

Drone Society: An Abductive Analysis of Civilian Drone Culture

by

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Dissertation Abstract

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Title: Drone Society: An Abductive Analysis of Civilian Drone Culture

While Sociology has historically engaged with the transformative social experiences associated with technology since the Industrial Revolution, the study of civilian “drones” (or unmanned aerial vehicles) in their current societal ubiquity has surprisingly remained neglected. This dissertation addresses this gap by taking the under-examined practice of civilian drone operations as its object of analysis and conducting an in-depth inquiry into civilian drone culture. Through an abductive, multi-sited investigation of drone pilots’ experiences, this study provides a sociologically-informed understanding of the processes that structure the identities and social practices of civilian drone pilots, as well as their role in the shaping of technonatural knowledge within the rapidly expanding “Drone Society”. By doing so, this dissertation positions civilian drones and their pilots as central components within an emergent social order, extending them far beyond their militaristic contexts, regulatory concerns, and other technical domains. Through its research questions and an interdisciplinary approach, the dissertation examines the mechanisms that concern the process of “becoming” a drone pilot, the nature of work within the drone society, the relationship between precarity and the use of civilian drones, and finally, the influence of drone media (i.e., drone photographs, videos, and other data) on perceptions of both, built and natural environments. Analysis of data collected through 29 in-depth qualitative interviews, participant observation, and digital ethnography performed over a year reveals how civilian drone pilots construct and negotiate their identities within broader technocultural networks and how civilian drone culture is often marked by a spirit of collaboration, economic informality and the exchange of specialized forms of knowledge. This dissertation’s findings also

furnish an examination of the gendered dimensions of drone operation, highlighting significant exclusionary practices that result from the masculinization of technical expertise and novel forms of precarity that civilian drone pilots are exposed to daily. Crucially, the analysis reveals how the use of drones and drone media creates dual perceptions of environments (on a physical and digital level), and how an interplay between physical and digital realities fosters new forms of spatial knowledge, awareness, and experience, thus reshaping how people perceive and engage with their surroundings. Collectively, these findings underscore how drones are redefining social organization, leisure, work, and epistemic practices, thus positioning them as influential actors in the contemporary sociotechnical landscape.

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For my parents, Pavitra and Sunil.

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The Road goes ever on and on
Down from the door where it began.
Now far ahead the Road has gone,
And I must follow, if I can,
Pursuing it with eager feet,
Until it joins some larger way
Where many paths and errands meet.
And whither then? I cannot say.

— J.R.R. Tolkien (2009[1954]),
The Fellowship of the Ring

I owe my first real debt of gratitude to my mother, Pavitra Issar, who would consistently read to me when I was a toddler, and unfailingly encourage me to read as I could as a young child and as a teenager. If it wasn't for her faith in me despite many of my own failures, naysayers and hurdles that came along the way, I wouldn't have finished this dissertation. She stood by me when many others didn't and believed in me when many others stopped doing so. Thank you, mom!

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My desire to pursue a scholarly life evolved over time. It was in the eighth grade that I first thought of pursuing a career as an academic (and as a historian, no less!). As someone who had always been a curious child, I had many questions about the past and present that simply hadn't been responded to well enough by my teachers at the time. Unfortunately, most of my curiosities had been

stamped out of me by the rigid institutional structures that most public schools subject children to. The dream of being an academic remained a dream for the many years where I conformed to what my peers had apparently thought of as careers paths for themselves. And with my father's passing in 2004, the pathway of a conformist seemed even more reassuring as I had justifiably equated conformity with the acquisition of many different forms of stability in my life.

It wasn't until 2014 that I arrived at a fork in the road and had to think more carefully about being purposeful with my future. Following an enduring and uncomfortable spell of unemployment, I had the option of following up my undergraduate education as a business major with an MBA or taking up a funded year-long postgraduate liberal arts fellowship at Ashoka University where I'd have the chance to think more critically about my interests. I knew nothing of what it would mean to be an academic at the time, nor did I know my odds of success; my immediate family was devoid of individuals who had pursued a career in academia. With no real idea of what the outcome would've been, I turned towards what had been the road not taken, and there's been no looking back.

