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**Title:** Investments in the imaginary: Commercial drone speculations and relations

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**Key words:** Drones, Unmanned, Speculation, Futures, Airspace

## **Investments in the imaginary: Commercial drone speculations and relations**

### **Abstract**

Drones are increasingly understood and imagined as important actors, inhabiting and transforming aerial space. From their entrenched establishment within battlefield operations, drones have spawned into a diverse ecosystem of platforms and applications, increasingly punctuating domestic urban airspace. While occupying a status as exemplars of urban innovation, the drone poses, and remains bound to, a range of techno-cultural contestations - from challenges around airspace integration, to concerns around privacy, safety, and pollution. Thinking with commercial drone futures, and specifically the logistics sector, this article interrogates the role of speculation in this unfolding techno-landscape. In so doing we turn to two key sites through which the drone is anticipated - namely patents and adverts, as lenses through which to investigate projected visualisations underpinning the emergent, envisioned, and anticipated drone. We argue that such drone speculations do not simply and solely envision new means of circulating goods, people, and information, but rather embody and act to promote a particular set of aerial-desires and social relations. Critically unpacking envisioned notions of frictionless mobility, instant consumption, and the appropriation of vertical spaces and spectra, we argue that such speculative sites and practices importantly participate in a techno-fetishist agenda positing drone technology as a privileged and panacea agent of futurity, while often eliding its implications.

### **Introduction**

Unmanned Aerial Vehicles, or drones as they are more commonly and colloquially known, are increasingly understood as important actors, inhabiting and transforming aerial space. While emerging through a military lineage as target practice devices, ‘flying bombs,’ and reconnaissance platforms, over the course of the War on Terror drones have become entrenched as key military tools for surveillance and strike operations (Shaw 2014, 2016; Gregory 2011). Touted as platforms enabling both the persistent surveillance of distant topographies, and the undertaking of ‘dull, dirty and dangerous’ missions, large drones such as the MQ-1 Predator and (now retired) MQ-9 Reaper are increasingly recognised as “contemporary icons” of air power (Wall 2013: 33). While traditionally understood as synonymous with its military applications, the spatiality, morphology and iconography of the drone is shifting (Klauser and Pedrozo 2015; Jackman 2016, 2019, forthcoming; Jablonowski 2015, 2019, forthcoming). Re-imagined from their battlefield applications, drones are both increasingly taking off, and anticipated to do so, in domestic urban skies. Here, a growing ecosystem of commercial, civil and consumer drones are being deployed, developed for, and imagined in diverse roles, those spanning emergency service assistance, infrastructure inspection and monitoring, security provision, and the delivery of commercial and medical goods and matter (Choi Fitzpatrick et al. 2016; Jumbert and Sandvik 2017). As the range of such drone applications grows, so too do efforts around the integration of drones-at-scale into domestic airspace, through developments in approaches to Unmanned Traffic Management (UTM).

If we are, as it is asserted, entering into a ‘drone age’ or ‘zeitgeist’ (Rothstein 2015; Coley and Lockwood 2015), a key facet of the evolving drone imagination is the aerial delivery drone. Drones are, after all, increasingly being fielded, trialed, explored and anticipated as ‘last mile’ solutions – namely those re-imagining, and re-spatializing through the making-airborne of, the final stage of goods delivery, from the warehouse to the customer’s home. Delivery drones have been presented as “potential disruptors” in this space, as platforms

associated with reducing both labour costs and road congestion, and enabling increasing popular ‘same-day or instant delivery’ options (Aurambout et al. 2019). In this vein, an estimated 26 nations are reportedly “trailing, planning to test, or have established drone delivery operations” (Unmanned Airspace 2019: n.p). The application of drones as aerial delivery platform can be emplaced within the wider “ascendancy...of ‘the good drone’” (Jumbert and Sandvik 2017: 1). Following calls for further consideration of the “terrain of the good drone as it is imagined, legally constituted and deployed” (Jumbert and Sandvik 2017: 2), we focus our investigation on the delivery drone – approaching it through the lens of two key speculative sites, namely the patent and advert, through which it is (re)presented, constituted, envisioned, and legitimated.

In its investigation of the speculative and speculated delivery drone, our article brings together three research trajectories. The first, within drone scholarship, calls for greater attentiveness to the ways and temporalities through which the drone comes to function. For example, calling for further interrogation of the non-battlefield domestic drone Klauser and Pedrozo (2015: 286) craft a politico-geographical research agenda comprised of three analytical foci, namely the ‘making’, ‘functioning’, and ‘implications’ of drones. Taking as its focus the ‘making of’ the drone, this article follows the authors’ call for further scholarship examining both “how, by whom and for what reasons drone systems are planned and subsequently put into practice” and the “domains and sources of authority, expectation and beliefs that interact, fuse, emerge and crystallise around particular systems” (p.290). Through the lens of the commercial delivery drone, this article reflects on the drone’s ‘making’ by turning specifically to key sites through which it is speculatively forged and formed. Focusing specifically on the role and politics of such anticipatory representations, the article both contributes to an emergent “mapping [of] the political geography our domestic dronescape”, and approaches the question of the “complex ways in which life is lived with, through, and against the drone” (Bradley and Cerella 2019: n.p) at an alternative, pre-deployment, temporal point.

The second research trajectory drawn upon explores instead the ways potential futures are anticipated, that is “prophesied, imagined, deterred, regularized, invested in, [and] hoped” (Anderson 2010: 778). Here, geographers have examined the ‘anticipatory practices’ through which “specific futures” are “performed, calculated and imagined” (Anderson 2010: 779; Kinsley 2019, 2012, 2010; Anderson and Adey 2012). As will shortly be introduced, our article approaches the delivery drone through two such ‘practices’ through which the drone is anticipated – namely patents and adverts. While cognizant that which is anticipated “may never happen” or materialize, such “anticipatory techniques” (Kinsley 2012: 1557), we assert, remain important sites and practices through which both potential techno-futures and the imaginations that surround and encase them are ‘made’ and forged. We thus seek to think with techno-designs and desires as they are speculated, asking wider socio-political questions – from airspace congestion to volumetric safety and security - of such anticipations. This critical reading follows scholars who have noted that the military drone is often fetishized, presented as “devoid of social relations”, those which instead remain “mystified and masked” (Shaw 2011: 8). To this end, we approach the patent and advert as anticipatory practices to be critically interrogated, tracing both their presences and absences – techno-capabilities and the wider relations within which they are embroiled.

