

Article

Aerial Politics of Visibility: Actors, Spaces, and Drivers of Professional Drone Usage in Switzerland

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Abstract

This article draws upon a large-scale survey of professional (public institution and private company) drone usage in Switzerland. The authors argue that professional drone usage includes a wide range of applications and objectives and, thus, logics of vision and visibility. Instead of being systematic and predictable, the visibilities created by professional drone usage are punctual in occurrence, highly varying in spatial logics and articulations, and, therefore, often unpredictable. This raises important questions and problems with regard to the power dynamics unfolding from the visual and visualising capabilities of the technology that reach far beyond the usual focus on surveillance in current academic engagements with the topic.

Introduction

After all, aren't they talking about producing a 'vision machine' in the near future, a machine that would be capable not only of recognizing the contours of shapes, but also of completely interpreting the visual field, of staging a complex environment close-up or at a distance? (Virilio 1994: 59)

Paul Virilio's (1994: 59) imagining of a "vision machine" that would automatically interpret the visual field both at close range and from far away seems to have become a reality. In recent years, drone usage has increased heavily in many fields and for differing purposes. Whereas drones are most often known for their military use, they have also been employed in many civilian professional branches such as filmmaking, the agricultural sector, and the police. With regard to the latter, drones are often referred to as the systematic new urban surveillance tools that swarm over the skies of our cities (e.g., Wall and Monahan 2011; Neocleous 2013; Hall and Coyne 2014; Jensen 2016).

This article argues that civilian drone usage is not producing a systematic and routine surveillance gaze (e.g., Lyon 2007). Rather, civil drones have multiple functions, are most often employed sporadically, and, as such, indicate an activity that is not routinised. What drones do, then, is create and establish a new kind of view from above that shapes, is shaped by, and changes the professions concerned. Such professions vary from aerial photography to agriculturalists who use drones to detect crop diseases. Whereas drones in filmmaking bring new perspectives of seeing, drones in the agricultural sector open up totally new business branches in which drones have not been active before. In sum, this article shows that drones produce and articulate novel, multisided, complex, and varying types and forms of politics of visibility.

In addressing the drone problematic from this angle, the present article focuses in particular on professional drone usage across the public and private (civilian) sectors. It critically explores the forms and logics of visibility conveyed by professional drone usage, thus inviting research focused on the power dynamics unfolding from the visual and visualising capabilities of drone technology. More specifically, we study (1) *who* produces visibility through professional drones, (2) *where* it is produced, (3) *for what purposes*, and (4) the “mode[s] of relationship between power and knowledge” (Foucault 2003: 185) thus created.

Empirically speaking, this study draws on the select results of a large-scale online survey conducted in 2017 amongst professional drone users in both the public and private sectors in Switzerland (Klauser et al. 2017). This survey is part of a broader politico-geographical research agenda on power and space in the drone age (Klauser and Pedrozo 2015).

The article proceeds as follows: First, a literature review on the current drone literature and a conceptual discussion on power and visibility set the theoretical stage for the analytical part of this piece. Second, a methodological section explains in detail the construction of the survey, its distribution, and the assessment of its results. Third, the analysis unfolds in three steps: (1) light is shed on the producers of visibility (who uses drones, how, for what purposes, and with what kind of collaborations); (2) the spaces of visibility are considered (what do the spatialities of drone use say about the relationship between visibility and space); and (3) the drivers of visibility are examined (the purposes of the production of visibility through drones). In the conclusion, we discuss the results, set them into context, and forecast future drone scenarios.

Drones and Surveillance Studies

Our focus on the forms and logics of visibility produced by professional drone usage connects neatly with recent discussions in surveillance studies about the multifold sites, means, and logics of “looking, seeing, presenting and circulating images” (Koskela 2002: 199) in the present-day world of big data. This has produced a range of novel research agendas that move beyond traditional foci on centralised state surveillance and on the panoptic logic of the few watching the many to concentrate instead on the “new politics of surveillance and visibility” (Haggerty and Ericson 2006) in which the many watch the few (Lyon 2006; Bigo 2006; Haggerty 2006; Gilliom and Monahan 2013: 18).

This enlargement of surveillance studies resonates with the broader engagements of cultural and visual studies with the logics and power dynamics that characterise the contemporary “scopic regime” (Metz 1982; Jay 1988; Cray 1988; Somaini 2005: 27–28), understood as the ensemble of social, cultural, political, and technological conditions that structure the mechanisms of vision at a given historical moment (Gregory 2011: 190; Feldman 1997: 30). This line of thought has emphasised the “new visibility” (Thompson 2005) of the present era, in which the unpleasant feeling of being under surveillance shifts towards the more pleasurable experiences of being ever more visible to others, as we see with the use of social media and other new information and communication technologies such as webcams (Koskela 2002) and mobile phones (Gilliom and Monahan 2013; Giroux 2015; Murray 2015).

Although scholars have also begun to address this problematic from the perspective of the drone (Jablonowski 2015), current engagements with this particular technology remain almost exclusively centred on issues of surveillance, policing, and “killing-at-a-distance” (Virilio 2006). This has established a reading of drones as remote “vision machines” (Virilio 2006) that combine and reinforce older forms of aerial supremacy with new possibilities of “air mastery through technological speed, verticality, and vision” (Wall and Monahan 2011: 240). Drones have, thus, been portrayed as lifting surveillance to a different level, both functionally and aurally (Asaro 2013). In the literature, three main streams of thought stand out.

The first research emphasis focuses on the military use of drones for the purposes of border control (Loukinas 2017; Pedrozo 2017), homeland security (Wall 2013), and armed conflict abroad (Gregory 2011; Greene 2015; Krishnan 2015; Kindervater 2016). With regard to the latter, existing research has problematised the asymmetries produced by the fact that drones allow their users “to be able to kill without

being able to be killed; to be able to see without being seen. To become absolutely invulnerable while the other is placed in a state of absolute vulnerability” (Chamayou 2011: 4). From an empirical viewpoint, authors have also, in a critical fashion, foregrounded the operators’ lived experience of the complex “geographies of proximity and reach” (Allen 2003) that emerge from the drones’ capacities of seeing, thereby criticising the military establishment for killing from afar (Gregory 2011). Additionally, they have highlighted how the distancing of military drone aircrews from the sites of war affects the very exercise of military power (Williams 2011). Although this literature is important, we do not engage with it here, particularly because we draw attention to drone use in civilian realms, an area in which a great deal less research has been conducted so far.

Moving beyond the strict military usage of drones, the second line of thought is concerned with the technology’s suitability for civilian surveillance purposes, especially in urban areas (Wall and Monahan 2011; Neocleous 2013; Hall and Coyne 2014; Jensen 2016). Wall and Monahan (2011: 245) argue that drone technology further develops and complements existing urban “surveillance networks” and, as such, contributes to the proliferation and normalisation of military technologies, expertise, and doctrines in urban policing. Jensen (2016: 21) asks whether drone technology could even herald in the arrival of an age of “urban drone surveillance” as potential “boomerang technologies” are brought back from war zones to civilian realms. The relevant literature, therefore, portrays drones as catalysts that contribute to the development of novel inter-organisational relationships that blur the traditional distinctions between civil and military contexts, war and law enforcement, and internal and external security, with wider implications not only for homeland security but also for everyday social life more generally (Graham 2010; Wall 2013; Wall and Monahan 2011). In Switzerland, for example, such debates emerged around the deployment of drones for the monitoring of urban space at the European Football Championships in 2008 (Schweizer Armee 2008). More recently, controversy has arisen over the purchase of field-tested Israeli drones for the purposes of border control and public safety (Lauener 2014). This article sets out to add a different approach to the above discussion. Instead of considering civilian drone usage—even by the police—as a new form of urban surveillance, we argue that drones have other more complex and diverse ways of being used by public and private actors, something that must be considered beyond the urban surveillance thesis.

The third body of literature revolves around the ethical (Geiger 2011; Gettinger et al. 2014; Gynnild 2014; Valavanis and Vachtsevanos 2015) and legal (Finn and Wright 2012; Stanley and Crump 2011; Clarke 2014) challenges associated with drones. Framed around issues of security (drone accidents), privacy, and civil liberties, among others, this literature also acknowledges the civilian and commercial usage of drones and the novel dynamics of power, counterpower, and resistance that are implied (Goodman 2013; Bracken-Roche et al. 2014; Tremayne and Clark 2014; Bracken-Roche 2016). Yet, because this literature remains framed in surveillance terms, it again approaches the deployment of drones as a technique for routine and systematic data gathering, transfer, and analysis (Lyon 2007: 14). The empirical material analysed here suggests that this is not what the use of civilian drones is all about.

In sum, these three lines of work have generated a wealth of empirically and theoretically driven research into the power issues associated with the proliferation of primarily military drones and drones as surveillance machines. Yet, as we argue here, they largely ignore the more sporadic, punctual, unpredictable, recreational, and professionally motivated uses of drones. Drawing on key findings from the large-scale survey conducted amongst professional drone users in Switzerland, the present analysis places the use of drones in practices such as aerial photography, land surveying/cartography, and infrastructure control, as well as by public and private actors such as the police and photographers, at its core.

On these grounds, this article complements existing engagements with drone problematics and fosters a more complete picture. In particular, we argue that there are multifold and more complex visibilities created by drones and, as a result, new power issues raised than so far presented in the existing literature. By way of example, consider how drones used for aerial photography are providing completely new visibilities. These new visibilities create new issues of power because the technology is not available to all and it is not yet known how the privacy and legal issues that may arise should be dealt with. It is critical to go beyond a

strict logic centred on public security and surveillance and take a broader approach to the politics of visibility as conveyed by drones if we are to acknowledge and question more fully the opportunities and risks implied by the visual and envisioning capabilities of this technology.

Power and Visibility

We draw upon Michel Foucault's (1982: 790) understanding of power as a mode of action that "structure[s] the possible field of action of others." There are three main reasons for this. The first is one of perspective. Foucault insists that power in itself does not exist. It is not a substance or property of specific actors but "exists only when it is put into action" (Foucault 1982: 788). The key question for Foucault, then, becomes how power is being exercised through what mediating techniques (Foucault 1982: 786). It is from such a relational- and mediation-centred posture that we talk here of drones as techniques of power that convey specific politics of visibility.