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My time as a doctoral student has been unconventional like many other experiences in my life. At the University of Wisconsin-Milwaukee, where I began my first year in August of 2019, I received

about six months' worth of in-person coursework before the COVID-19 pandemic happened. The less I say about the many months of remote work that followed, the better, but I do wish to convey my heartfelt thanks to the many Professors, graduate students and friends who supported me extensively throughout the entirety of my time there, and in the time that has transpired since I left UWM. Among the Professors, Prof. Cary Gabriel Costello, for showing me that there is nothing more valuable than acts of kindness in the classroom; Prof. Timothy L. O'Brien, for their insightful critiques of my work; Prof. Marcus Britton, for making advanced statistics fun and accessible; Prof. Erin Parcell, for the best methods course I've ever taken; Prof. Kent Redding and Prof. William Vélez, for their friendship. Among my fellow graduate students and friends at UWM Sociology (and their families): Dr. Antonio Paniagua Guzmán, Jeffrey Kroll, Adam Loesch, Reggie Wynn, Juhee Park, Boci Meng, Stephen Hawkins, Brian Thomas, Dr. Vijaya Tamla Rai, Hannah Smith, Kristen Schmidt. And those in other departments: Dr. Jan Kretschmann, Matthias Schilli, Ati Gurcay, Dr. Sujin Oh. Among UWM Sociology's Alumni: Dr. Stephanie Baran and Dr. Daniel Bartholomay – for their consistent support over the past five years. And to Sarah Weidner, the Department of Sociology's administrator. I owe you all so much.

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List of Abbreviations

Actor-Network Theory (ANT)
Beyond Visual Line of Sight (BVLOS)
Built-to-order (BTO)
Business-to-Business (B2B)
Business-to-Consumer (B2C)
Business-to-Government (B2G)
Cost to Revenue Ratio (CRR)
Directorate General of Civil Aviation (DGCA)
Drone as a Service (DAAS; or DaaS)
Drone Federation of India (DFI)
Federal Aviation Administration (FAA)
First-Person View (FPV)
Geographic Information Systems (GIS)
Great Trigonometrical Survey of India (GTSI)
Human-Drone Interaction (HDI)
Human-Robot Interaction (HRI)
Indian Drone Racing League (IDRL)
Indira Gandhi Rashtriya Uran Akademi (IGRUA)
Interagency Committee for Aviation Policy (ICAP)
Large Language Models (LLMs)
Local Hobby Stores (LHS)
Obligatory Passage Points (OPPs)
Remote Pilot Certificate (RPC)
Remote Pilot Training Organization (RPTO)
Remotely Piloted Aircraft (RPA)
Remotely Piloted Vehicle (RPV)
Science and Technology Studies (STS)
Serious Leisure Perspective (SLP)
Social Construction of Technology (SCOT)
Sociology of Scientific Knowledge (SSK)
Survey of Villages and Mapping with Improvised Technology in Village Areas (SVAMITVA;
also Swamitva, or SWAMITVA)
Unique Identification Number (UIN)
Unmanned (or Uncrewed) Aerial Systems (UAS)
Unmanned (or Uncrewed) Aerial Vehicles (UAV)
Unmanned Traffic Management (UTM)
Visual Line of Sight (VLOS)

Introduction

For a discipline known for its early engagement with the industrial revolution, bureaucracy, and factory labor (“until the last ton of fossilized coal is burnt” - (Weber 2002[1952])), and whose reflections on technology (“The hand-mill gives you society with the feudal lord; the steam-mill, society with the industrial capitalists” - (Marx 1920[1847])) laid the groundwork for the debate not only on technological determinism (Heilbroner 1967; Smith and Marx 1994) but also whether industrial modernity had birthed a new kind of being, there has been surprisingly little engagement in sociological literature with the rapid evolution and proliferation of drones as an omnipresent element of contemporary society and their growing importance in social organization (for notable exceptions, see Hildebrand 2019; 2020a; 2021; Hildebrand and Sodero 2021).