Finally, the third trajectory with which this article thinks is that of the visual character of speculation. In focusing upon particular aesthetic mechanisms, including diagrams and videos, through which the drone is imagined and mobilised, we seek to undertake a ‘critical

visual' analysis of sorts - one that thinks such visualisations of the drone in relation to the "power relations that [they encompass and] produce, [and] are articulated through" (Rose 2001: 3). Just as scholars have applied such approaches to contexts such as computer-generated images of urban redevelopments and tourism destinations, we too seek to interrogate the speculative representation of forms, relations and "places not yet built" (Rose et al. 2014: 386; Sheller 2009). In interrogating critically sites and fantasies of convenience in the future drone city, we follow Sheller's (2009: 1399) contention that speculative visualisations, "amalgams of infrastructure, architecture and software", too often remain "unbundled" from the communities and actors living with, and in our case, under them.

In bringing together these threads, the article is structured as follows. Acknowledging that the drone landscape is an emerging one, "actively performed by various interested actors in...material and discursive ways" (Crampton 2016: 141), the article first provides a brief introduction to our case study, namely leading e-retailer Amazon's emergent drone programme - Prime Air. In analysing key visualisations through which Amazon's delivery drone fleet are anticipated and imagined, the article then turns to the patent and advert. Approaching patents as speculative artefacts through which intellectual property is actively and competitively forged and showcased, we explore critically Amazon's desired drone-techno-future. Here, we think with the patent's status as a document "poised between 'reality and dream, present and future, fact and fiction'" (Hayles in Anderson 2007: 158) – one articulating a potential future that may or may not materialize or manifest, but while approached in bureaucratic paper trails nonetheless constructively informs "visions of...[potential] future technology use" (Kinsley 2012: 1555). At once examining the patented drone and its infrastructure, and a series of wider socio-economic and lived relations that accompany it (from pollution to congestion), we argue for the importance of attending to such speculative sites and sources – as those in and through which futures are envisioned, anticipated, and desired.

In this vein, the article proceeds to explore its second speculative site. Following Kinsley's (2010, 2019) assertion that there are a range of forms through which 'futures are made present', we turn here to examine a series of Amazon's videos envisioning the future operations of the Prime Air programme. Here, we understand Amazon's visualisations as "vision videos" (Kinsley 2010), as they do not simply showcase a desired product or service, but rather sketch out a wider vision of a particular future encompassing and accompanying it. While employing different modes of communication and drawing on different aesthetic genealogies, these videos remain, we argue, similar to patents inasmuch as they are both fundamentally speculative and allow us to think more widely about speculation as a commercial-cultural practice. Specifically, we examine how a 'realist' aesthetics is employed to situate the anticipated drone in *social* as well as *spatial* contexts that convey a speculative, though unspectacular sensibility for *lived* technological change. Collectively in interrogating such speculative sites we seek to contribute to calls for further attention to "the power structures built into drone systems from the project stage" (Klauser and Pedrozo 2015: 290). In staying with, and thinking across, delivery drone speculations, conclusions are then offered.

### **Commercial drones: Amazon's aerial pursuits**

A key trope within the unfolding imagination of the urban drone is that of the delivery drone. In our exploration of speculation through the lens of the patent and the advert that follows, we have thus selected a key actor proposing and seeking to propel the delivery drone into action – namely Amazon and their 'Prime Air' programme. While important to note that

Amazon is one of a growing number of market players developing drone programmes globally – accompanied, for example, by Alphabet, DHL, Swiss Post, JD.com, UPS and others, Amazon remains a large, global, company repeatedly entering the headlines not just for its delivery drone efforts, but for its articulation and envisioning of distinct drone-enabled techno-futures more widely. An e-commerce giant who has made its name globally as an online marketplace and delivery service, Amazon continues to diversify its products, developing, for example, a range of home assistant technologies (West 2019). What is shared across Amazon’s business endeavours however is a vow to convenience, to “make your life easier” or “more efficient” (Woods 2018: n.p). This imperative has more recently manifest in Amazon’s plans to re-imagine their approach to delivery itself, taking it airborne through a network of drones. Launched in 2013, ‘Prime Air’ comprises “a future delivery system...designed to safely get packages to customers in 30 minutes or less using drones” (Amazon n.d.: n.p). Here, drones are presented by Amazon as a ‘disruptive’ technology, one both re-imagining the ‘last mile’ leg of parcel transportation – one remaining logistically challenging in part due to road-based congestion (Schröder et al. 2018), and one offering a speedier form of home-delivery. While vocal advocates for a re-imagined and commodified airspace, Amazon too are active crafters of drone futures - undertaking significant research, development, and trialling of delivery drones. Here, a significant programme milestone occurred in December 2016 in Cambridge UK, when a drone trial saw a package delivered in 13 minutes. Further, the project is very much an international one, with Amazon since being issued both a Special Airworthiness Certificate (2019) and Part 135 certificate (2020) by the US Federal Aviation Administration (Mihalcik 2020). While cognizant that Amazon’s drone programme, then, is a multifaceted and sited endeavour - one thread is shared in key materials through which the company seek to both actualize and promote *their* vision of a delivery drone future - that of the visualisation. As will be unpacked, visualisations act as key sites and representations through which the drone is speculated. After all, visual representations and practice act as a cornerstone in (crafting) our understandings and imaginations of technologically-mediated space and place - and our expectations and assumptions therein (Giesekeing 2017). In what follows, we thus turn to two key visualisations – the patent and advert – though which delivery drone futures are forged and formed, imagined and speculated.

### **Patents as speculative visualisations**

The city can be understood as a “plurality of urban actuality and expectation” (Olson 2018: n.p). Thinking specifically with the role of speculation in the (future) drone city, this section turns to the patent as a form of ‘anticipatory practice’ through which potential drone futures are ‘imagined’ (Anderson 2010; Adey and Anderson 2012). As will shortly be introduced, patents are documents seeking to lay claim to intellectual property. While far from solely visual in their documentation of ideas and inventions, visualisations are often an important component of applications. Drawing upon a selection of Amazon’s delivery drone patents, this section critically investigates visualisations of the delivery drone’s speculative infrastructure therein. Taking as its starting point the recurrent legitimating narrative of convenience, it first asks: convenience for whom? Here, it teases out how and where the mobile drone is speculatively grounded, docked, and encountered. From drone towers to aerial highways, patents are, we argue, an important window into potential co-habitation with a new breed of (comparatively) low-flying aerial craft, those whose speculative implementation too often eschews fundamental socio-political questions of urban design and geography. Through the lens of the patent, this section thus offers an alternative, speculative,

contribution to wider debates around the “making of the drone” prior to its “functioning” (Klauser and Pedrozo 2015).

### *Speculating delivery drone futures: Understanding patents*

Patents are the documentation of an invention, filed with relevant authorities for the purpose of protecting it as intellectual property. The granting of a patent allows its filer to act as the sole owner of said intellectual property for a period, during which they can make, use, and sell the invention, while excluding others from doing so. As such, patents have been understood as “central techniques of accumulation in contemporary capitalism” (Kang 2015: 29). In the case of Amazon’s Prime Air, the company have both filed over 60 drone-related patents, and hired patent lawyers into the team (Holland Michel 2017). Filing patents at a comparably “faster rate than any other company working on drone technology today”, Amazon’s applications have spanned “aircraft designs, safety and security systems, methods for transferring goods from the air to the ground, and hive-like fulfilment [warehouse] centers” (Holland Michel 2017: 1).