Second, Foucault's concept of power is interesting in that it highlights the need for an understanding of drones that moves beyond the dualistic distinction between the powerful and the powerless, the watchers and the watched. On one hand, Foucault's (1982: 790) understanding of power implies *eo ipso* a field of possibilities in which several ways of acting, reacting, and resisting are possible. With regard to the drone problematic, this leads to the question of how society reacts to the technology and how this, in turn, informs public and private drone usage. On the other hand, Foucault's (1982: 793) approach conveys the idea that techniques of power can be socially redistributed, rearticulated, renegotiated, and, hence, inverted. This is exactly what happens with the current civil proliferation and private appropriation of drones for professional and recreational purposes.

Third, Foucault's (2007: 182) insistence on approaching particular techniques and apparatuses of power as "matrices of organisation and knowledge" is of great interest for our analysis here. For Foucault, acting as a result of other actions—that is, the exercise of power—always implies specific forms of knowledge and understanding that are accumulated, legitimised, and mobilised in specific ways. We pursue this reflection further in addressing the politics of visibility conveyed by professional drone usage as both the product and producer of specific forms of expertise and professional identities.

Moving beyond the broad question of power towards the more specific one of visibility, it is helpful, first of all, to remember how Foucault (1977) famously connected visibility and power in his analysis of the panoptic prison. Here, visibility is engaged in a logic of disciplinary power, mediated by a specific architecture of control. More generally speaking, this example powerfully underlines the link between visibility and power, something that we want to address from a drone perspective. In this respect, we draw upon Andrea Brighenti's (2007, 2010) theoretical work, which complements Foucault in interesting ways.

Brighenti (2010: 44, 38) understands visibility as a "field of action and affection" that inheres in and arises from specific "configurations, connections, events, forces, mechanisms, associations, regimes, strategies, practices, rhythms and situated activities." From this broad stance, it is possible to derive three interrelated key qualities of visibility that provide an analytical heuristic for our study of professional drone usage in Switzerland.

First, Brighenti (2010: 41; 48) stresses that visibility is inherently relational, in a socio-technical sense, as the outcome of a complex set of "linkages and mediations which occur in that 'middle realm' where ideas and material forces coexist, and where thought—properly understood—presents itself as embodied in material connections and linkages." Conceiving of visibility as a socio-technical field means to understand it as being constantly co-produced and shaped by the entities involved therein.

For our analytical purposes, this invites a focus on the relational configurations within and through which specific logics of drone usage unfold. What actors and relationships lie behind current drone usage? In turn, what specific actor networks do contemporary (professional) drone usage create? These questions,

addressed in the first part of our analysis, are of fundamental importance if we are to better understand and challenge the power issues unfolding from professional drone usage. It is not just the technology's visual capacities per se that determine its effects. Rather, its logics and implications and, therefore, its opportunities and risks, lie in the ways in which visibility is employed, by whom it is mobilised, and in what kinds of relationships it comes into being.

Second, Brighenti (2010) argues that visibility is fundamentally “positional,” occurring at those sites at which its inherent socio-technical mediations unfold, and “territorial,” in that it territorialises the objects and spaces made visible. As Brighenti (2010: 44) puts it, “the result of the acts that inscribe or project something into the visible is the territorialisation of an environment—a haptic ‘extraction’ of an object from the environment. This is why to investigate visibility we need a perspective that enables us to recognise the multiplicity and the materiality of these processes, as well as the fact that they unfold within a horizon of experience and existence.” Applied to the drone problematic, the question of “where” drones are being used, and where and how their gaze “falls on the ground,” is never neutral but revelatory with regard to the specific politics of visibility conveyed. The second part of our analysis looks at this issue.

Third, if visibility implies a set of mediated relationships that articulates specific ways of “seeing and being seen or, more generally, . . . noticing and being noticed” (Brighenti 2010: 187), this also means that visibility is never neutral or “fixed” but instead is fundamentally strategic and processual. For Brighenti (2007: 326), the strategic dimension of visibility considers its asymmetric and distorted aspects: it always responds to specific needs and intentions, it is both shaped by and shapes those involved with it, and it is de facto influenced so as “to obtain real social effects” (Brighenti 2010: 39).

In turn, the processual dimension of visibility refers to the practices and efforts of managing what is seen and what is not. Given the rapid expansion and commercialisation of the “socially visible” in the present-day world, this directs our attention towards the “supply and demand market” (Brighenti 2007: 327) in which visibility is produced and consumed. This third element of visibility brings us to consider what kinds of decisions and economic reflections underlie and drive professional drone usage. In sum, our study is structured around the three main qualities of visibility discussed above, thus exploring the (1) relational, (2) positional–territorial, and (3) strategic–processual components of the politics of visibility conveyed by professional drone usage in Switzerland.

Bringing together a Foucauldian concept of power and Brighenti's idea of visibility allows us to appreciate drones fully as powerful socio-technical tools that convey specific politics of visibility. Both concepts—power and visibility—as expounded here, are brought together by their truly relational foundation.

Drone Survey

We draw upon data stemming from a large-scale survey conducted between July and September of 2017 amongst professional (public and private) drone users in Switzerland. The country was chosen because the survey was part of a larger research project about drone usage in Switzerland funded by the Swiss National Science Foundation. However, the decision to work in Switzerland was not accidental because, in effect, the Swiss civil drone industry is one of the most developed worldwide, exporting know-how and technology globally. Switzerland still has one of the most liberal legislations with regard to regulating drone usage and has had a major influence on the new European Aviation Safety Agency (EASA) regulations (Interview with the co-director of innovation and digitalisation at the Federal Office of Civil Aviation by Pauschinger, April 3, 2019). In addition, there is an active group of civil users that lobbies and influences policy makers in Switzerland and Europe, as well as a thriving start-up scene in relation to purchasing and starting to use a drone. The police were involved from the beginning of the project, so there could be a serious debate on the introduction of drones into everyday police routines, to which the research team had extraordinary access.

There are two important reasons for studying civil as opposed to military drones. The first reason, as outlined in our literature review, is that the research related to drones is overly focused on the military use of the technology. In this article, we want to add to the discussion by providing a more nuanced picture, as drone technology has recently entered the civilian realm in a way that creates a pressing need to study its manifold effects on everyday society.

The second reason derives from the fact that the studies on civilian drones have been highly speculative and have often shown a tendency to describe drone technology as a surveillance threat. Although we are aware of the ongoing militarisation of police forces globally (e.g., Balko 2013; Graham 2010), here we consider the Swiss police as most definitely a civilian actor and, therefore, include them in our sample of public institution drone users. This also offers the possibility of better contributing to a more fine-grained understanding of why state actors such as the police are mobilising drones today.

The distribution mailing list, design, and content of the survey were informed by a systematic review of existing academic and non-academic work on drones combined with a series of exchanges with various stakeholders in the field, including the Federal Office of Civil Aviation, the Swiss Federation of Civil Drones, and the Swiss association of professional drone pilots UAW.aero. The questionnaire was sent to potential participants as an email link in French and German to be filled in online using Qualtrics software. Questions were structured around eight main themes: (1) basic information about public and private drone usage, frequency of use, height of flight, drone types, and deployed software; (2) reasons for the usage of drones; (3) practices of drone usage; (4) collaborations in relation to the setting up and usage of drones; (5) emerging questions with regard to the airspace within which drones operate; (6) advantages and disadvantages of drones; (7) legislation in the field; and (8) future scenarios with regard to drone use in Switzerland.

With a view to the distribution of the survey, the initial categories of public institution and private company drone users were both divided into five subcategories (see Table 1), which were then used to set up our mailing list. We selected the categories according to our pre-research with key actors in the public and private fields of drone use, as described above. The table, therefore, reflects the five professions in both the public and private realms that are using drones or are most likely to use drones in the future. While there are some more obvious professions, such as aerial photography and filmmaking, we have also included activities that we may not immediately think of as attracting drone use, such as private infrastructure services and public archaeological and urban planning services. The latter are, typically, state-run services in Switzerland.

| Public institution drone users | Private company drone users |
|--|------------------------------------|
| Fire services | Aerial photography and filmmaking |
| Police | Security businesses |
| Emergency services (excluding fire services) | Land surveying/cartography |
| Archaeological services | Infrastructure services |
| Urban planning services | Agriculture |

Table 1: Professional categories used for setting up the address file for the survey.

The questionnaire was sent by email to 297 public institutions and 562 private companies. In addition, in order to engage with as many institutions and companies as possible within the predefined professional subcategories, a number of umbrella organisations and other potential distributors of the survey were

identified and contacted with a request to email the link to our online questionnaire to their members. Thus, the link to the survey was sent in a targeted way to 3,170 recipients. This number includes the members of the 297 public institutions and 562 private companies mentioned above but does not take into account the possible further dissemination of the survey by recipients who might have contacted other institutions or companies. Nor does it include the dissemination of the survey by company newsletter, as was done by the Swiss Society of Engineers and Architects, for example; the survey link was sent to 15,000 recipients using this method.

During the survey period of ten weeks—spanning July 5, 2017 to September 18, 2017—1,014 participants registered, filling in a total of 922 valid questionnaires (either in French or German). In relation to the number of respondents targeted (3,170), a return of 1,014 questionnaires gives an acceptable response rate of 32%. This makes the present survey the first systematic and comprehensive study of professional drone usage in Switzerland, providing a detailed picture of the extent of the phenomenon, including its facets, risks, opportunities, and expected future evolution. Overall, 432 representatives from public institutions and 490 representatives from private companies completed the survey. We decided not to collect any personal data—such as sex, age, or the exact geographical locality—from the participants. When we asked “who” uses drones and “where” drones are used, we were not interested in the demographics per se but in the professions/activities involved and the fine-grained geographical layers between urban and non-urban.

Analysis

Producers of Visibility

This first section of analysis explores who produces visibility through drones, how, for what purposes, and through what kinds of collaborations. To start, consider that all survey participants except one indicated that they use drones equipped with at least one type of (visual) sensor. As shown in Table 2, most respondents use drones that are equipped with photo cameras (46% of the public institution participants; 40% of the private company participants) or with livestream video cameras (30% of the public institution participants; 32% of the private company participants). In addition, a limited number of participants also use infrared or thermal cameras. Thus, drones are hardly ever used for transportation purposes alone. Rather, professional drone usage must be considered within a framework of the production of visibility.

| Type of sensor | Public institutions | Private companies |
|------------------------------------|---------------------|-------------------|
| Photo camera | 46% | 40% |
| Video camera with livestreaming | 30% | 32% |
| Video camera without livestreaming | 7% | 10% |
| Thermal camera | 8% | 9% |
| Infrared camera | 5% | 4% |
| Air quality measuring device | 1% | 1% |
| Laser sensor | 0% | 2% |
| No sensor | 0% | 0% |

Table 2: What sensors do you use with your drone? N=529, N=123 (several responses possible).