Indeed, we are living within a “Drone Society”. The sociology of drones has been examined extensively in a militaristic context (Allinson 2015; Wiesner 2018; Wilcox 2017b; Elliott 2019; Suchman, Follis, and Weber 2017) and in the context of protests and organized forms of political resistance (Zuev and Bratchford 2020b), but the sociology of civilian drones remains comparatively under-developed. The literature on civilian drones tends not to take the drone itself as an object of analysis as part of an emerging social formation; rather, it tends to focus on its various applications in natural resource management, crop conditions, human geography as well as the ethics of collecting and analyzing aerial data on people in public places and the legal, safety and regulatory frameworks across various jurisdictions and areas (Smith 2015; Finn and Wright 2016; Luppicini and So 2016; Birtchnell 2017; Weller 2020; Rogers et al. 2022; Hafeez et al. 2023). It encompasses a range of dimensions deeply embedded in our societal patterns, which when applied to the study of technological artefacts such as drones, reveal them as subjects of great sociological interest.

In order to delink drones from their military origins, there have been efforts to encourage the use of terminology more reflective of civilian uses. Scholarly literature often labels them as unmanned aerial vehicles (UAV), remotely-piloted aircraft (RPA) or vehicles (RPV), unmanned aerial systems (UAS), or the more recent, gender-neutral term, uncrewed aerial vehicle (UAV) (Custers 2016; Hall and Wahab 2021). However, the term "drone" persists in public as well as industry discourse. Therefore, in this study, I retain the term "drone," specifically referring to the aerial systems used to collect photos, videos, and other forms of data.

Both leisure and work have been greatly impacted by the use of drones, but few studies have chosen to make the former a subject of inquiry (Tham 2020). Drones have become popular devices for leisure activities such as drone racing, videography and photography, and have changed the dynamics of our leisure, entertainment and even tourism (Vujičić et al. 2022). Drones have also transformed our experiences of outdoor activities, offering new perspectives and opportunities for interaction that were previously unavailable. The rising significance of drones within the domain of leisure brings the concept of "serious leisure" (Stebbins 1982; Veal 2017) and the discourse on the re-imagining of leisure in the digital age (Silk et al. 2016) into focus. "Serious leisure" denotes pursuits that people undertake with the same earnestness and dedication typically associated with work, and as drones transition from simple playthings to devices requiring substantial skill, knowledge, and experience, their use fits well into this concept. This viewpoint provides a sociological lens for understanding the deeper social and cultural implications of their use, shedding light on new social dynamics, identities, and communities formed around this burgeoning form of *technoleisure*.

From the perspective of work, drones have proven to be utilitarian in a number of industries, from delivery services to agriculture and real estate, revolutionizing our work environments by mediating them in innovative ways. They often redefine what is considered professional practice, pushing the limits of possibility, and revolutionizing the way various businesses function. This shift

not only affects local and global economies, but also the social aspects of work, including job roles, skills, and relationships between employers, employees, and customers.

Additionally, the discourse surrounding drones often intersects with concepts of masculinity (Salter 2014; Kunashakaran 2016; Bellamy 2018; Clark 2018; Olson and Labuski 2018; Bjerre 2023). The operation and control of drones, along with their technological complexity, subtly reinforce gendered stereotypes (Wilcox 2021), associating drones with technical expertise and control, which are often seen as masculine traits. The marketing, usage, and discussions surrounding drones may perpetuate these stereotypes, adding another sociological layer to their influence. There could be implications for civilian drone operator culture, such as the marginalization or exclusion of non-male identifying individuals or certain other minorities, indicating the necessity for further exploration in this area. As such, the sociology of civilian drones unveils a compelling intersection of technology, society, and culture, necessitating thorough interdisciplinary investigations. My work in this dissertation provides an analytical framework for such investigations, while affording an investigation of its own.

