nondigital precedents in a range of efforts to create convincing three-dimensional films.

Nonetheless, there are clear connections between these post-cinematic movies and the rather more prosaic visualizations discussed in the chapters collected here. The first relates to the *processuality* of post-cinematic images and its effects on what those images look like. Digital images can show spaces differently: less tracing and more sculpting.

Several chapters discuss processes that visualize urban worlds from the digital data extracted from it. Two focus on how various kinds of software work with data about urban environments to produce visions of that environment, visions which align with many of the qualities identified with post-cinematic digital images. The first is Joel McKim's discussion of a number of arts-based projects working with artificial intelligence (AI). McKim begins with a clear exposition of deep learning AI as a process that sculpts new kinds of urban images from other visual data. As he explains, different kinds of neural networks are trained to describe any image, initially on the basis of large numbers of manually tagged images. More recently, such deep learning AI can also generate its own images from that same training. McKim discusses a number of critiques of this sort of imaging. In particular, since machine learning is based on humans describing a large set of images using a delimited set of tags (often the Wordnet database of semantic relations), a number of norms and values are embedded in the AI learning via such datasets from the outset. This is of course an increasingly widespread critique of AI, and critics often focus on the racism, sexism and classism enacted in the tagging process (Benjamin 2019; Noble 2018).

As McKim notes, many criticisms of AI assume that AI are representational, and accuse AI of misrepresenting the actual world because they have been trained wrongly, as it were. However, McKim's chapter also hints at the processual agency of such AI. They may work with images that look as if they are lens-based and they may therefore be said to mis-label what a lens apparently shows – in a cinematic moment. But the three artists' projects discussed in McKim's chapter also have post-cinematic elements. Their sense of presence and stability is not secure. As McKim describes them, and indeed as one is titled, they are uncanny, hallucinatory, sinister. They are both recognizable and not. Their AI picture, or search for, objects that in part have been designed by AI. This is close to how Levitt (2018, 51) sees animations: they are sufficiently recognizable but never entirely so. It is not that they have no relation to the visible world, but rather that that relation is no longer representational.

Another kind of real-but-not digital image of many city streets are images generated by the various sensing technologies embedded in autonomous vehicles. These are images generated by digital devices which show urban

environments in ways that have very little in common with film or photography: like McKim's case studies, what they show are recognizable as streets, but point clouds and technicolour skeletons are less familiar. Sam Hind's chapter focusses on the dynamics of AI processing that control how autonomous vehicles navigate streets, particularly busy urban streets, and which generates those images. The main focus of his chapter is the process of "real-time" recognition done by autonomous vehicles' onboard lidar devices (lidar is short for "light detection and ranging"). Hind describes that process as composed of data generation, capture and processing – as per accounts of post-cinematic images – and it is that processing which both generates decisions about the vehicle's mobility and which also, in the process, sees urban spaces in new ways. If McKim only hints at the uncanny newness of machine-learnt imagery, however, Hind argues explicitly that this way of seeing moves quite radically away from familiar ways of seeing, and also from the ocular-sensory, embodied identity of cinematic observer. As Hind notes, autonomous vehicles do not require direct human involvement to engage in their sensemaking activities. Rather, the various technologies continually and processually "broker human accessibility" (Hansen 2015, 6) to the urban environment through new visual forms.

Ayona Datta's chapter explores another technology which could be described as brokering human accessibility to the urban environment: the smartphone with a WhatsApp messaging app. Her analysis focusses more on the human aspects of that brokering. Again, this chapter does not suggest – or does not only suggest – that smartphones allow a more accurate representation of urban life. Rather, Datta emphasizes the ongoing journeys, communications, connections, associations, and interceptions enabled by WhatsApp in the hands of a group of young women in Delhi's urban periphery. By focussing on their everyday and ongoing uses of the messaging app, Datta suggests that complex negotiations over urban space are constantly enacted and re-enacted. They are performed again and again, with and through the use of WhatsApp. She thus indicates how human accessibility to urban spaces is rendered processual when mediated by digital technologies that are themselves processual (see also Rose 2017). WhatsApp written and audio messages, as well as photos and videos, document urban encounters but also co-constitute their users.

Asli Duru also explores what happens as a city is encountered through mobile visualizing devices, in her case GoPro cameras and smartphones. Her account of an Istanbul neighbourhood emerges from her own imbrication in the enactment of digital mediations, as a researcher. She is concerned to evoke "a sense of the existing and emergent worlds, hierarchies and

sensitivities that come alive through the interactions between visual practices, things and subjects". This produces a different kind of knowledge about urban spaces which, like the urban geographies of Datta's collaborators, is not revelatory but processed on-the-fly: Duru describes it as "speculative" rather than inscriptive. It interrogates visibility itself through insisting, through the affordances of digital image making and editing, on the provisionality of what is shown.