With regard to the professional fields/activities in which the drones’ visual capabilities are used, Table 3 and Table 4 show that, with regard to participants from public institutions, 50% work for the police, 10% are from the fire service, and 8% work in archaeology. Of the private company participants, 28% specialise in aerial photography, 23% in land surveying/cartography, and 16% work in filmmaking. This shows that drones are related, fundamentally, to the production of visibility and that this relationship plays out in quite different ways. Drone usage in private companies occurs in professional fields and is used in activities in which the production of visibility is the actual core activity and an end in itself, whereas drone usage in public institutions adds the technology to previous work routines. In the latter, visibility is something auxiliary that is useful in specific situations and activities—for example, in relation to policing and firefighting—but should not be considered the driver that created the relevant professional field/activity in the first place.

| Public institution participants with a drone – areas of specialisation | |
|---|-----|
| Police | 50% |
| Fire services (with and without integrated emergency medical and rescue services) | 10% |
| Archaeology | 8% |
| Spatial/urban planning | 4% |
| Emergency medical and rescue services (excluding fire services) | 1% |
| Other | 27% |

Table 3: Public institution participants with a drone—areas of specialisation, N=94.

| Private company participants with a drone – areas of specialisation | |
|--|-----|
| Aerial photography | 28% |
| Land surveying/cartography | 23% |
| Filmmaking | 16% |
| Infrastructure control | 4% |
| Agriculture | 4% |
| Security | 1% |
| Other | 25% |

Table 4: Private company participants with a drone—areas of specialisation, N=299.

The participants’ responses with regard to their specific types of drone usage (Figure 1) partly confirm this initial interpretation. Although in the private sector drones are mainly used for filmmaking (24%), this is almost non-existent in the public sector (3%). In contrast, drones are used twice as often to support missions on the ground by public actors (13%) than by private ones (7%).

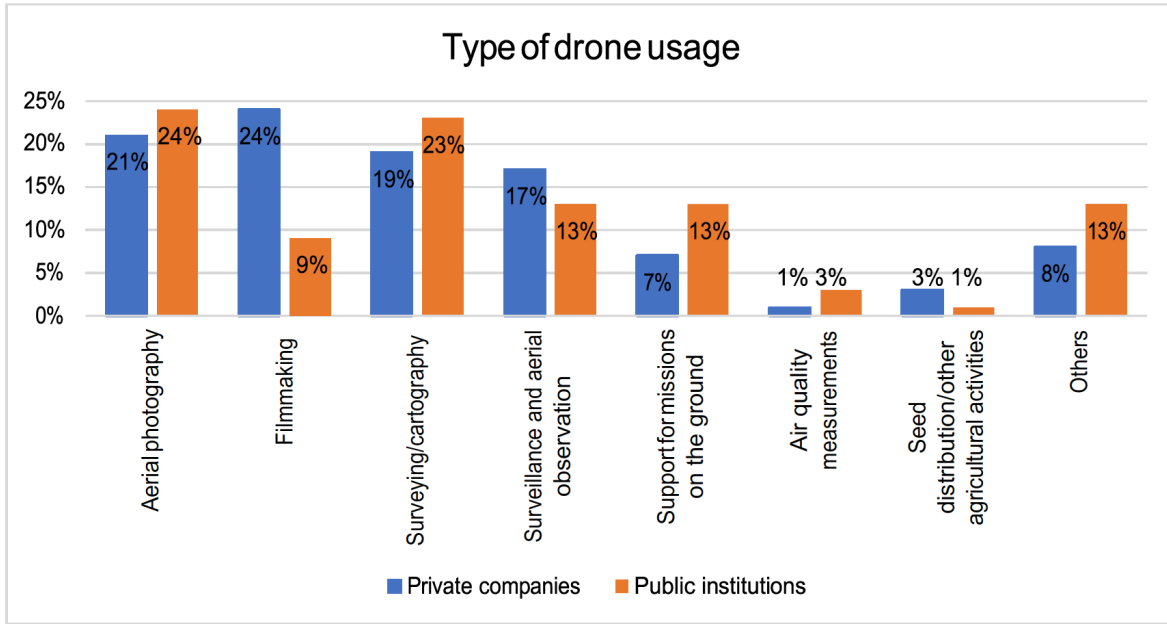


Figure 1: Types of drone usage, N=487, N=128

Granted, both public institutions and private companies use drones for aerial photography, land surveying/cartography, and surveillance and aerial observation, but they do so in different ways and with different frequencies. Private company drone users deploy the technology more frequently than those in public institutions: 5% of the private company drone users operate drones every day, as opposed to 3% in public institutions; 38% of the private companies with a drone use their machine at least once a week, compared with 14% of public institutions.

If we compare companies that specialise in aerial photography with the police, an identical picture emerges: 46% of the companies that specialise in aerial photography use their drone at least once a week, whereas only 15% of the participants from the police do likewise. These numbers testify, again, to the fact that visibility is the core business of private company drone users, whereas the police only mobilise drones in specific situations. In this sense, in Switzerland today there is no systematic state-driven drone usage for routine and everyday surveillance missions.

Further advancing our analysis, Figure 2 shows how the production of visibility brings various actors together and creates new relationships. We asked survey participants to assess the collaborations created by and around their drone usage. Amongst lending, renting, and the use of the data or images gathered, the option of providing services to others was rated the most highly.

Forty-seven percent of the private company users said that they deliver services to peer private companies, 71% deliver services to other private companies in general, 68% to public institutions, and 61% to private individuals. Of the public institutions, 27% said that they deliver services to peer public institutions, 20% to other public institutions in general, 14% to private companies, and 3% to private individuals.

Although both public institution and private company users tend to work with other organisations from the public and private sectors, it appears that private companies are more likely than public institutions to collaborate with peer companies in the use of drones. Moreover, the private companies offer more drone-related services to public institutions than the other way around (Figure 3 and Figure 4).

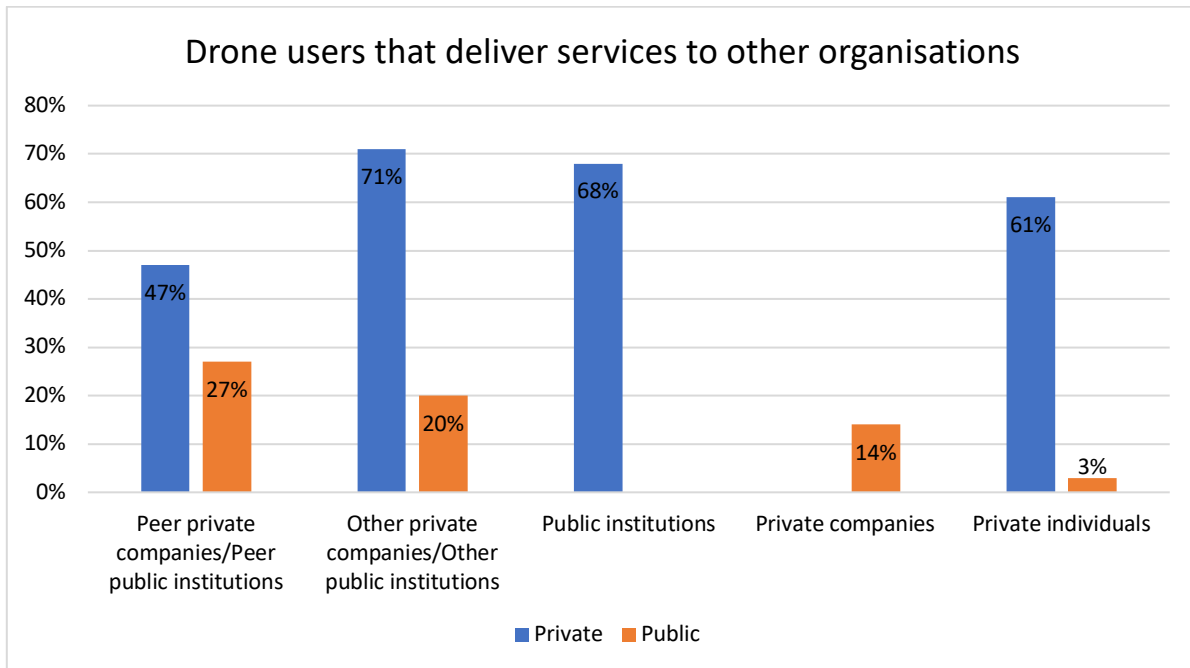


Figure 2: Collaborations by private company and public institution drone users, N=247, N=59

Filtering these relationships through the different domains of use, we can detect that those companies working in aerial photography, filmmaking and, land surveying/cartography use the services of others much less than those working in the areas of infrastructure control or agriculture. These companies provide visibility per se as a service and product to others, based on their specific forms of expertise.

These results indicate an interesting turn in relation to the power dynamics at play. If we think about drone technology as something that was initially developed for military purposes but has now reached the civilian sphere, what happens here is a conversion and appropriation of not only the technology itself but also the power that its usage implies. Drones in this sense are socially redistributed. More than that, if power is also something that emerges through the mobilisation of “matrices of organisation and knowledge” (Foucault 2007: 182), consider our findings in this section: visibility is the core activity of private company drone users but not public institution drone users and is not merely an addition to already existing routines but something that is produced on purpose for the professional activity at stake. Knowledge as a form of power is accumulated, reinvented, and distributed in completely new ways.

Most interesting in this section is how visibility is produced in a socio-technical way. As outlined earlier, Brighenti (2010: 48) shows how visibility is constantly co-produced and comes into being through the connections and collaborations between the entities involved. What we have seen here is that drones are functioning like mediators that connect different partners in (at times unexpected) relationships through which and in which visibility is produced. It is mainly the private sector that reinvents, reinvents, and redefines power and visibility through drone usage by innovating, thereby creating new professional fields/activities and new ways of seeing, such as through aerial photography. In this sense, the private sector has become an actual “entrepreneur of the air.”