In this dissertation, I argue that the contemporary age is witnessing the rise of a new societal construct - the “Drone Society”. This metaphor encapsulates a society profoundly influenced by, and potentially even organized around, drone technology. Drones, within this framework, transcend their roles as mere tools to become influential actors shaping societal, economic, governmental, and ecological dynamics. Their impacts ripple across various facets of life, transforming work, leisure, public discourse, and the production of various types of knowledge and media, to name a few. A comprehensive understanding of this “drone society” calls for an in-depth sociological study of civilian drones. An examination of this nature ought to encompass ethical dimensions, policy considerations, matters of access, and the profound influence that drone technology has on our perception and understanding of both, built and natural environments (to name a few). Before I dive

into the focal areas for this dissertation, I wish to highlight certain arguments, considerations and points of information that would be accounted for in the questions that this dissertation seeks to answer.

What one must consider for starters, is that the ethical dimensions and policy considerations of civilian drone usage present multifaceted challenges (Boucher 2014). Striking a balance between the merits of drone technology and concerns related to privacy, safety, regulations, and noise/environmental pollution (amongst others) requires nuanced decision-making by policymakers. Communities worldwide tackle these issues through varying approaches, reflecting their ethical values, legal frameworks, and societal norms, which is why the sociological study of civilian drones is best studied from a multi-sited perspective. Unpacking these facets offers insightful revelations about societal priorities and the broader implications of technological progress across the world.

The issue of access to drone technology surfaces as a significant sociological concern and potentially, as a symptom of the digital divide. The digital divide – the unequal distribution of technology – naturally extends to drone technology. By probing into questions such as who gains access to drones and who benefits from their usage, we can unearth and potentially amplify existing social disparities and social inequalities (Estrada 2017), ranging from economic to educational divides.

It is also worth noting that drones intended for civilian use also meaningfully alter our perception and understanding of our environment. They provide unique vantage points, both physically and symbolically, revolutionizing fields such as environmental science by facilitating novel and efficient forms of data collection and exploration, hence reshaping our comprehension of the world. Utilizing drones for environmental surveillance, agriculture, disaster management, and scientific research also shifts the epistemological frameworks underpinning our understanding of the natural world.

An investigation into the sociology of unmanned aerial vehicles thus encompasses a multifaceted exploration of the function, influence, and consequences of drone technology within our communities. This dissertation's inquiries probe the sociocultural, economic, ethical, and environmental dimensions of this technology, unveiling intricate interrelationships between the myriad agencies of societal frameworks and technological progress, particularly within the domains of labor and recreation. Furthermore, the correlation between drones and gender, which may subtly reinforce masculinity by associating it with technical proficiency (amongst other factors), is also a topic that merits scrutiny. Finally, drones have a significant impact on *technonatural knowledge production* by enabling unprecedented remote sensing capabilities that alter our understanding of the environment. These factors collectively underscore the criticality of social scientific research in the field of civilian drones, particularly in today's world, which is increasingly integrated with these devices.

In conclusion, the rise of a "drone society" is a testament to the profound interplay between technology, societal structures, and cultural norms. As we navigate this dynamic landscape, it becomes increasingly vital to critically examine the multifaceted impacts of drones, recognizing them as more than just mere tools, but as influential actors within the fabric of society. Their capabilities extend beyond their technical attributes, shaping and being shaped by society, culture, and gender. The study of this drone society therefore constitutes a rich and complex interdisciplinary endeavor that is key to understanding our technologically mediated world.

The Introductory section of this dissertation provides a brief overview of what the field of drone studies is, and how it came to be, following by an overview of the research questions, methods and data that are used in this dissertation. The introductory section concludes with an overview of the chapters that follow.

1. What is Drone Studies?

“Drone Studies” might seem like a confusing term at first, but that needn’t be the case. It is quite simply in the broadest sense, the study of drones, encompassing all their social, economic and technical aspects, for the three can never fully be disentangled from each other. But if this was all that it was, this section of the dissertation would end right here, and I wouldn’t need to say more. I shall attempt to add some nuance to this definition further along in this section.