Containing both diagrammatic imagery and textual descriptions of an invention, patents can, we assert, be examined as techniques both through which urban techno-futures are envisioned and imagined, and wider ‘infrastructural imaginaries’ forged (Parks 2014). After all, in their envisioning of desired sites, spaces, and (techno-)relations, patent visualisations, like speculative computer-generated images, are “laboriously” crafted (Degen et al. 2017: 3). In the case of the patent, a key site of visual labour is that of the diagram – namely an illustration and “schematic presentation” of the invention (McCormack 2009). As McCormack (2009) continues when writing of the diagram, as important as its visualisation of sites and sets of processes, is its “projective quality” – namely how it images, imagines, and anticipates “what might happen”. The diagram, then, can be understood not simply as a “representation of future activity, but rather as a generative device,” opening us up to possibilities and practices (Latham & McCormack 2004: 708). This speculative quality chimes clearly with the patent, itself a schema of a (commercially) desired reality. While within a patent such schema are arguably purposefully techno-oriented and seemingly ‘disembodied’, as Degen et al. (2017: 5) write of CGI imagery of future urban developments more widely, such speculative visualizations remain encompassing of, entangled within, and advocating for particular socio-technical configurations and relations.

In our interrogation of the patent that follows, we thus seek to re-focus the question of whether the urban designs within them may become actualized or rather “turn out to be useless” (Kang 2015: 30), to one instead attending to the role of such speculative documentation in the forging and (ongoing) formation of drone imaginations, relations, and co-habitations. In other words, whether or not the full scope of Amazon’s techno-desires are realized, in and through such speculative visualizations, they nonetheless seek to foster – and normalize - particular drone visions and expectations. Further, while cognizant that Amazon’s speculative drone vision is not singular but rather multiple - catering to and proposing different operating conditions, and that its scaling remains contingent upon a range of factors beyond itself – be they regulatory, technical, or socio-cultural (Holland Michel 2017), in the analysis that follows we approach speculation-in-patents both *as volume* (i.e. as multiplicity), and *in volume* (i.e. in volumetric airspace). Here, we converse with scholars asserting that we are in midst of a volumetric “shift” in spatial thinking, one marked by “less human-centered, more collaborative, [and] eminently three-dimensional” thinking (Billé 2019: n.p). As such, in the two readings of the patent that follow, we tease out both

speculated spatial volumes, and the “interests, rationales” and relations enclosed and enmeshed within them (Klauser and Pedrozo 2015: 287).

*(In)convenient airspace: (Uneven) affordances and/of drone co-habitation*

Drones futures have been, and are, speculated through a range of anticipatory representations. Presented are different visions of a “city co-habit[ing] with ‘intelligent’ semi-autonomous flying machines” (Superflux 2015: n.p). In such visualisations, the drone tends to feature as the main character, seamlessly moving, hovering, floating through the scene. In what follows we focus instead on the drone’s wider infrastructure – that is the distributed architecture and network which underpins and supports its becoming airborne and functioning as deliverer extraordinaire. After all, from docks or ports to power stations, and data signals to wireless communications, the drone remains one part of a wider system. In its interrogation, we follow scholars who have approached infrastructure not as an “apolitical context or backdrop” (Fish et al. 2017) but rather as that which both enables connection, and enacts “uneven... circulation” (Cowen 2018: n.p). Here, we argue that the patent is a valuable site through which infrastructure is accessible – not materially per se, but rather as a speculated, imagined, and potential blueprint.

In the case of Amazon’s Prime Air drone programme, this infrastructure, as it is speculated in patents filed and granted, takes a specific form (Figure 1). While Amazon’s ground-based delivery networks currently centre around large warehouses known as fulfilment centres, in taking delivery networks airborne via the drone, these are re-imagined. This re-imagining is sketched out in a patent filed by Amazon in 2015 and released to the public in 2017. Here, Amazon present a “concept for a high-rise” warehouse, the looming exterior of which would be adorned with “multiple take-off and landing ports” for the delivery drones travelling from it (Holland Michel 2017). This ‘multi-level’ structure, geometrically organized to neatly stack rows and columns of occupying and mobile drones, is designed to “fulfil hundreds or thousands of orders each day” (United States Patent and Trademark Office 2017a: 14), deploying drones in collaboration with methods of ground-based delivery. It can thus be understood as both an extension to, and distinct volumetric expansion of, existing delivery approaches.

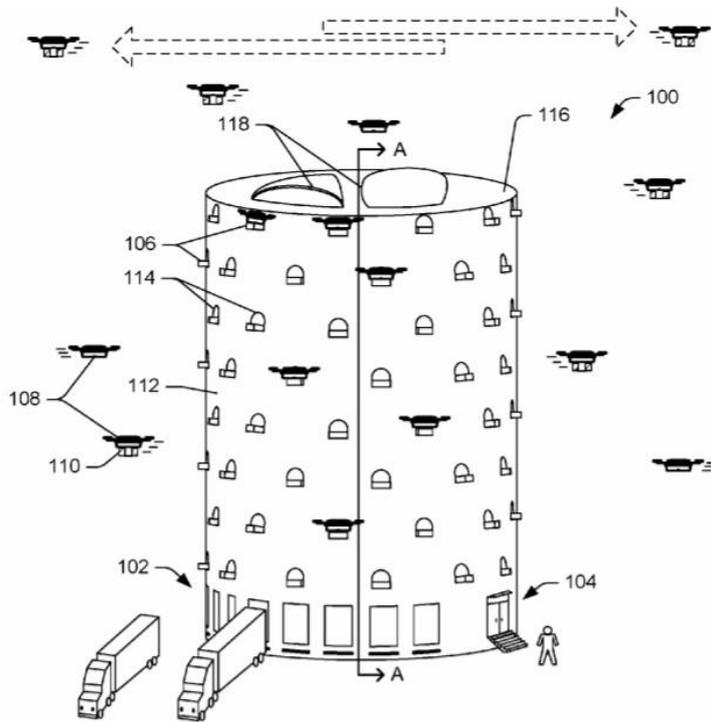


Figure 1: Amazon patent: Drone-supported fulfilment centre (United States Patent and Trademark Office 2017a)

In thinking further with Amazon’s drone-centred delivery re-imagining, it is pertinent to note that while their warehouses have traditionally been located in city outskirts, this re-imagining would instead include a ‘fulfilment centre’ located “in an urban setting, such as in a densely populated area” (United States Patent and Trademark Office 2017a: 1). In the patent, this relocation to “downtown districts” is couched in terms of enabling ‘quicker delivery’ to growing urban populations and workforces (ibid: 13). Referring to a city’s central business district area, typically punctuated with high rise buildings housing key institutions, amenities, and retail sites, ‘downtown’ locations have historically been associated with “valuable” and exclusive land (Murphy 1971: 1-2). While acknowledging periods of decline and urban renewal, such central urban sites largely remain sought after plots, variously congested and contested. In thinking with the speculated drone, then, we need to approach it as “an assemblage of the vertical” (Crampton 2016: 137) - attending to both the object itself, and the wider networks, spaces, and relations that encompass and envelop it. One such avenue through which to think speculatively with ‘technological developments and their effects and affects’ (Crampton 2016: 137) is through the issue of pollution – both visual and sound.