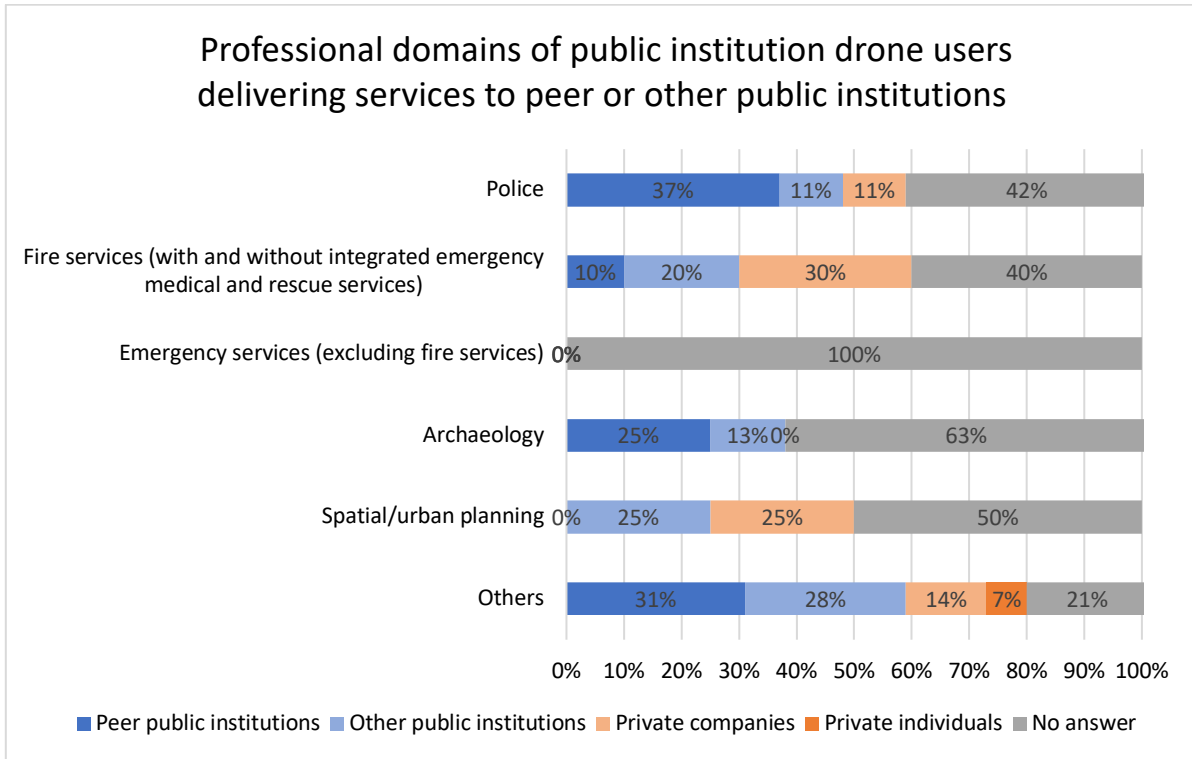


Figure 3: Professional domains of public institution drone users delivering services to peer or other public institutions, N=59

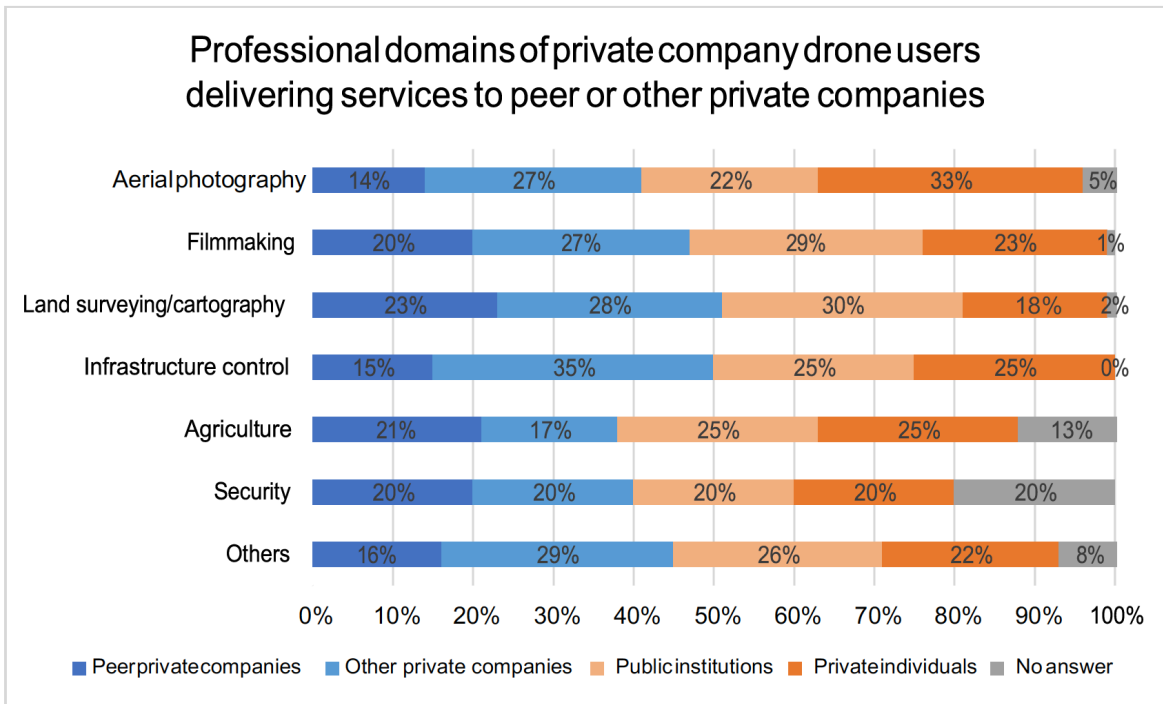


Figure 4: Professional domains of private company drone users delivering services to peer or other private companies, N=247

Spaces of Visibility

Drones produce visibility in specific spaces. In this section, then, we are interested in the connections between drones, visibility, and space. As we depart from the assumption that visibility is fundamentally positional and territorial—that it territorialises the spaces in which it unfolds its socio-technical capabilities (Brighenti 2010: 44)—it is crucial to comprehend *where* drones are mobilised, what kinds of spaces and territories are being used as drone spaces, and what happens in these places. For example, the findings from our study indicate that, contrary to many expectations, drone spaces are not primarily urban but rural. We will look at these phenomena in what follows.

First, descriptively, we draw attention to where drones are mainly used by public institution and private company users. Figure 5 and Figure 6 show that drones almost never fly over city centres, protected eco-zones, and gatherings of people, whereas they are often used above (1) farmland and nature areas (46% public; 72% private), (2) residential rural zones (43% public; 61% private), and (3) peripheral urban zones (46% public; 61% private).

In looking at what kinds of jobs are carried out in the three areas that drones most frequently fly over, we see that private company drone users most often use drones for filming, air photography, mapping, ground support, pre-planned control missions, and work related to agriculture (Table 5). In contrast, public institution drone users do these kinds of jobs much less frequently. Indeed, they never use drones for agricultural work.