Considering how the identity of “drone studies” is in flux, the “history of drone studies” becomes an equally complex area of study to define. As a Sociologist and a scholar of Science and Technology Studies (STS), I am quite naturally tempted towards acknowledging Chamayou (2015) and Rothstein (2015) as the first “true” drone studies scholars, given the popularity of their work and their focus on onto-epistemological analyses of power, but there were many scholars who worked on different social and/or technical aspects of drone technology many years before them. For example, Schörnig (2014) writes about why drones were popular among western militaries, Leander (2013) spoke of how the agency of drones was a crucial factor in the formation of legal expertise concerning federal drone programs in the United States, and Jutta Weber (2010) used drone warfare as an example of security architectures that compelled them to write about how feminist technoscience studies had changed after 9/11.

This is where it might become apparent that drone studies is not necessarily an entirely new field of inquiry, and that different disciplines have studied (and/or aided the development of) drone technology at varied points of time. As a field, drone studies rests upon a long accumulation of histories – including, but not limited to – the history of aviation, the history of aerial photography in the late 1800s (or the history of photography itself, for that matter), the history of aerial communication and surveillance during the first World War (Amad 2012), the history of the militarized

drone in the 1900s (Hall 2024), and the nature of Human-Drone interactions in the post-2000 era (to name a few). The focus on studying disembodied aerial “vision”, verticality, aerial mobilities, policing, militarization, and surveillance in connection with drones has endured over time. More technical fields such as robotics (Suzuki 2018), and human-robot interaction (HRI) or human-drone interaction (HDI) articulate their own domains of interest with slight (or pronounced) differences (Herdel, Yamin, and Cauchard 2022) between each other. Depending on who you might ask or whose work you might read, you might receive a very different explanation concerning the origin of drone studies. Take for example, how as a form of inquiry, Bratchford and Zuev (2020) situate drone studies within the context of a “visual sociology of the sky”, inspired by the vitality of a “volumetric turn” towards observing society as noted by in Weizman (2004), which could, in turn, be placed within a longer history of the sub-discipline of visual sociology (Henny 1986).

I must confess that I am inspired by Foucault when it comes to the ways in which I think about history (Foucault 2002[1969]), but I do not claim to apply his methods in a comprehensive manner; my approach towards delineating the history of drone studies is simplistic by comparison. A firm application of his methods (to the history of drone studies) lies far beyond the scope of this dissertation. Genealogies of drone studies are wildly varied in their framing as well: While Fish and Richardson (2022) draw on the genealogies of “environmentality, humanitarianism, securitization and militarization”, Rothstein (2015) masterfully elicits a historical framing of the drone through the histories of the automobile, aircraft, computer and robot. Genealogies, in this way, are subjected to either a logic of convergence or divergence, leading to a curated framing of the history of the drone, and by extension, the history of drone studies itself.

In framing a genealogy of drone studies through the interdisciplinary field of STS, I rely upon these complementary logics of convergence and divergence and offer a way of understanding how drone studies can also be approached as a postmodern, postcolonial area

of study. By doing so, I also reveal how the metaphor of the “drone society” might be best understood and applied in different contexts. Postcolonial projects often benefit from resisting analytic bifurcations and prioritizing relational theories (such as Actor-Network Theory) over substantialist thinking (Go 2013). This will become clearer through a close reading of the following sub-sections, which also provide a basis for understanding why I prioritize the use of Actor-Network Theory and Niklas Luhmann’s Systems Theory in the subsequent chapters.

1.1 A Brief (and Relatively Simplistic) History of Science and Technology Studies (STS) – Part One

To begin with, I must highlight that the brief history of STS that follows from here provides a “sociological starting point” (Wiesner 2018) for my work within the field of drone studies. Most crucially, it helps understand why it matters to approach drone studies as a postcolonial project in the present moment, and how the field of STS has provided a conceptual basis for it to be worked upon. The history of STS presented here is, therefore, a selective history of STS, framed in a way that makes certain exclusions that aren’t entirely relevant to how I came to understand the emergence of drone studies, or situate the theoretical and empirical contributions of this dissertation. Yes, even a few canonical ones.