In the case of the drone patents surveyed, the ‘imaginaries’ of drone towers remain isolated or detached from the busy, lively, and congested landscapes within which they are described and anticipated to feature. They are imaged as standalone structures: drones perched, launched, hovering around, and returning to, abstracted buildings on plain white backgrounds. In the text that accompanies such diagrams, Amazon recurrently return to the trope of convenience – with drones centrally embedded to serve swelling urban populations at speed. What is elided in this speculative infrastructure, however, is how the drone, and its supporting infrastructure, would fit in. Writing of computer-generated images of potential urban futures, Degen et al. (2017: 19) note that such speculative imagery suffers a “problem” in “visualis[ing] the anticipated future social life” of the imagined “development”. Here, the authors get at the trickiness of conveying visually the social in imagery often focused upon

technologically-centred urban futures. Thinking with Amazon's patent, we can however discern, albeit also speculatively, particular social configurations residing within, and borne of, such imagined developments. For example, while narrated in terms of convenience, drones and their supporting towers are accompanied too by a changing urban skyline – towers nestled in between high rises, and drones punctuating low-level airspace. In the context of existing issues of urban congestion – both in spatial terms, namely demands on (often costly) housing and property, and in relation to pollution - namely vehicular transport and emissions, the social effects of such anticipated delivery drone networks remain ill-considered within patent documentation. After all, how would drone towers, and the craft emerging and residing within them, impact upon the aesthetics, and vertical and volumetric spatialities, of an urban skyline? Further, what would such anticipated structures, and aerial occupations encasing them, mean for the buildings and residents that neighbour them? As Gillian Rose (2001: 15-16) writes of visual representations more widely, they “both depend on and produce social inclusions and exclusions”. In the case of the urban drone, portraits of (fetishized) convenience and speed, appear to trump those of both living in proximity with, and displacing – that is making aerial – urban congestion, via the drone.

Here, in thinking speculatively with the social futures presented and/or absent in patents, we can also turn to noise pollution. For example, in describing the re-imagined fulfilment center, Amazon state that the drones “may be located on an exterior...proximate to an internal airway” which “may have direct access to a navigable airway (i.e. open air)” (United States Patent and Trademark Office 2017a: 14). This ‘navigable airway’ would, as the patent envisions, feature a “cruising zone or altitude used by many of the [drones] during delivery of the packages” (ibid). Here, Amazon references ongoing advances in the area of ‘Unmanned Traffic Management’ (UTM), namely an aerial system designed to coordinate the safe management and integration of a range of multiply-purposed drones into our airspace. Such an approach, which remains under development by a range of – in some cases competing – actors, is differently envisioned – as highways, zones or avenues. While it should be noted that many UTM systems remain relatively “nascent”, requiring “further testing” (Kuhn 2017: 12), UTM remains a proactive and well-resourced space, albeit one also at the speculative stage. While desires and developments to enable the integration of drones into airspace continue apace, comparably little consideration of the acoustic effects of drone operations at scale has occurred. Researchers at RAND, for example, note that while locations near a delivery centre “should expect more drone activity overhead”, noise from “aerial delivery vehicles may be less than the range commonly experienced in cities” (Lohn 2017: x). While the report does note that “there would need to be many drones directly overhead to surpass the noise volume of city traffic” (Lohn 2017: x), what is elided and eschewed in this analysis are critical questions of both operational scale and distributed congestion.

For example, acoustics scholars note that given the rapid rise of the drone market, further consideration of that both *overhead* and *overheard* is necessitated (Sinibaldi and Marino 2013). Further, this rapidly growing market is multiple - variously and differently anticipating drone futures – not as singular or monopolistic platforms and operations, but rather as multiple (c.f. PricewaterhouseCoopers 2016). As such, in thinking with drone operations and their accompanying acoustics we need to think at scale. Here, in reflecting on drone futures, acoustic ecologist Paine (2019: n.p) fears that “the world is about to get a lot louder”. Paine (2019) warns that many commercial drones are both considerably louder than their recreational counterparts, and emit a “higher pitched” sound than other aerial craft encountered in urban areas, such as helicopters. Looking to the patents through which Amazon presents speculative delivery drone futures, we find merit in Paine's (2019: n.p)

claim that “drones are taking to the air without a lot of thought for the ears of people on the ground” or for animals that inhabit vertical urban spaces (Mulero-Pázmány et al. 2017). Here, further questions need to be asked of sound emissions and the effects of differently weighted cargo, as well as of hours of operation (Paine 2019). Just as Klauser and Pedrozo (2015: 289) call for drones to be further considered in relation to “fixity and mobility, enclosure and openness” – we must acknowledge the buzzes and hums of the drone that fill and punctuate spatial volumes.

In this vein, we can also alternatively volumetrically approach the drone – instead in terms of the data topologies it renders visible, via its (speculative) engagement with the electromagnetic terrains that underpin its functioning. After all, the electromagnetic spectrum is particularly important in the drone space – first given the drone’s reliance upon wireless radio wave communications in order to navigate and manoeuvre, and second given the drone’s fundamental function as an image and video capturing platform (see Shaw 2016). Drones then, both reside in and interact with the electromagnetic spectrum – a ‘relational’ terrain that “becomes infrastructural” (Tawil-Souri 2017: n.p). Therein, while drones are often understood as ‘eyes in the sky’ capturing optical imagery, importantly they are increasingly also being equipped with sensors (Jackman 2017). From multi-spectral infra-red units, to hyper-spectral chemical detection devices, such sensors enable the rendering visible of non-visible portions of the electromagnetic spectrum, thus offering ‘more-than-visual’ capacities (Garrett and McCosker 2017). In thinking specifically with such affordances, and responding to wider calls for an interrogation of the drone’s presentation of “new ways of monitoring and control” (Klauser and Pedrozo 2015: 287), we can turn here to the patent as a key site through which Amazon’s electromagnetically-mediated delivery drone futures are speculated.