Several chapters emphasize the multiple temporalities that emerge with the processuality of digital images. The emphasis on processuality and emergence in the chapters by McKim, Hind and Datta tend to focus on the in-the-moment working of software and hardware. The chapter by Scott Rodgers also elaborates a distinctively digital temporality which is experienced as "now". Rodgers explores how the circulation of images on Facebook and Twitter mediates the making of a local area in north London, specifically how the area took shape as a cycling infrastructure scheme was discussed online. He explores how these social media platforms translate asynchronous images and other data into an apparently-real-time experience of immediacy. While social media is experienced in and as the present or the "now" as people scroll through their feeds, what they are seeing might have been uploaded, or commented on, or shared, at many different moments in the past. Rather like the uncanny spatialities discussed by McKim and Hind, Rodgers proposes that the temporalities of online images are paradoxical: "A succession of 'nows'."

Duru also suggests that digital imagery can articulate not only immediate urban experience but also memories of past experiences. Memories infiltrate images too, again rendering them ambiguous. The chapter by Monica Degen and Isobel Ward also explores the multiplicity of temporalities enacted in digital visualizations of urban locations. Their case study is an urban regeneration project in London, and the digital images produced by the many stakeholders in the project. Degen and Ward are particularly interested in the multiple temporalities that are enacted as the plans for the area have developed. They point to a strong sense of the importance of the historic buildings in the area, which has been mobilised to resist past redevelopment plans, and the complex diurnal rhythm of the area's workers and inhabitants through the area's workplaces, clubs, and residences. The latter has been mobilised by one of the project's stakeholders and expressed in the form of large-scale photographic portraits of a diverse range of local residents, while other stakeholders have curated online archives of historical and contemporary images of the area. Still other stakeholders share images of branded cultural events, or picture the future development using computer

generated images of its proposed new buildings. While it is the case that cities have very often been seen as palimpsests of different historical moments, Degen and Ward's analyses of digital images of the area's past, present and future suggest that the digital technologies have intensified that multiplicity.

The second aspect of discussions of post-cinematic and post-photographic images that is relevant to several of the chapters here is that digital images circulate. A critical aspect of the sociomaterial affordances of digital images is that they are designed to be distributed digitally (Munster and MacKenzie 2019; Rubinstein and Sluis 2008). The shift from analogue to digital popular photography, for example, was enabled not only by digital cameras but also by increasingly seamless connections between cameras, other viewing devices like computers, and then phones and social media platforms. McQuire (2016) emphasizes the resulting ubiquitous availability of media content as a key aspect of the digital mediation of cities, and accounts of post-cinema pick up on this ubiquity by emphasizing digital movies' ability to be watched on digital screens in all sorts of situations (Casetti 2015). This is one of the ways in which digital imagery must be placed in relation to platform urbanism. Much of the data harvested and distributed by platforms takes visual form on screens. Films and videos, all sorts of photos, animated graphics, memes and gifs, app icons, and more appear on screens that are themselves visual user interfaces. Thinking about the digital visual mediation of urban space must therefore also consider how their patterns of image distribution have consequences.

But the mediation of urban space by digital images shared via social media platforms is a little more complicated than everything being viewable on any screen. Not everything can be shared: technical incompatibilities between devices and software, sometimes generated specifically to protect copyright or a platform, create frictions. Many images are shared as part of an exploitative global division of digital creative labour, through which repetitive processing tasks are sent to cheap labour markets in the Global South (Chung 2018; Murphy and Walker 2019; Rose, Degen, and Melhuish 2014). And on social media, there is evidence that the uneven clustering of likes, follows and comments enacts differentiation between urban spaces.