There’s another disclaimer that I must provide. Where the epistemological logics of convergence/divergence are concerned, it becomes necessary to embrace the view that all forms of scientific knowledge establish divergences (Haraway 1988) that extend well beyond the domain of science/technology. More than often, these divergences might even come from outside of scientific/technological communities, or from the “general public”, for that matter, owing to how knowledge is constructed and/or perceived. Therefore, pinning down the way in which these divergences are generated through “key interventions” by certain individuals might only be meaningful

to those seeking to establish a genealogy of STS through a certain historical/ideological lens or model (Lamy and Saint-Martin 2015), given how the field is constantly evolving and re-arranging its body of knowledge. Interpretations of what could be thought of as a “key intervention” too, will shift, perhaps even into obscurity, as time goes by. Historically speaking, the majority of what have been deemed to be key interventions within STS have stemmed from western, male-dominated epistemic communities (Keller 1982; Faulkner 2001). The politics of difference that emerged through more recent feminist, queer and postcolonial turns within STS challenged this paradigm and made it necessary to welcome new epistemological formations within the field. These new formations possess genealogies of their own, which *productively* problematize what could be seen or debated upon as a key intervention by decentering the politics of the field itself.

Having prefaced those two disclaimers, I shall proceed with this modest, selective history of STS. Much in the way that Gieryn (1999) might recommend, I utilize the work of Kuhn (Kuhn and Hacking 2012) as one set of “temporal coordinates” that might help with the navigation and loose/fluid boundary-work of the STS landscape. This approach is not unique by any means or measure, as Thomas Kuhn’s writings have been extensively developed as a set of “coordinates” that has made it easy to distinguish “pre-Kuhnian” science studies (Ball 1976; Kaplan 1981; Ramsey, Stich, and Garan 1990; Thomas 2020) from a “Mertonian-Kuhnian” sociology of science (Restivo 1981; Collins and Restivo 1983), and “post-Kuhnian” STS.

At the risk of sounding slightly reductive, **pre-Kuhnian science studies** was largely characterized by the work done by the “Vienna Circle”, which situated itself within the domain of logical empiricism (Ferrari 2014). Their influence, however, was far from absolute. Within the pre-Kuhnian tradition, one must also pay attention to the writings of Ludwik Fleck (1979), given that his skepticism of the Vienna Circle signaled tensions with the notion of scientific rationality (Engler, Renn, and Schemmel 2018). Originally written in German in 1935, Ludwik Fleck’s *Genesis and*

Development of a Scientific Fact presents the ideas of “thought styles” and “thought collectives”, which might seem uncannily similar (and perhaps even identical) to Kuhn’s research on the “scientific paradigm” and the “scientific community” (Mößner 2011), though they are not. Key differences emerge between the two sets of terms when the “constructive scope of the social” (371) is examined, with Kuhn’s terms being the more restrictive of the two. Karl Popper emerges as another prominent figure of interest within this era, as he possessed a complex relationship with the Vienna Circle that might lead some scholars to either directly associate with him with its membership or situate him at its boundaries. This could occur on account of the numerous exchanges between Popper and the Vienna Circle, which can be witnessed within the many footnotes of *The Logic of Scientific Discovery* (Popper 2002). In this respect, Naraniecki (2010) clarifies that Popper was not a member of the Vienna Circle, but that he “shared many neo-Kantian philosophies with the members of the circle” (511).

It was, perhaps, Popper’s negative view of Heidegger (525) and Kuhn’s relativistic treatment of “constitutive *a priori* principles” (Friedman 2002) that were two of the key factors that fueled the infamous “Popper-Kuhn debate” (Kassiola 1976; Barnes 1982; Notturmo 1984; Bloor 1991; Fuller 2004; Rowbottom 2011; Omar 2012), whose key arguments can be found in the proceedings of the International Colloquium in the Philosophy of Science held in 1965 (Lakatos and Musgrave 1970). Disciplinary differences between Kuhn and his critics provides a sense of the breadth of this phase of STS, for as Barnes (1982, 58) points out with respect to the proceedings of the aforementioned colloquium, “five of these essays are by philosophers, two are not”. Additionally, the epistemological leanings of Kuhn’s critics gave away a “normative orientation to science” (59) on top of a moralistic one. This is precisely what Heidegger (1977, 70) cautions readers against, as in his view, it would be easy to remain embedded within a moralistic philosophy if any Neo-Kantian preoccupations were to be foregrounded. Kuhn’s position (Kuhn and Hacking 2012) on the other hand, relies upon the idea that the “fundamental presuppositions of one’s practices do not and cannot usually come into