While Amazon’s business plan has long revolved around data collection – particularly around browsing habits, in a 2017 patent Amazon reveal their desire to take this cornerstone enterprise airborne. As their drones deliver a parcel to a customer’s door, a navigational process reliant upon the spectrum, Amazon’s patent (Figure 2) also demonstrate a further spectral engagement. The drone, it is articulated, captures data about the area surrounding the delivery stop – noting for example missing roof tiles or a rusty bicycle – with the explicit aim of generating a “recommendation” for separate and additional purchases through Amazon’s online marketplace (United States Patent and Trademark Office 2017b).

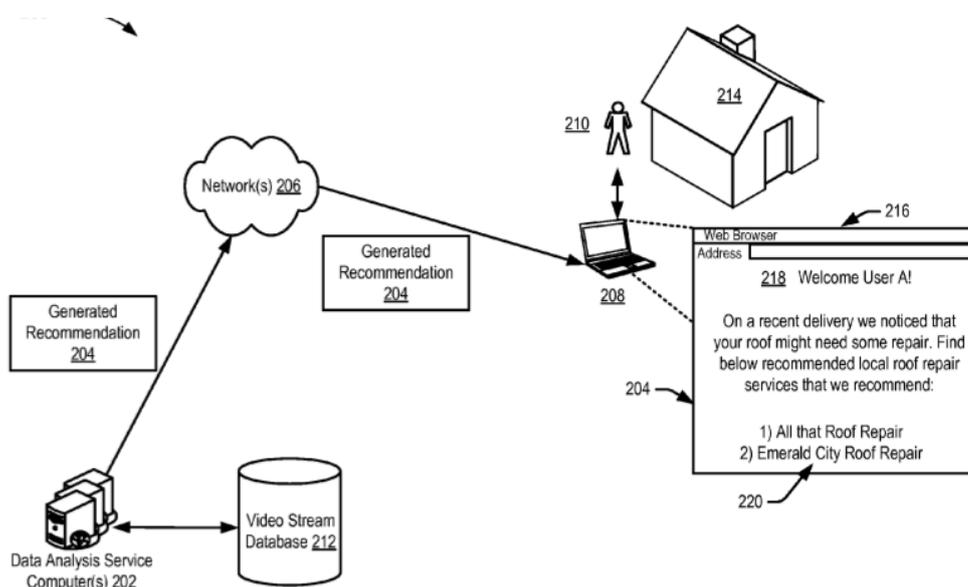


Figure 2: Amazon patent, data capture from drones (United States Patent and Trademark Office 2017b)

Here, both the spectrum, and the landscapes below the drone, are distinctly commercialised and commodified. In this desire for and vision of sensorially-attuned contextual targeting, namely the marketing practice of displaying tailored advertisements, we see questions raised around both a spectrum-conscious accounting of data landscapes, and a spectrum-aware privacy politics more widely. Therein, the context of spectrum competition and increasing scarcity (Li et al. 2018) remains particularly pertinent. While such patents visualise speculative methods for delivery drones to safely and successfully navigate in airspace, they nonetheless eschew both competitions in and for such spectral terrain (Tawil-Souri 2017), and the contested legality of a range of drone technologies (c.f. Holland Michel 2018). In advocating for further attentiveness to multiple drone agendas, we have elsewhere stated that the spectral remains at once selectively “emitted and omitted from imaginings of the future drone city” (Jackman 2017: n.p), in spite of its volumetric qualities and infrastructural significance.

In bringing this examination of the speculative drone through the lens of the patent to a close, we hope to have demonstrated that patents act both to reveal potential material futures and the logics that seek to legitimate them, and can prompt critical questions of these anticipations. While legitimated through convenience, our investigation of both the speculative infrastructures and social relations enmeshed within them, demonstrates that delivery drones remain bound to a range of (uneven) affordances and complex techno-human co-habitations. While the patent offers one lens, there remains of course more to tell of these speculative drone stories. One particularly pertinent thread of this wider tapestry is the pre-emptive announcement, by a luxury property developer, that their future residential tower in London will feature drone-enabled balconies. Known as Spire London, the under construction skyscraper to become the tallest residential tower in London is marketing the future provision of “drone deliveries to private balconies” (Homes and Property 2016: n.p). While at present speculative and contingent, such developments remain indicative of a lengthier association between “height and power in the capital” (Garrett and Fish 2016: n.p). While important to note that this form of delivery is accompanied by a cost premium (i.e. available to those able and willing to fund it), this section has demonstrated that questions of social inequality extend beyond solely financial forms of privilege, and instead to wider questions of both lived experience in proximity to drones, and the making-volumetric of congestion - as drone networks spatially expand. Thus while the sky remains ‘public’, through such anticipatory developments it is nonetheless speculated as becoming “increasingly and deliberately enclosed” (Crampton 2016: 140), in a process both replicating, and re-spatializing entrenched social relations. Here, while providing one window of access to potential and speculative drone futures, patents too highlight absence. While laid visible are hive-like towers and aerial craft designed to navigate and deliver parcels to/in urban space, so too are their urban surroundings and co-habitants variously eschewed. From visual pollution and sound emissions, to re-distributed congestion, the patent selectively speculates about convenience affordances while conveniently not speculating about that which remains bound to them.

### **Adverts as visual speculation**

While Amazon’s patents are directed towards a more specialized, technologically knowledgeable audience, our second example of speculative drone futures, namely Amazon’s advert videos, seeks to gain the attention of a wider public. The differing target audience

results in different aesthetic and communicative strategies that also employ other modes of speculation. Over the course of the last few years, Amazon has published in total four videos in order to flesh out their vision of the Prime Air technology and service (Amazon 2013; 2015; 2016; 2019). Regarding their ‘genre,’ while certainly also being adverts, though not of a particular product or service but primarily of a corporation’s image, the videos can be understood as “vision videos” (Kinsley 2010), as they do not simply showcase an anticipated product or service, but sketch out a vision of a particular future. However, as Kinsley (2010: 2773) continues in discussion of visualisations of computing research, such videos “are not entirely fiction” but have “a basis in contemporary industrial research”, even if they may not be yet possible to realise at commercially desired scale.