A study of Instagram use in Amsterdam is instructive here. Boy and Uitermark (2017) analysed 400,000 geotagged Instagram posts from Amsterdam. While they do give some attention to their visual content, they are also particularly interested in the distribution of those posts across different users. They identify what parts of Amsterdam appear most frequently on Instagram and also identify different clusters of users who like and comment on each other's posts; they show that different

clusters tend to picture specific parts of the city. Boy and Uitermark thus demonstrate that Instagram mediates Amsterdam not only in terms of how locations are pictured but also by co-constituting different social groupings in relation to those places ("locally oriented gentrifiers", for example, who post a lot of photos with a neighbourhood vibe, or the "vanguard of lifestyle promoters" who post fewer pictures and focus more on their lifestyle aesthetics). What this demonstrates is that it is not just the visual content of Instagram pictures that matters to how social media images shape urban space. So too do the social groupings co-constituted with the patterns of their production and distribution (see also Crang, Crosbie, and Graham 2006). The chapter by Rodgers also focusses directly on the constitution of an urban space – in his example, a local neighbourhood – through the circulation of images on social media platforms, in this case Facebook and Twitter. Rodgers examines how images are embedded in lively debates, banter, and speculation across these platforms, often shared multiple times. These practices produce animated visual environments through various platforms' screen interfaces.

The argument that the extensive distribution of digital images both picture urban spaces (among other urban-related kinds of images) and also create an image-saturated environment is taken in a somewhat different direction by Giorgia Aiello, in her chapter on stock images in urban locations. Aiello's chapter discusses the pervasive use of digital stock photographs with "uplifting visual content" to enliven shopfronts and streets. Aiello explores how stock images are often used not to advertise particular businesses or products (though they often do that on urban billboards and screens) but to create a mood of comforting familiarity in many public spaces. Aiello argues that their ambience is an effect as much of their ubiquity as of their content, making the inhabitants of urban space feel good about it. Her chapter, with Rodgers', thus underlines how it is not only the visual content of digital images that mediates urban space but also their distribution across many surfaces. Furthermore, like the chapters by Rodgers and Degen and Ward, Aiello's also contributes to a body of work which emphasizes how the digital mediation of cities is producing particular urban atmospheres. Degen and Ward, for example, describe how councils and developers increasingly post images on social media that picture the desirability of their projects in terms of what they will feel like, in efforts towards urban placemaking (see also Degen and Rose 2022).

Aiello's discussion of mood and atmosphere also addresses the issue of what it feels like to see digital images in city spaces. This is also the focus of the chapters by Krajina and Rose. Discussions of post-cinematic

spectatorship suggest that in relation to the movies at least, sensation and spectacle become more important than narrative or spatial coherence. Just as the post-cinema film pivots on processual transformation and metamorphosis, there is that sense that the viewer too is no longer a stable point but is also assembled and reassembled as they experience post-cinematic affect. Because digital images are the result of the constant processing data by software, there's a sense that the viewing experience is also somehow liquid: viewing becomes more of a live event as sensations of "real-time" feedback become pervasive (McQuire 2016, 5).

Gillian Rose's chapter is an account of the spectating body in digitally mediated cities, which returns to the processuality of the digital image. In that chapter, I explore the implications of the notion of animation, as discussed by Levitt (2018), for viewers of the flows of digital images of and in urban spaces. Particular kinds of bodies coagulate at the interface between digital images and their viewers; flesh is organized visually and spatially. I sketch the ways in which bodies are seen and see in representational visual regimes, as well as in post-cinematic, animatic ways of seeing. I then explore how animated bodies look, and suggest that this has important implications for the bodies doing that looking in the digital image-saturated environments of cities. Like the images that constitute urban code/space, bodies in that space are also constantly emergent, mobile, fluid and mutating.

Zlatan Krajina explores experiences of the mediation of cities by digital images in relation to longstanding conceptualizations of urban space as public space. As he notes, urban public space has very often been understood as constituted by encounters between bodies, speech acts, and objects. What happens then when many of those objects are digital images materialized? His answer further deepens this book's focus on ambiguity, uncanniness, and paradox. Krajina discusses how encounters in urban code/space entail an attentiveness to the city while being otherwise engaged. Through three case studies, he elaborates different configurations of the intertwining of attention and distraction. In all three, he evokes particular tones and moods that are both expressive and diffused.

All of these chapters explore different aspects of the digital processing of images and its configuration of urban spatialities and temporalities. There are two more themes threading through these chapters. One is social power. All the chapters affirm that many kinds of power are imbricated in digital images. Sometimes this power remains representational: digital images of cities represent only some kinds of city spaces and bodies, only some memories and futures. In other examples, power settles in the capacity to move or not, to be mobile or not through various spaces both material and

digital. In other chapters, power is in the constitution of certain kinds of bodies, temporalities, and spatialities, in urban code-space. These forms of power have different modalities, but the chapters by Datta, Hind, and Duru in particular all propose that, diffuse and atmospheric as processual as digital images may be, they nonetheless can be imbricated in questions of bodily violence and even death.