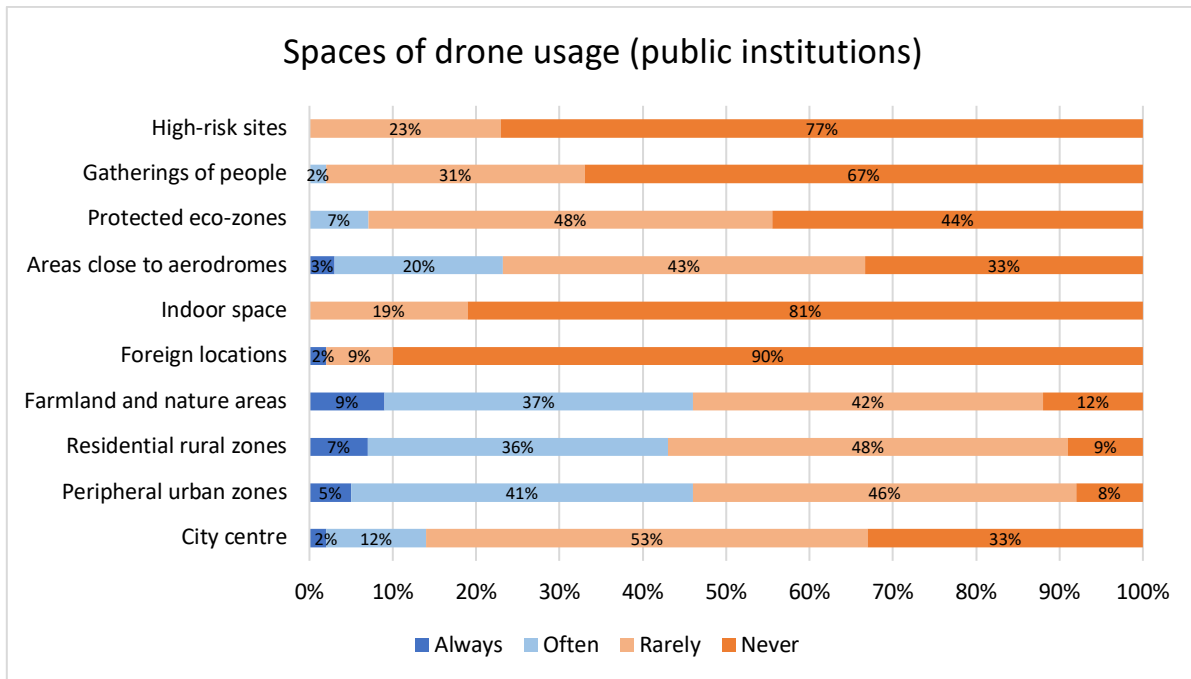


Figure 5: Spaces of drone usage (public institutions), N=60

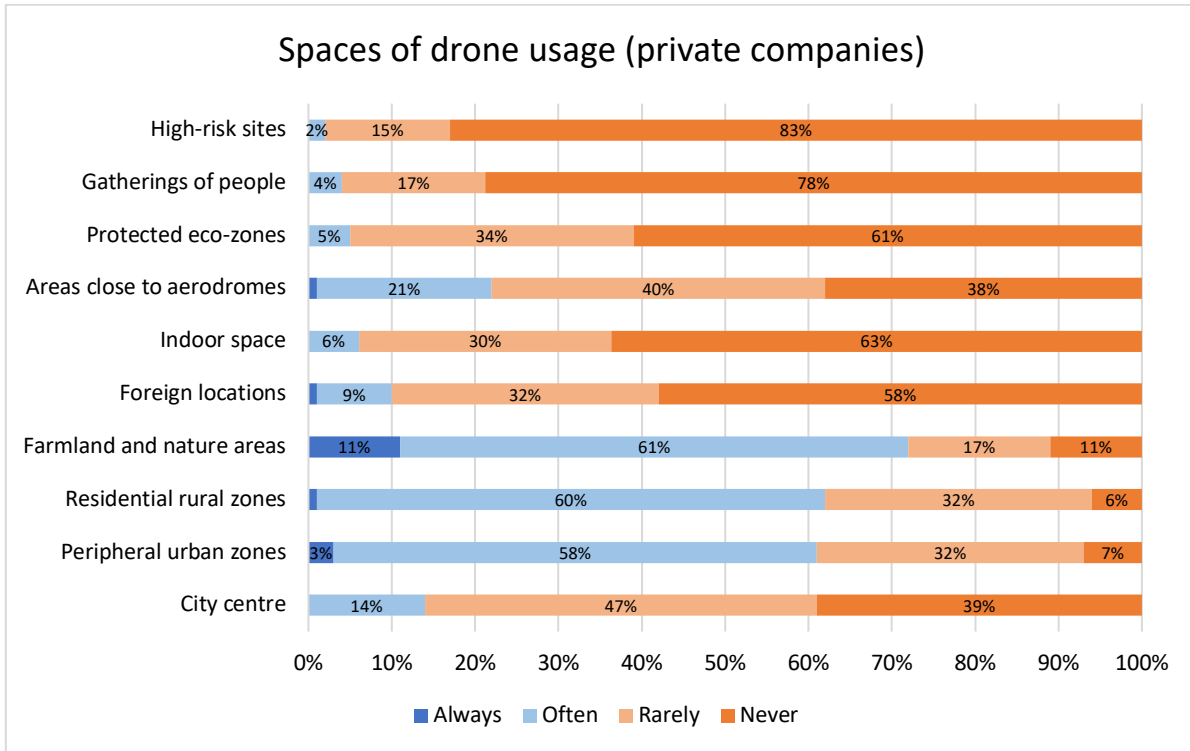


Figure 6: Spaces of drone usage (private companies), N=258

| | Rural residential zone | | Peripheral urban zone | | Farmland and nature areas | |
|--|------------------------|---------------|-----------------------|---------------|---------------------------|---------------|
| | Private (N=155) | Public (N=21) | Private (N=148) | Public (N=24) | Private (N=150) | Public (N=21) |
| Land surveying / cartography | 62% | 44% | 57% | 46% | 66% | 54% |
| Surveillance and aerial observation | 67% | 35% | 66% | 41% | 63% | 50% |
| Support for missions on the ground | 63% | 35% | 60% | 35% | 53% | 12% |
| Aerial photography | 71% | 35% | 64% | 35% | 60% | 35% |
| Filmmaking | 65% | 25% | 62% | 75% | 64% | 50% |
| Air quality measurements | 50% | 44% | 75% | 33% | 25% | 33% |
| Seed distribution and other agricultural activities | 64% | 0% | 57% | 0% | 21% | 0% |
| Others | 49% | 43% | 46% | 33% | 53% | 50% |

Table 5: Kinds of jobs, frequency, and location of private and public drone usage (answer possibility "often").

Another important dimension in our data appears when we compare the responses of public institution and private company drone users with regard to whether they could use a helicopter/small aeroplane or a camera on the ground instead of a drone. Seventy-seven percent of private company users disagree or somewhat disagree that they could use a helicopter/small aeroplane, whereas 89% reject the idea that they could use a camera on the ground. The public institution users disagree less with the idea that they could use a helicopter or small aeroplane (58%) but disagree equally strongly that they could use a camera on the ground instead of a drone (88%). Thus, the very point of using drones is that they provide visibility from the air.

Yet, importantly, the air itself is not used uniformly or indifferently, as we see when we look at the altitude at which drones are being deployed. According to our survey, 89% of the private company drone users always fly below 300 m, compared with 86% of the public institution drone users (Figure 7).

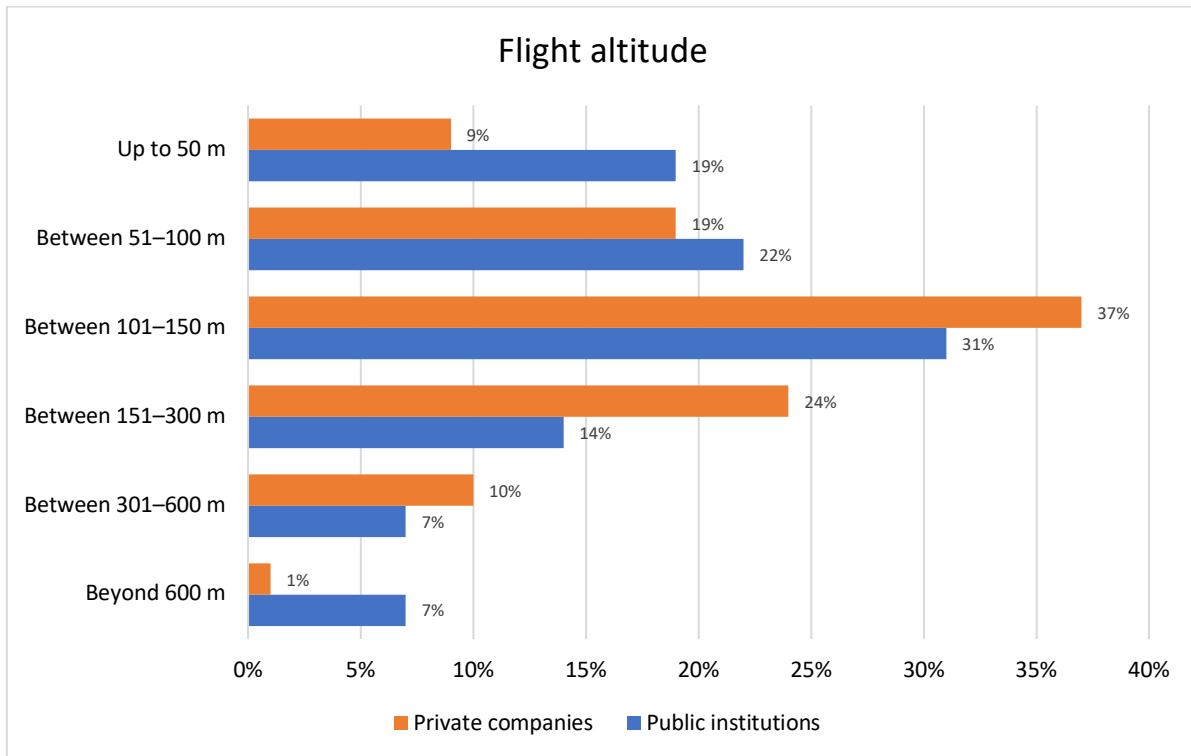


Figure 7: Flight altitude, N=254, 58

More specifically, it is interesting to see what happens when we examine different types of drone users in terms of how high they fly. For example, as shown in Figure 8, only 5% of the companies specialising in aerial photography and filmmaking fly below 50 m (83% of aerial photography drones and 90% of filmmaking drones fly between 50–300 m). The police, in contrast, are much more likely to fly their drones below 50 m (47%) and much less likely to fly them as high as 300 m (11%).

This indicates not only a fundamental difference between public institution and private company drone users but also raises awareness of the diverse ways in which visibility is mobilised and produced. The companies that have visibility as their core activity, such as those working in aerial photography and filmmaking, seem to produce a kind of large-scale, “generalist” visibility. In contrast, it should be noted that the police use drones mainly for two main purposes: (1) aerial photography in cases of accidents, crimes, and recognition (40%) and (2) support for missions on the ground in real time (18%). Although this use of visibility is also fundamentally vertical in a technical sense, it is bound up more closely with action—that is, the exercise of power—on the ground and, as such, is, literally, closer and more specific and precise.

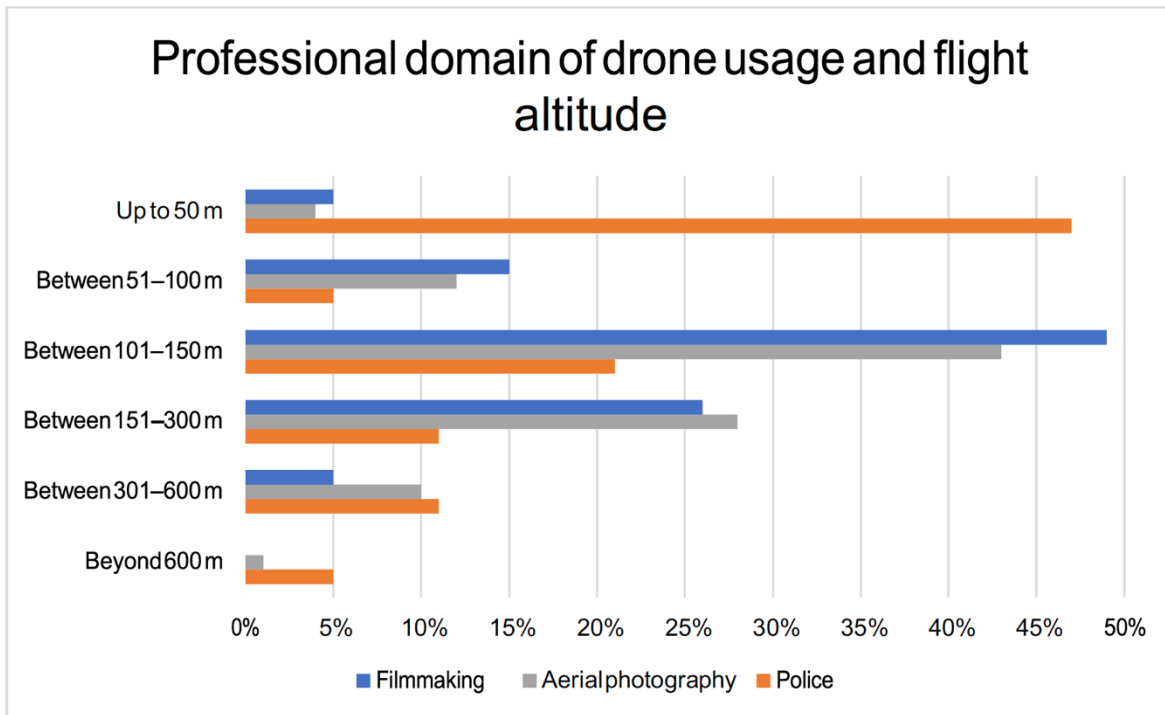


Figure 8: Professional domain of drone usage and flight altitude, Police N= 19, Film-making N=39, Aerial photography N=64

In this respect, it should also be noted that an overwhelming majority of both public institution and private company drone users consider the fact that drones can be operated from the ground to be an important advantage of the technology (99% of public users and 98% of private users). The spaces of visibility created and territorialised through professional drone usage must be understood in their complex compositions of both aerial and terrestrial realms. As a visualising technology from both above and afar, drones do indeed bring the air and the ground together in a novel relationship of “vertical reciprocity” (Adey 2010: 3).