Both adverts and “vision videos” specifically are thus a pertinent source for analysing speculative drone futures. They are part of a wider shift in the widespread creation and sharing of visual content, increasingly mobilised in developing, promoting and monetising investments – from urban development sites (Rose et al. 2014; Degen et al. 2017) to technological products (Kinsley 2010). Such visualisations, advert videos included, can be understood as an important facet of contemporary ‘sociotechnical imaginaries’. Coined by Jasanoff and Kim (2009), ‘sociotechnical imaginaries’ are understood as “collectively held, institutionally stabilized, and publicly performed visions of desirable [science and technology] futures” (Jasanoff 2015: 4). While Jasanoff (2015: 27) primarily analyses sociotechnical imaginaries through policy documents such as roadmaps, legislative texts, or the like, she nonetheless indicates that they “may permeate into popular culture, finding expression in the mass media and in nonofficial genres such as advertising or the popular writings of prominent individuals.” Beginning with this proposition, we want to suggest that popular products from visual culture, such as adverts, are indeed a valuable and rich source to analytically access contemporary as well as historical sociotechnical imaginaries. While these sociotechnical imaginaries are not necessarily speculative but rather deeply entangled into governmental strategies aiming at precluding alternatives and possibilities, their more popular manifestations share a temporal sensibility that seeks “to cultivate a sense of the possible that concerns, but does not owe its existence to, the ways in which the actual determines the distribution of what is probable” (Savransky et al. 2017: 7). Therein, because the drone as technological artefact owns a distinct iconicity, it is particularly suited to this imaginative and speculative work. In this vein, Sandvik and Jumbert (2016: 11) identify drones as “a species of visual images.” As the authors continue, this ‘species’ draws heavily on actual images of (and by) military drones in global media coverage, as well as a wide visual repertoire from more speculative registers, such as science fiction films or video games (Maradin 2013). Both as image and imagination, drones are thus a highly productive techno-cultural object deeply entangled in contemporary visual culture (Jablonowski 2019).

### ***Interrogating Amazon’s Prime Air adverts***

On the evening of 1 December 2013, the Sunday before Cyber Monday, Amazon’s CEO Jeff Bezos presented a video advert for the company’s new project on the CBS show *60 Minutes*; named Prime Air, the venture promised the shipment of goods to customers via drones within thirty minutes. According to Bezos announcement, Prime Air should be realised within five years (going live in December 2018), a deadline that Amazon has lapsed. However, Bezos’ announcement struck a chord in both news and social media, with the first video attracting more than 14 million views on Amazon’s Youtube channel alone. This attention arguably makes Prime Air the first discursive event of civil drone application. While initially exposed to ridicule by media coverage and in the comment sections below the video, Amazon’s plan

and the concomitant visualisations went on to change the trajectory of how drones more widely, and commercial drones in particular, are publicly imagined. In particular, it contributed to their popularity by offering a vision of how drones will integrate into our everyday lives – acting to familiarise us with the idea of being surrounded by and interacting with commercial drones on an everyday basis in the near-future.

Over the course of recent years, Amazon has published four videos in total in order to flesh out their vision of Prime Air. Interestingly, all videos employ very different visual styles. In terms of aesthetics, the first video (Amazon 2013) is the least ambitious. It comes without score, voice-over or any other technical explanations. It simply depicts a shipping process from placing the order via tablet over the processing of the order in a fulfilment centre—the camera moves close to the ground through countless lines of filled shelves, conjuring up the feeling of moving through a server room of the envisioned Internet of Things, to the delivery - the drone drops off the parcel on the front lawn of a house while a man and a boy - clearly marked as father and son - are waiting excitedly, in safe distance, in the half-opened front door.

The second video was published almost exactly two years after Bezos' initial announcement and employs a very different aesthetics (Amazon 2015). It features Jeremy Clarkson, the former host of the (in-)famous BBC automobile show *Top Gear*, who promises to tell 'a story from the not too distant future'. Here, the viewer with the required genre competence immediately knows what s/he can expect: cutting-edge (but actual!) technology, speed and fun; in Clarkson's own wording, 'a miracle of modern technology' and 'amazing innovation' (Amazon 2015). Beside the illustrious protagonist, the video introduces another stylistic strategy to: The camera shows what the drone 'sees.' As drones are commonly understood as media technologies, their specific visual or 'more-than-optical' (Jackman 2017) capacities have fostered an intensive academic engagement with the notion of 'drone vision' (Stahl 2013; Greene 2015; Jablonowski forthcoming). In artistic contexts and popular culture, representations of drone vision are used as an important tool for criticising the employment of military drones and for envisioning various drone futures. The typical aesthetics of imagining drone vision usually draw on established characteristics of techno-aesthetics. Amazon's take on drone vision exhibits two of these typical features: first, the colouring: the colour screen tinges the image in cool blueish and greenish hues; and second, markers of technomorphous vision: the on-screen-display overlays the field of vision with additional technical data, such as speed, altitude, time to delivery and the feedback of collision detection sensors. In this shot, the drone automatically recognizes a hot-air balloon in its flight path and corrects its trajectory to avoid collision.

During the scenes where the drone is shown in the air, a text overlay in the upper left corner informs the viewer that s/he is seeing 'Actual Flight Footage. Not Simulated' (Amazon 2015). The third video (Amazon 2016) builds on and expands this sense of actuality. Unlike the two previous videos, this video doesn't want to be understood as an advert anymore; it rather employs pseudo-documentary aesthetics to convey the impression of being a truthful report from Amazon's test runs. The text overlay from the video's beginning stresses this aspiration (Figure 3):

“First Prime Air Delivery  
December 7, 2016  
Fully Autonomous – No Human Pilot  
13 Minutes – Click to Delivery” (Amazon 2016)



Figure 3: Establishing shot and text overlay (Amazon 2016; screenshot by the authors)

The video again shows the shipping process, but this time with more detail: After the customer—an elderly man - has placed his order, the camera moves over meadows and fields towards a complex of low, unremarkable buildings equipped with numerous antennae and transmitter masts. The next shots show an Amazon employee receiving the man’s order on his screen; another employee registers the ordered goods with a hand-held scanner and places them in a box; the box moves on a conveyor belt towards the drone; a close up shows how a small lifting platform automatically hoists the box into the drone; after the loading is completed, the drone is moved on rails to the outside take-off-site (Amazon 2016). The whole process is explained to the viewer by a female voice-over, which to the end of the video also anticipates the future of Amazon’s drones:

*“We will use the data gathered through these beta tests, and the feedback provided by the customers, to expand the private trial to more customers over time. We’re starting with two customers now, and in the coming months, will offer participation to dozens of customers living several miles of our UK facility. And they’re growing to hundreds more. After that? Well, it would be easy to say: The sky is the limit. But that’s not exactly true anymore, is it?” (Amazon 2016)*

By drawing upon the ‘sky is the limit’ trope, Amazon’s engages “romanticised idioms” that are widely used by the commercial drone industry to evoke “the drone-possible” (Jackman 2016: 4) and “solutionist” (Morozov 2013) desires that drones will be able to technologically address all kinds of social problems in the near-future.

In a short video published in the summer of 2019, Amazon swaps these documentary aesthetics for a completely different visual style. The fourth Prime Air video is the first that doesn’t introduce new technical details and doesn’t further the Prime Air narrative. It simply shows Amazon’s newly designed drone flying over a vast and almost empty, undulating landscape and against a slightly cloudy blue sky. In contrast to the first three videos, the drone doesn’t perform any shipping duties; rather it seems to be flying without a purpose, swaying with the wind, accompanied by stereotypical gentle piano music: its movements giving the impression of a somewhat clumsy ‘drone ballet’ (Figure 4). Situating drones in a more creative register, Amazon participates in the cultural popularity of drones. The video

remains however aesthetically less ambitious than the first —and arguably less successful, as it (September 2019) has less than ten percent of the first videos views on *YouTube*. In the following, we will thus concentrate our discussion of Amazon’s adverts on the first three videos.