The final contribution made by the authors of the chapters collected here relates to the research methods most appropriate to how cities are seen digitally. Of the chapters gathered here, Duru's reflects at greatest length on the methodological implications of digital ways of seeing urban spaces. Resisting the modes of visualizing cities which replicate the analytic eye of representationalist images, she counter proposes a speculative research methodology as itself an appropriately processual approach to urban code/space. Rodgers experiments with data visualization methods that present images en masse, and Datta has developed an online multimedia website which works with a number of different visuals generated as part of the collaboration; the site is interactive and offers multiple encounters to its visitors rather than a single urban reality. Duru and Aiello immerse themselves in the cities and theorize from their own embodied experiencing of visual atmospheric code/space, a method which might align with the focus of Rose's chapter. All this suggests that new ways of seeing urban space digitally also require (some) new methods of researching urban space visually which more closely align with new, post-cinematic ways of seeing. This is an aspect of the arguments presented here which deserves considerable further elaboration and experimentation.

Conclusion

This chapter builds on the arguments made in the various chapters gathered in this collection, as well as from a rich body of work on digital images, urban screens and post-cinema. There are without doubt other relevant bodies of work: on sensory urban atmospheres (Sumartojo and Pink 2019; Degen and Rose 2022) and nonrepresentational urbanism (Thrift 2014), for example; as well as the posthumanist, technosocial and materialist theories assumed by many of the chapters here but not unpacked. And important forms of visualizing cities are absent in this collection: as the introduction has already noted, there are no chapters on the cities to be found in superhero movies, nor on computer games or influencer feeds; there is no discussion of digital visual surveillance in cities (Zuboff 2019).

Nevertheless, the rich discussions here do clearly demonstrate that digitally mediated cities are visualized no less thoroughly than cities were before digital technologies became so commonplace. Cities have not become any less visible since the heyday of modernist planning. Rather, what has changed is the form of the visualizing that brings them into (new forms of) visibility. Planning and much urban management in the nineteenth and twentieth centuries relied on a representationalist visual paradigm that valorised particular kinds of images, which were assumed to display a particularly close relation to urban reality. In this they were typical of a visual culture in which photography and film were also broadly taken to be representational of what they pictured. This representationalism depended on both some of the affordances of lens-based technologies and on the specific ways in which they were interpreted. This paradigm weakened towards the end of the twentieth century. New digital visualizing technologies and new ways of making images with them, as well as new forms of urban governance, became increasingly pervasive. Now, as we enter the third decade of the twenty-first century, it is more evident that many cities remain as visible as they ever were: indeed, in an era of "ubiquitous photography", it could be claimed that cities are more visible than ever (Hand 2012). What has changed, though, is the kinds of imagery through which cities become seen. No longer necessarily offering analytical insight into the truth of urban life, digital images are *processual* and *circulatory*, and, as this introduction has discussed, this has implications for how images organize urban spatialities and temporalities.

Finally, it is interesting to note that all of these chapters have a somewhat oblique relationship to "the image". While all focus on particular images, often many kinds of images, few spend time interpreting specific images. There is little of the careful decoding of specific images using the conventional critical toolkit of semiology or discourse analysis. This reflects the particular kind of visuals these chapters address. This introduction has used a variety of terms to refer to these digital images: post-cinematic, post-photographic, animations, digital images, digital visualizations. All of these terms emphasize that the images which mediate urban code/space are digitally processed and ubiquitously distributed. These aspects of their digitality produce not only the uncanny or paradoxical spatial and temporal effects of their visual content, as explored by several chapters here. It also means that these images are multiple. They can be made and remade, they are refreshed and renewed, and they travel through networks, servers and screens to appear many times on many interfaces. As the chapters here suggest, this means that they have to be approached less as single objects

and more as environments or atmospheres, which are visual but do not render cities imageable in the ways cities have been for the past two or three hundred years. What the chapters in this book suggest is that this does not lead understanding how cities are rendered visible into a blind spot: rather, it encourages researchers to see cities differently both when we are in urban spaces but also when we design our investigations into those spaces. Picturing the city representationally no longer quite works. But the city as a system of systems, as an ecology of decentred and recombinatory platforms (Barns 2020a), or as a multispeed city with variable geometries (Crang, Crosbie, and Graham 2006), can certainly be visualized by digital images that themselves flow and morph. Cities are thus constantly transformed in the "mixed-space effect" of animation (Levitt 2018, 68). And those pictures, digital all the way down, also in part constitute a distinctively digital urban geography.

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