question” (Rouse 1981). His conceptualization rests upon Heidegger’s notions of “authenticity” and “resoluteness”, and more specifically, an “authentic human existence” (285) amidst the chaos of disruptive social practices. It would have been difficult to bring these positions together without witnessing a series of challenges to **Kuhn’s idea of “puzzle-solving normal science”**; Popper’s own comments summarily (and vehemently) dismiss Kuhn’s thesis as “the thesis of relativism” (Popper 1970). Indeed, as Bloor (1991, 62) puts it aptly, the Popper-Kuhn debate represents “an almost pure case of the opposition between what may be called the Enlightenment and Romantic ideologies”, with Popper being positioned as an “Enlightenment thinker”, and Kuhn being classified as a “Romantic thinker” (64).

The next developmental phase within STS might be thought of as a period where a **“Mertonian-Kuhnian” Sociology of Science** occurred. With respect to Robert K. Merton, the “myth of the Kuhnian revolution” (Restivo 1983) might lead people to believe that Kuhn and Merton are completely at odds with each other, but the way in which Kuhn does not treat sociological factors as explicitly problematic (294) is complemented by Merton’s focus on institutional analysis (Ben-David and Sullivan 1975). Both Merton and Kuhn correlate scientific progress with changes in the way by which science is carried out, and both of them posit somewhat similar arguments regarding the role of competition within the sciences, social control within the sciences, the matter of what ought to be or ought not to be considered scientific knowledge, and the very idea of scientific discovery itself (Salmond 1980). One key point of difference between the two of them lies within the determination of the “sociological interpretations of extra-theoretical influences upon the selection of problems for investigation in a science” (Merton 1973), where Merton maintains that a much broader set of “exogenous influences” (555) must be taken into account. Another point of contention emerges with respect to Kuhn’s assumption of how a scientist’s age might affect the way they respond to certain ideas when they encounter them (557) – an assumption that Merton problematizes on account of how

he fails to see any supporting evidence. Most crucially, it was Kuhn's analytic notions of the "paradigm" and "paradigm shift" that were not compatible with Merton's functionalist approach (Armstrong 2013). But despite the differences between the two, the idea of labeling this phase of intellectual inquiry as a partially congruent, "Mertonian-Kuhnian" sociology of science is valid on account of how Kuhn was interpreted as "not only a Mertonian, but...a Mertonian *sans* sociology" (Collins and Restivo, 1983), and how some Mertonians might resonate with a conservative interpretation of Kuhnian thought (Pinch 1997).

Onto the phase of "**Post-Kuhnian STS**", then. While Kuhn's contemporaries and those deriving from his studies relied upon the theses of "rupture and discontinuity" (Joas (ed.) et al. 2016), the post-Kuhnian tradition is one that is largely in support of "gradualism and continuity" (292) and a constructivist approach to science and scientific knowledge. It was in the 1970s that an "epistemic splintering" of sorts occurred and a series of approaches towards the sociological studies of science emerged. As Collins (1983) points out, the "sociology of science" was more or less in opposition to the "sociology of scientific knowledge", or SSK, towards which there were six prominent (and independent) contributors to SSK. Here, Bloor and Mulkey represented two ends of a spectrum (266-271). Bloor (1991) exploited the Popper-Kuhn debate extensively within the development of the Strong Programme within SSK, where he defined the four tenets of "causality, impartiality, symmetry and reflexivity" (7) as ways of studying the sociology of knowledge. This was in direct opposition to teleological assumptions that were prevalent at the time (12). Other prominent work that occurred at the time of this "splintering" include Shapin and Schaffer's (2011[1985]) *Leviathan and the Air-Pump*, which pulled historians and philosophers of science and knowledge into conflict with SSK (Dear 2012) on multiple different fronts, though it was well-received within the field of sociology (Achbari 2017).