Figure 4: Still from Amazon’s last Prime Air video advert (Amazon 2019; screenshot by the authors)

### *Unspectacular speculations*

Each Amazon video employs explicitly realist aesthetics: apart from the short drone vision scenes, they refrain from using Computer Generated Images which are common to the visualisation of technological innovation. Amazon’s style thus avoids the look and feel of speculation. However, the videos are clearly recognisable as highly choreographed and carefully edited, thereby performing the “elision of the difference between description and aspiration” that is characteristic for technological speculation (Suchman and Weber 2016: 90). The first video’s editing suggests autonomous flight over greater distances, even though commercial drone use was still banned in the United States when the video was published. The video doesn’t depict a pilot or controlling authority steering or even supervising the drone. But it’s not only the drone that is unmanned; the whole shipping process is depicted as being almost completely automated: the huge warehouse is completely deserted, the line-up of countless filled shelves reminds of a server room for the Internet of Things. Only a single close-up shows the hand of a worker putting the parcel in a yellow plastics box (Figure 5); the barely visible hand of contemporary ‘logistical fantasies’ (Neilson 2012: 336). In the second video, Amazon’s worker also remain very much in the background; it focuses on its star—Jeremy Clarkson—and celebrates drone vision, the sensory capacities of the drone. Only the third video depicts the required infrastructure and personnel in more detail. This (pseudo-)documentary visual strategy suggests near-term feasibility—and probably also wants to address the widely expressed concerns that Amazon seeks to run down staff numbers by employing drones and other technologies to automate the ordering and shipping processes.



Figure 5: Still from Amazon's first Prime Air video advert (Amazon 2013; screenshot by the authors)

Despite the regular emphasis on the technological innovativeness of Amazon's drones—labelled by the company as a “miracle of modern technology” (Amazon 2015) and “innovative Prime Air technology” (Amazon 2016)—Amazon's adverts engage a very careful mode of anticipation that tries to avoid any obvious relations to Science Fiction or other speculative registers: while Amazon's visions certainly are speculative, they do not want to be spectacular at all. This is, as Kinsley (2010: 2783-4) argues, a deliberate strategy in the creation of technological visions. Even though they have to evoke a sense of innovation and futurity, the anticipated worlds and artefacts have to remain relatable to the targeted audiences' lifeworlds.

No matter how different their aesthetics, the first three videos have two striking commonalities: they share similar *social* as well as *spatial* contexts. The *first* commonality of the videos is that they always situate the drones in a comprehensible and relatable “social universe” (Callon 1989), illustrating their possible embeddedness in near-future lifeworlds. The first two videos show situations from white, upper middle-class suburban family life, the third video shows a solitary, but financially well-off senior citizen, who lives with his dog in a rural area—the videos' protagonists represent Amazon's targeted customer groups. Furthering Amazon's narration of drones offering convenience from the air, all three videos depict situations from everyday life, where a sudden demand emerges that has to be covered quickly—a tool for the son's broken skateboard, a new football shoe for the daughter, or a new TV remote and biscuits for the dog. The second video draws on the theme of family harmony: Milly, the daughter of the depicted family, has an important football match, but Stuart, “the family's three year old bulldog” (Amazon 2016) chewed on her football shoe. While Clarkson's voice-over describes the problem, the camera shows an agitated Milly yelling at her father, who's looking somewhat helplessly at the dog. Clarkson helps the suffering father and considers his options: “Well, you could yell angrily at the poor thing, but what's the point? Because all it will hear is blablabla Stuart blablabla Stuart bla. Much better to behave like a rational human being, find your tablet and place an order with Amazon ... and have them delivered in 30 minutes or less.” The mother in the video then does this. After the video depicted the delivery, Jeremy Clarkson sums up this situation and ends the advert video with a gendered phrase: “And balance is restored to the universe” (Amazon 2015). Similar to adverts for early TV remotes (Benson-Allott 2015), Amazon advertises its commercial drone services with the promise of a harmonic and convenient domestic life. The drones are situated

in a rather mundane, tame, even stuffy social context. Thus, all videos follow a rather traditional aesthetic. In a review of Amazon's first video, the German journalist Christian Geyer was reminded of the aesthetics of the 'Miracle on the Rhine,' the economic reconstruction of West Germany in the 1950s and 60s, "where the rattling of assembly lines started again and the family is going to the countryside with their Volkswagen to have a picnic" (Geyer 2013: n.p.; own translation). Jasanoff (2015: 4) has pointed out that "[i]maginaries, moreover, encode not only visions of what is attainable through science and technology but also of how life ought, or ought not, to be lived". In the same vein, Amazon advertises want to participate in "performing and producing diverse visions of the collective good" (Jasanoff 2015: 11) by bringing together an economic-logistical imagination of instantaneous and convenient consummation with a traditional imagination of functioning family life.

The *second* commonality of the videos is their spatial context. Interestingly, all videos are set in suburban or rural environments that create a sharp contrast to Amazon's own speculations on downtown drone-supported fulfilment centres or the hyper-urban imaginations of other delivery drones, such as *Uber's* project Elevate (Uber 2017) or the similar vision of a passenger transportation drone—or Autonomous Air Taxi (AAI)—by the German company *Volocopter*. Contrary to Amazon, the visions of Uber and Volocopter strongly rely on Computer Generated Images as means for creating speculative futures. Videos of the two-seated Volocopter drone, for example, see it fly between modern urban canyons and lands on circular droneports that are built on the glass facades of skyscrapers (Volocopter 2017, 2018). These visualisations draw conceptually as well as aesthetically, on the one hand, on imaginations of "flying cars" from the early times of manned heavier-than-air flight when people were expecting the "aerial equivalent of the Model T" or "some Henry Ford of the aeronautical world" (Corn 1983: 94); and on the other hand on more contemporary visualisations of future life in hyper-vertical megacities, such as Ridley Scott's *Blade Runner* (1982) or Luc Besson's *Fifth Element* (1997). The colouring in Volocopter's videos can serve as a striking example of how they only seldom use warm colours; with the generally cold colours—blue, grey, white, black—suggesting a feel of technogene "Science Fiction cool" (Maradin 2013). In comparison, Amazon's videos with their suburban or rural setting almost come across as hesitant and even dated.