As outlined at the beginning of this section, these results indicate clearly that drone usage is not an urban phenomenon in Switzerland but is closely tied to rural areas. Within these areas, drone usage is fundamentally diverse, multisided, and sporadic. The results do not indicate a routinised and systematic use. However, the introduction of drones as a relatively cheap technology has led to the possibility of creating new professionals who have established their core business around visibility. In some cases, drone usage has changed already established professions. Consider photographers who were only able to shoot landscapes in the horizontal plane and are now capable of establishing a totally new perspective and a novel way of seeing. More importantly, the space in which these professions work is shaped by and shapes their way of seeing with the drone. For some actors, drones as socio-technical mediators create the possibility of “territorialising” the air (Brighenti 2010: 44).

Drivers of Visibility

In this third part of our analysis we are interested in the purposes of the production of visibility through drones. Why do professional drone users work with or through visibility, and do the reasons differ between users? Conceptually, this resonates with our aim of bringing together visibility and power, considering the former as never neutral but strategic-processual in deciding who and what can and cannot be seen (Brighenti 2010) and the latter as a mode of action that “structure[s] the possible field of actions of others” (Foucault 1982: 790) and implies specific forms of knowledge (Foucault 2007: 182).

As depicted in Figure 9 and Figure 10, 75% of both public institution and private company drone users agree or somewhat agree that drones help their organisation to save money. Furthermore, drones are seen as making existing services safer; 58% of the public institution users and 48% of the private company users agree or somewhat agree with this. Yet, above all, drones are perceived to help develop new services, with 84% of the public institution users and 95% of the private company users agreeing or somewhat agreeing with this. It is also worth considering that 79% of the public institution users and 90% of the private company users claim not to need official authorisation for all of their work. Thus, visibility is not only interlinked with the production of knowledge that helps make existing services cheaper and safer but also seems to enable the actors involved to develop novel forms and types of practices. Conceptually speaking, what we can observe here is how new power relations are in the making. Novel services also mean new expertise, new professions/activities, and, thus, new decision-making processes in relation to *what* and *who* is seen, all enabled by drones.

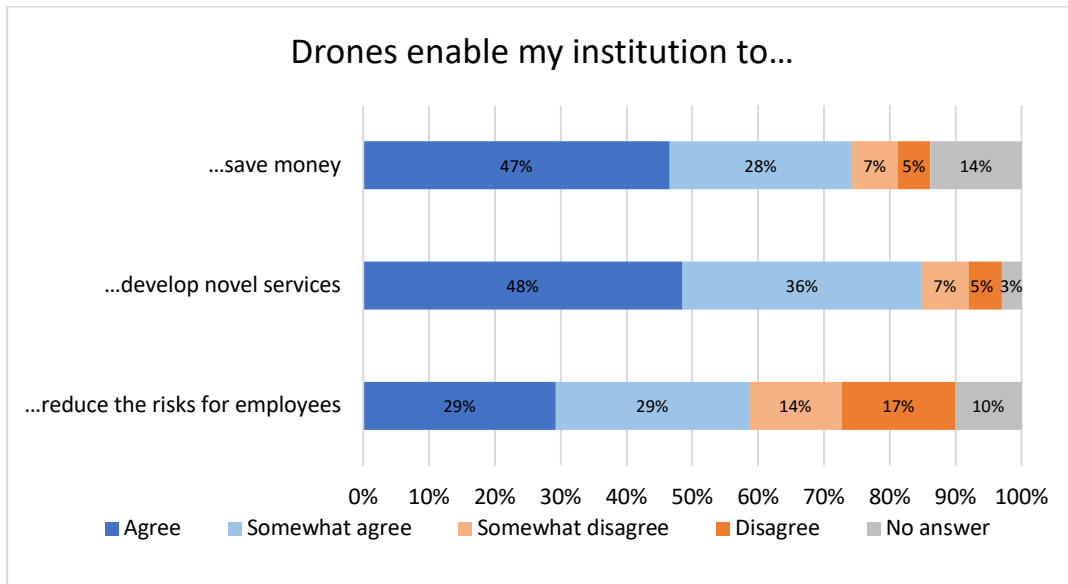


Figure 9: Drones enable my institution to..., N=58

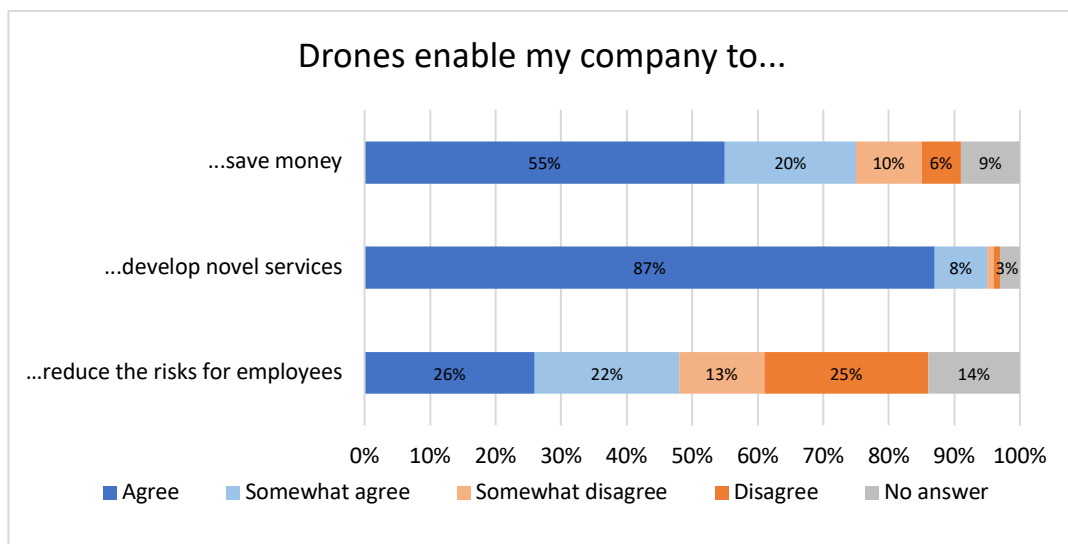


Figure 10: Drones enable my company to..., N=243

In addition, Figure 11 shows that the use of drones has become indispensable for 83% and 75% of public institution and private company drone users, respectively (considering the “agree” and “somewhat agree” responses).

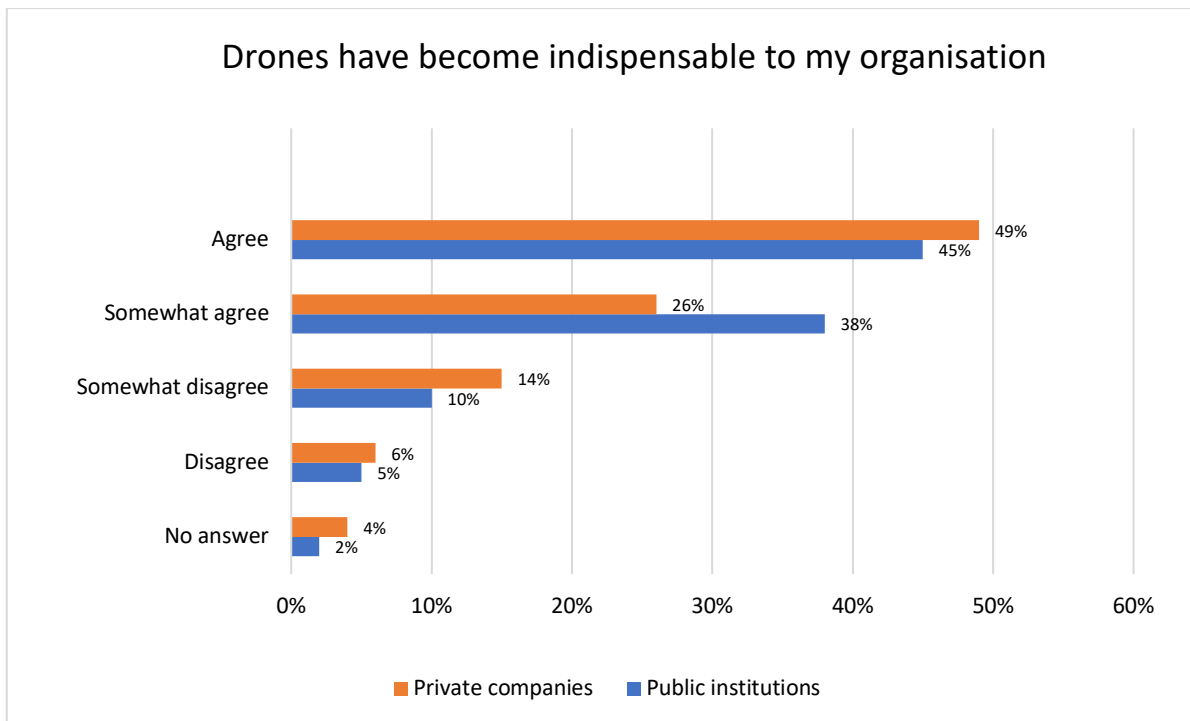


Figure 11: Drones have become indispensable to my organisation, N=242, N=58

These results can be brought into dialogue with the survey participants’ responses with regard to the main advantages of drones: in relation to the users for whom drone technology has become indispensable, the most important advantage is the ability to see places that are far away or difficult to access from a vertical perspective (Figure 12).

Here, we see two important aspects coming to the fore. First, these results reiterate that the remote gaze, both horizontally and vertically speaking, tends to perpetuate itself once it has been discovered. Second, visibility in cases where it would not otherwise be possible appears here as a motivation for drone usage. Drones produce and perpetuate visibility in cases in which no visibility was possible before. Equally, we argue that this means that a new vertical gaze becomes established and that this, in turn, also signifies that a new specific form of knowledge production takes place. This knowledge production is in itself bundled around visibility as a force that cannot be considered neutral. Much to the contrary, the vertical view the drone enables is also the vertical view that the actors involved have decided to use, work with, and sell to others. In other words, this is a conscious, strategic, and empowering strategy that drone users mobilise to establish visibility as their core business.