As we have argued earlier in this section, Amazon deliberately employs an aesthetics that refrains from any allusion to Science Fiction, while nonetheless remaining not yet actualised and/or potentially fictitious. No matter what the feasibility, the popular imagination of commercial drones is closely linked to Amazon Prime Air, because Amazon was the first company to outline a 'realistic,' even if improbable narrative how drones could be embedded in actual near-future Western middle-class lifeworlds. Degen et al. (2017: 19) point to the widespread "problem" of speculative imagery to portray a convincing "anticipated future social life." In this sense, Amazon's adverts address this "problem" as they go beyond a speculative visualisation or cognitive anticipation of future technology, instead seeking to capture the feeling of *lived technological change* that forgoes hyper-vertical and hyper-urban imaginaries and relies heavily on stereotyped visions of family life.

While Amazon's project lacks the technological and juridical conditions for its realisation, we can understand Amazon's effort and achievement not necessarily as primarily technological, but instead discursive. Amazon expended speculative and imaginative work—with some success, as can be seen in retrospect—to position commercial drones as a possibility in the imagination of near-future everyday life and to link this imagination with

the image of the own corporation. Bloomberg journalist Brad Stone, who has long-covered Amazon, pointedly sums up their communicative strategy: “The aerial drone is actually the perfect vehicle—not for delivering packages, but for evoking Amazon’s indomitable spirit of innovation” (Stone 2013). While certainly opening up the tension between attention economy and business economics and illustrating the relationship between innovation and impression management (Löfgren 2003), Amazon Prime Air was primarily an investment in the customers’ sociotechnical imaginary; as such, it doesn’t necessarily need a short-term return on investment. Amazon Prime Air shows that the value of speculative work can be realised without being immediately monetised.

### **Conclusions: Speculative sites and sights, privileges and politics**

Drones are increasingly posited as the ‘disruptive’ technology of the moment. Both having and anticipated to have a “marked effect” on a range of employment sectors, drones are simultaneously bound to and productive of “new socio-spatial relations of production and consumption as well as human/nonhuman relations” (Bissell and Del Casino 2017: 437, 438). In thinking with the drone’s (potentially) ‘disruptive’ capacities, this article began with a particular provocation in mind – “what then of drone culture?” (Coley and Lockwood 2015: 2). Here, following Jumbert and Sandvik’s (2017: 5) investigation of the ‘good drone’ and the “technological fantasies” that surround, fuel and underpin it – we turned our attention specifically to the commercial delivery drone, and two sites through which particular potential drone futures are accessible, speculated, and even actualized. Both patents and adverts can, we argue, be understood as sites through which drones are both visually and textually narrated and envisioned, and potential socio-technical relations emerging from and residing within them read, thus contributing to the ‘making of the drone’ more widely (Klauser and Pedrozo 2015: 287).

In examining the patent, we sought to respond to a relative “dearth of critical and nuanced analyses” of patents (Kang 2015: 30), approaching them instead as speculative sites and opportunities for a critical reading of commercially-desired urban techno-futures. Here, we sought to de-centre the drone, attending instead to its wider infrastructures and interrogating this in relation to the wider social environments within which they speculatively exist. Therein, we examined not just what the patent renders visible – that is gains in delivery speed and efficiency in and through frictionless movement – but also what it eschews – namely redistributed noise pollution and congestion. Further, in thinking with the dronescape as an emergent and competitive space, we challenged such monopolistic visions with the question of scale and the elision of the issue of other aerial inhabitants. In their vision of convenience, Amazon presents, we argue, a convenient and simplistic airspace vision. Future research could beneficially examine both how Amazon’s dominant envisioning of a (its) drone future might act to inform the anticipatory practices of wider drone proponents, and to focus particular attention to moments of friction – given that airspace is increasingly subject to competition from a growing myriad of drone users and applications.

In further exploring the role and results of speculation we then turned to the advert. Treating it as a further site through which techno-drone-futures are envisioned, imagined and encountered, the speculative advert is interrogated in its portrayal of *lived* technological change. In so doing, two key narrational and aesthetical strategies that aim to seamlessly situate the speculative device of the delivery drone in actual lifeworlds are discerned: first, an idealized *social* context drawing on traditional imaginations of harmonic family life; and second, a corresponding suburban and rural *spatial* context that explicitly avoids any

allusions to hyper-urbanized speculations or Science Fiction aesthetics common to many techno-scientific speculations. We see these strategies as ‘realist’ aesthetics seeking to deliberately embed the concept of the delivery drone into actual near-future Western middle-class lifeworlds. By envisioning the delivery drone in such mundane and comprehensible frames of reference, these videos seek to cultivate a “literacy of inferred futurity” (Kinsley 2010: 2783) where the drone is desired and aspired. Following the approach to offer a deep and sited analysis of future-making practices herein, future research could consider how such anticipatory visualizations travel, circulate and are engaged and amplified – interrogating them in a more collective sense.

Thinking across this multi-site analysis, our aim was twofold. First, we approached the patent and advert as sites through which the drone is ‘made’ – that is represented, anticipated, and in some sense formed. Second, in their interrogation we sought to highlight that the “existing city and anticipated future city are of course co-constitutive” (Leszczynski 2016: 1701). Importantly, we sought to highlight the role of speculation in presenting, promoting and prescribing particular techno-futures, relations and politics. While delivery drones are speculated as aerial inhabitants poised to feature and punctuate our everyday lives, we highlight that they do not simply and solely envision new means of circulating goods and information or frictionless mobility and instant consumption, but rather embody and act to promote a particular set of aerial-desires and relations - from the appropriation of vertical spaces and spectra to the re-spatialization of pollutants. In looking across both sites we thus draw two conclusions. First, in examining how drones manifest, we assert that such speculative sites of the drone (and of droning more widely) significantly participate in the formation and entrenching of techno-fetishist neoliberal agenda positing technology as a privileged and panacea agent of futurity. Second, in thinking through how we, as researchers, can both theoretically and as empirically approach both such speculative spatialities and drones as research objects more widely – we present our visually-focused analysis as one pathway through. In offering deep readings of patents and adverts we sought to contribute to debates around both drones, and in particular a desire to view drone use multiply, beyond a “military equivalent” (Bradley and Cerella 2019: n.p), and techno-mediated ‘cities-to-come’ more widely (c.f. Leszczynski 2016; Bissell and Del Casino 2017). Whether or not the speculations examined materialise in aerial form, they nonetheless remain both “instrumental devices” and those which “actively shape the larger...cultures” that surround the aerial drone (Sandvik 2016: 58). In interrogating delivery drone potentials, we assert, then, that reflections on (future) airspace should further feature analysis attentive to the speculative. After all, such sites and sources act as both valuable windows into and active anticipatory envisionings of airspace futures, as well as the social relations that cohabit and enliven them.

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### Key messages:

- Drones are increasingly understood and imagined as important actors, inhabiting and transforming urban airspace
- Interrogating the domestic drone, we offer a critical visual analysis of key sites through which it is speculated
- While envisioning convenience from the air, commercial drone speculations too embody and promote particular aerial-desires
- We argue that staying with speculation enables the critical unpacking of notions of frictionless mobility, instant consumption, and the appropriation of vertical space

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