However, the picture is very different for some specific drone users—for example, for the security industry in the private sector and for the emergency medical and rescue services (not linked to fire services) in the public domain, of which 0% feel that drones have become indispensable for their organisations (Figure 13). These differences show that drones can have various impacts on different professional sectors, resulting in differing degrees and forms of techno-dependency. This, in turn, underlines the need for more detailed qualitative future research that could provide a better understanding of the reasons why people employ drones and the resulting practices of drone usage.

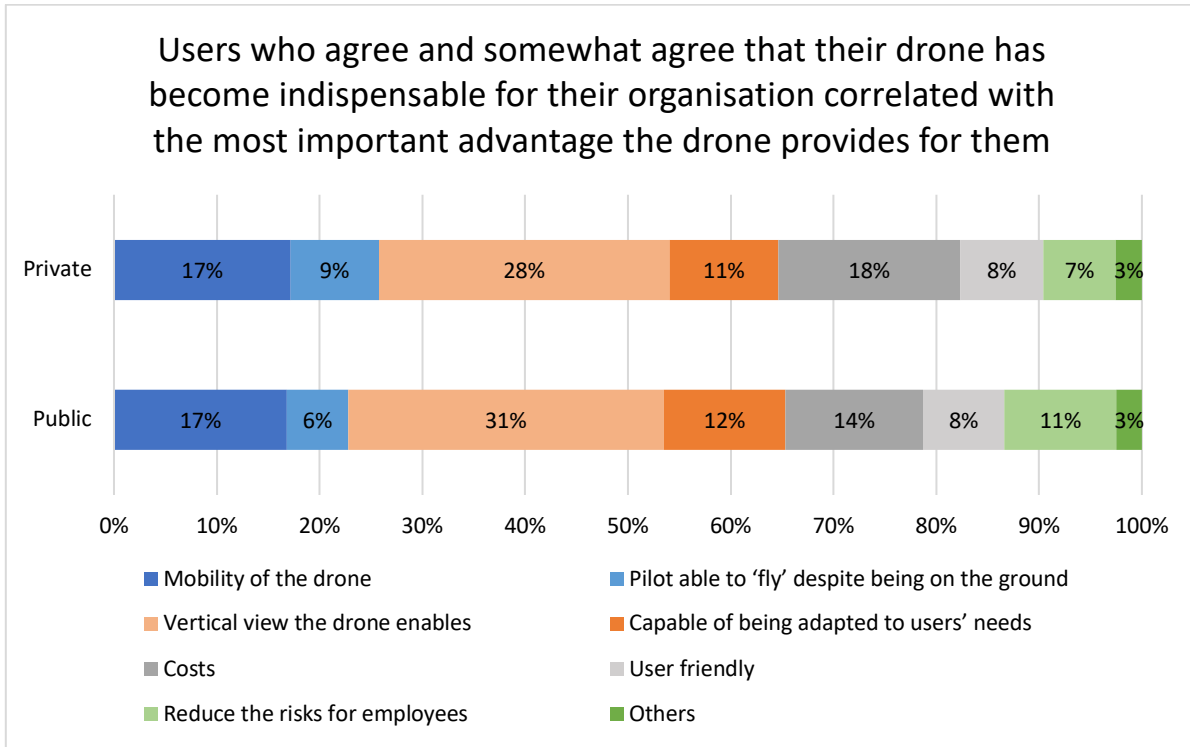


Figure 12: Users who agree and somewhat agree that their drone has become indispensable for their organisation correlated with the most important advantage the drone provides for them, N=174, N=67

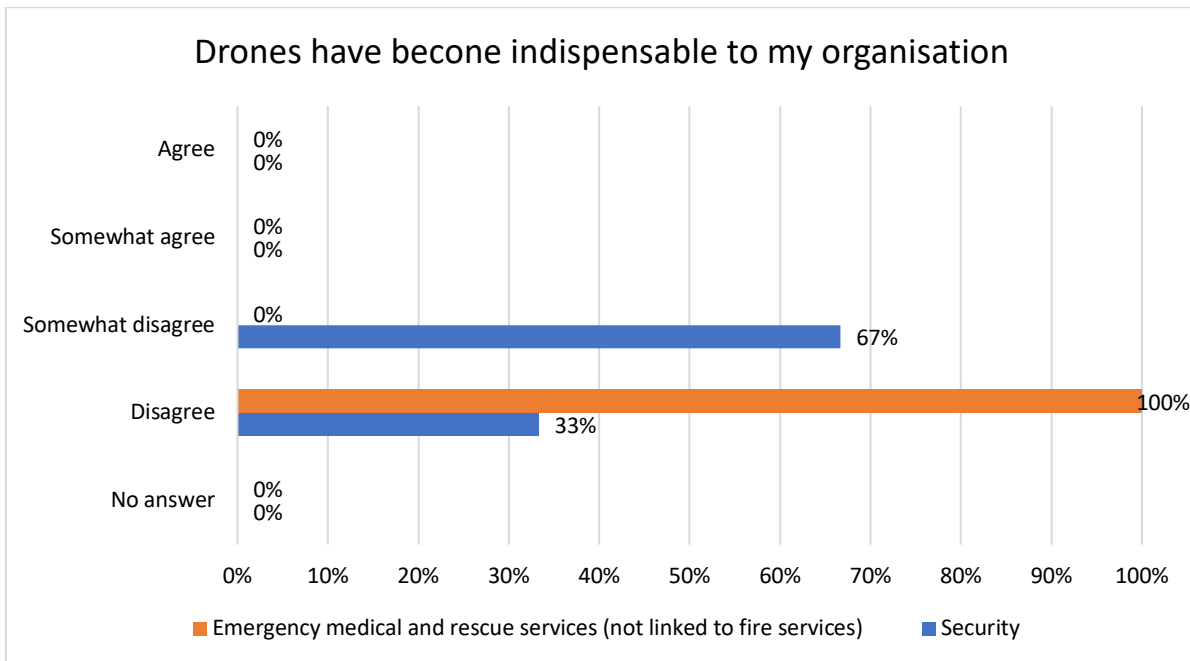


Figure 13: Drones have become indispensable to my organisation, Emergency services N=1, Security N=3

Another revealing dimension opens up when we look at the money involved in professional drone usage (Figure 14). Those companies that indicated they have an income of between a hundred thousand and ten

million francs through drone-related activities are those for whom drones have become indispensable. As seen above, they are mainly from professional sectors in which visualisation plays a key role. We see here how revenues are tied to the actual usage of drones and to visibility. To put it another way, visibility drives and is driven by economic factors. The drone users' businesses both shape and are shaped by visibility, and the market is initially shaped by companies that discover the airspace through new drone technologies and then further shaped by the visualising services these companies offer. For the public institutions, visibility is important but can be considered as an auxiliary motivation to their other core tasks such as policing, firefighting, or operating other emergency services. This also resonates with Mark Andrejevic's (2016) work and his argument that drone usage is deeply embedded in commercial reflections by its users because the technology enables the creation of new businesses in new fields, businesses that only require a relatively small amount of effort and a moderate financial investment to produce a sizeable economic return.

This triggers a reflection as to what place the visual and the "socially visible" have in a "supply and demand market" (Brighenti 2007: 327). When the power involved in visibility means having the capability to decide what should be made visible and what should not, then we can see here how these decisions are aligned with economic purposes. In addition, it is a reminder of how much visibility responds to specific needs and also to certain expectations (Brighenti 2007: 326), which here appear to be commercial and financial interests. The data from this part of the survey underline our assumption that professional drone use is, therefore, not rooted in the motivation to carry out well-planned, routinised, and systematic surveillance missions. Here, drone usage appears as a multisided, diverse, and random activity that is of commercial interest to the actors' network, a network that offers and asks for services. Seeing this in the light of a Foucauldian power analogy, new knowledges are brought together and are reassembled as actions resulting from other actions.

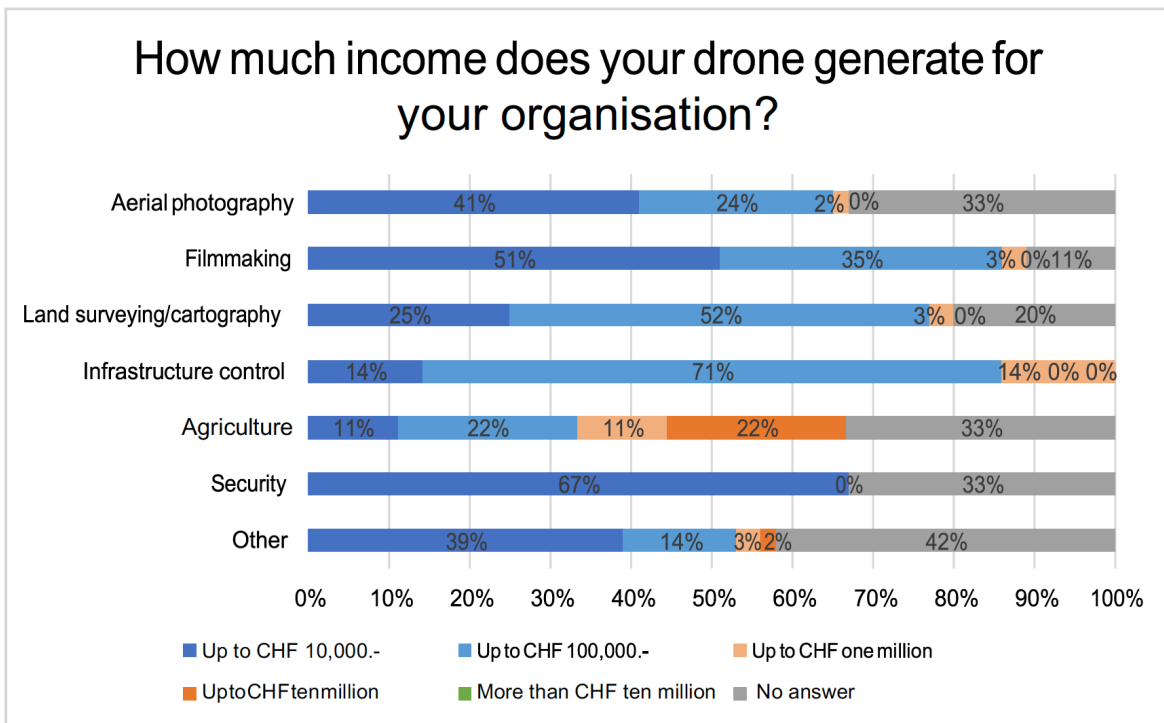


Figure 14: How much income does your drone generate for your organisation? N=239

Conclusion

Drawing upon our large-scale survey of professional drone usage in Switzerland, and channelled through Andrea Brighenti's (2007, 2010) understanding of visibility, our analysis adds a different viewpoint to the

literature that currently interprets and focuses on drones as new technologies of urban surveillance (Wall and Monahan 2011; Neocleous 2013; Jensen 2016). Following the analysis of our survey results, this different viewpoint asserts that, in Switzerland, neither public institutions such as the police nor private companies use drones in a systematic and routinised way for urban surveillance purposes. Much to the contrary, drones are used in far more sporadic, fragile, and diverse ways. Professional drone usage by public and private actors and all the problematics attached to it are, first and foremost, rural phenomena. Within these rural spaces, drones are being used to enable and establish new ways of seeing, open up new professional fields, produce totally new ways of collaboration and commercial possibilities, and mobilise a myriad of different actors in these new fields. We here reiterate some of the main findings from our analysis in connection with the (1) relational, (2) positional–territorial, and (3) strategic–processual qualities of the visibility conveyed by drones before continuing with some conceptual reflections and outlining some expected future evolutions in the field that ask for more extensive research.

Relational Visibility

The numbers provided here underline the extent to which public institutions and private companies alike currently mobilise drones, create new working areas, and drive technological innovation. From policing, aerial photography, and filmmaking to agricultural practices and land surveying/cartography, drones have become daily working tools in manifold professional fields. In this process, novel forms and logics of visibility are produced, which, in turn, enable and foster new collaborations and interdependencies within and between public and private organisations.

Yet, there are important differences in the specific logics and forms of visibility created by public and private organisations. For private companies, especially those specialising in aerial photography, filmmaking, and land surveying/cartography, visibility is at the centre of their activities and represents their main professional motivation. Public institution drone users, in contrast, add the technology to their existing work routines in a more pragmatic fashion.

In both cases, our findings show that drones are not deployed primarily for the purposes of routine, focused, and systematic work—meaning surveillance (Lyon 2007). Rather, the technology is used in sporadic and variable ways. Hence, we use a framing that understands drones as techniques of vision and visualisation rather than as techniques of surveillance. Although this allows for a wider focus on the unsystematic visibilities created by drones as increasingly mass-marketed devices that have many and varied public and private uses, it by no means implies that drones are in any way unproblematic or neutral. Indeed, it is the very complexity of the visibilities created, and their unsystematic nature, that raises all kinds of new power issues, regulatory challenges, and further questions that need to be addressed in future research. One of these is the new way in which visibility becomes both a social and political issue as a result of the proliferating use of drones.

Positional–Territorial Visibility

The sites above which drones operate have been revealed in this study as primarily rural and peripheral rather than urban and central. Here, drones are deployed to produce pragmatically motivated forms and formats of visibility, which in turn allow novel services and mediate specific actions on the ground. It is also in this sense that visibility territorialises the very spaces in which it is being produced (Brighenti 2007: 326).

Therefore, visibility is being produced at varying altitudes—in the case of private companies this tends to be higher up than with drone users in public institutions—and in direct contact with the ground, given the importance attached to the fact that drones look down from above (replacing helicopters rather than spatially anchored cameras) but are piloted from below. This reiterates the fact that the drones’ territorialisation through remote “vertical mediation” (Parks 2016) takes place in an intimate and reciprocal *mélange* between the ground and the sky.

Strategic–Processual Visibility

Our survey data have revealed that the production of visibility through drones is driven by very pragmatic considerations: it makes existing services cheaper and safer and offers opportunities for novel practices that the actors would not have had without the technology. Interestingly, once discovered as a working tool, the technology seems to be perpetuating itself.

More specifically, although private drone users perceive drones to be economically beneficial, this is in relation to modest incomes. Our study thus reveals the emergence of a dynamic branch of economic activity in which drones are often used weekly or at least monthly by relatively small companies who would not be able to do what they do without the new technology at hand. In sum, the relatively straightforward legislation pertaining to drone usage and the ease of purchasing and operating drones have made visibility an easily accessible supply and demand market. Drones have led to the emergence of a novel form of entrepreneurship, that of the aerial gaze.

Drones, Visibility, and Power

As shown above, the survey results highlight some interesting aspects with regard to how we can understand professional drone usage at this particular contemporary moment in Switzerland. However, the results equally provide the opportunity to think beyond our specific case study. Mainly, the results can help us to say something more about power and visibility and how they interrelate and intermingle in the capabilities, usage, and proliferation of the drone technology. We want to raise three main conceptual points before moving on to consider the possible future evolution of drone technology.

First, we comprehend power in a Foucauldian tradition as actions resulting from other actions and not as something that naturally inhabits specific actors or objects; power can only exist when “it is put into action” (Foucault 1982: 790). Drones breathe fresh life into relational concepts of power because they offer multiple possibilities of usage by so many different actors. Drones, in this way, diversify the exercise of power and multiply the possibilities of actions resulting from other actions. As an example, consider the myriad of different professions, ranging from aerial photography to infrastructure control, that today use drones as their core business and, thereby, react to and act upon actions resulting from other actions.

Second, power techniques and actions resulting from other actions always imply the creation of new forms of knowledge (Foucault 2007: 182). This is what professional drone usage is about. Consider our findings in the light of how drones open up a wide field of new professionals who use drones not only as instruments to assist their work in professions that already exist, such as the police, but also as tools that produce completely new fields of action. Aerial photography and filmmaking are professions that directly produce, reassemble, and transform new and old forms of knowledge and expertise. Add to this new companies such as those that use drones with specialised cameras to detect crop diseases, for example, in vineyards. These novel dynamics of knowledge also produce new actor networks, such as those between private and public players, in emerging fields of operation; these networks are brought together and react to each other through the mobilisation of drones.

Third, we refer back to what we outlined as visibility’s non-neutral form. The decision as to who, where, when, and what is made visible is never of a neutral nature (Brighenti 2010: 187). Rather, it is here explicit that power and visibility must be understood as mutually relating to each other, in this way co-producing visibility as “a field of action and affection” (Brighenti 2010: 44) and establishing an alliance in which power as a technique constantly offers the possibility of reaction, redistribution, and resistance (Foucault 1982: 793). For example, our survey results show it is the private companies that state the drone technology enables them to save money, develop novel services, and reduce risks for their employees (see Figure 9 and Figure 10). Here, the technology affords a direct possibility of reacting to, resisting, and redistributing possible threats imposed by the market in which these companies operate.

Future Evolution

Taking a step back from our results, there is much potential in thinking beyond the national (Swiss) context explored here. A pressing question is how civil drone usage is developing in other countries. Essentially, how is professional drone usage developing in rural regions in countries other than Switzerland, and how will it develop in the future? What legislative differences are there, and how do they affect the use of drones? What are the global trends in professional drone usage, and to what extent do social and cultural differences limit or accelerate the proliferation of this technology? What kinds of private and public actors and interests are involved in these processes, and what kinds of legal and societal regulations are required?

This kind of research agenda is particularly important if we consider the potential future evolution of professional drone usage (Figure 15). Sixty-three percent of private company drone users believe their drone will be used more frequently in the future, and 68% state that their current drone will be improved or replaced for increased performance. Furthermore, 38% agree and 40% somewhat agree that peer companies will also be using drones. In other words, drone usage is expected to increase in the coming years. This makes the question of visibility as power an even more urgent topic for research.

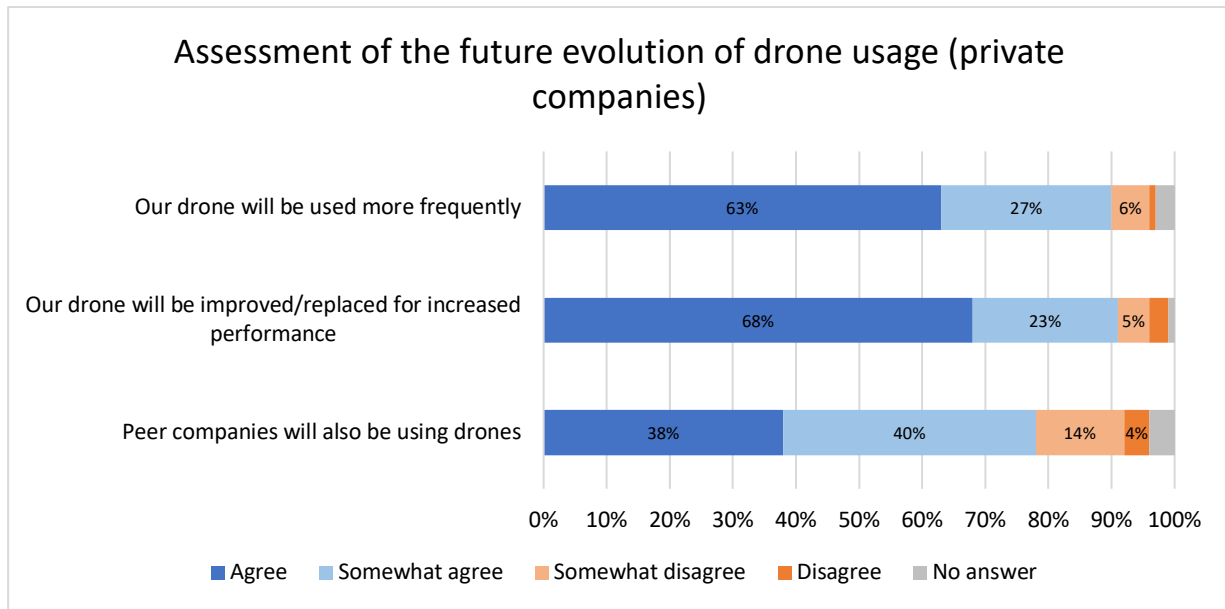


Figure 15: Assessment of the future evolution of drone usage (private companies), N=239

Thus, in the future, Paul Virilio’s (1994) futuristic imaginings will gain further relevance and momentum. Visibility from and through the air has marked the past, shapes the present, and will continue to play an ever more fundamental role in the near and distant future.

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