The laboratory studies carried out by Latour and Woolgar (1987[1979]) pushed beyond Bloor's theories by ethnographically investigating and sociologically deconstructing and reconstructing

knowledge itself (Tibbetts 1986). Within laboratory studies, narratives would typically be structured through the usage of discursive materials taken from sites of research, and the subsequent examination of how scientific methods would be applied within varying sociopolitical and socioeconomic contexts. The goal here would be to produce alternative narratives that might decenter or destabilize dominant narratives about the process of knowledge production. Knorr-Cetina (1981), Knorr-Cetina and Mulkay (1983), and Callon (1984) are also thought of as seminal works within the constructivist tradition. SSK arguably met its demise at the hands of the infamous “epistemological chicken” (Collins and Yearley 1992), which challenged the degree of pragmatism afforded by Latour and Woolgar’s (1987[1979]) *Laboratory Life* and the work done by Callon (1986) within this domain. *Laboratory Life* could certainly be considered a precursor to Latour’s Actor-Network Theory, or ANT (Latour 2007), which incorporates an engagement with the fundamental, dualistic nature of the social as a “substance” and a “a movement between non-social elements” (159).

The material-semiotic approach developed by Latour, Callon (1986) and others arguably succeeds the theories and methods devised by scholars who worked on the social construction of technology, or SCOT (Bijker, Hughes, and Pinch 1987; Hacking 2000), for as Latour (2007, 95) puts it, “they were never able to offer a reason why science itself could not be scientifically studied”. Moreover, it is worth mentioning that since Collins and Yearley’s (1992) paper was first published, Latour’s ANT has been defended with respect to how it offers an engagement with pragmatism (Latour 1999; Harris 2005; Mialet 2012; Hennion and Muecke 2016), indicating that Collins and Yearley (1992) were not able to fully grasp the subtlety of Latour’s work.

On a different front, a far more civil, collegial and constructive set of critiques and replies was exchanged between Latour (2003; 2004) and Ulrich Beck (Beck and Camiller 2005), where Beck likens Latour and himself to the figure of a “realistic cosmopolitan” that Latour distanced himself from. And on yet another front, Latour and Bourdieu differed with respect to non-human agency and the

interests of human subjects, the treatment of objects, and other points that Latour found too eclectic, signaling an incompatibility between the two (Nelson 2014). Some of Bourdieu's (2004) most vital contributions to STS, namely the notion of an "intellectual field" and an understanding of reflexivity beyond the mainstream were thus, sidetracked until a special issue of the journal *Minerva* brought it back into focus.

Temporally-bound forms of resistance and accommodation also emerged as key themes within post-Kuhnian STS when both human and material agency were taken into account (Pickering 1993). As Pickering clarifies through his interactions with Latourian theory, this dialectic emerged exclusively at the intersection of both forms of agency (582-585). Several strands of early feminist STS appeared at this juncture as well (Shapin 1995), with Donna Haraway's (2020[1992]) articles and books being closely aligned to that of Latour's. For both Latour and Haraway, science possessed numerous pluralities, and was simultaneously "active and reactive" (Ihde and Selinger 2003). But despite the clarity presented by the work of Haraway and other feminist theorists such as Harding (1986; 2009), Shapin (1995, 306) was of the opinion that feminist STS had "vexful" relationships with both SSK and broader social theory. Though he fleetingly attempted to situate some of it within post-Kuhnian STS, he concludes by labeling variants of feminist STS as mere "tributaries of SSK" (307).

Finally, there is the matter of thinking of what comes beyond Post-Kuhnian STS. *Post-post* Kuhnian STS doesn't exactly have a nice ring to it, nor does it make much sense. And then there comes the problem of failing to acknowledge one of the new "turns" in STS or prioritizing one over another – a problem I hope to have addressed through the disclaimers I provided earlier. To make matters simple and as inclusive as possible, I call this the phase of the **"Contemporary theory of STS"**, for lack of a better term. Arguably, this could be thought of having begun when SSK and SCOT were succeeded by Jasanoff's (2004) theory of co-production, which provides insights into how the "social" and "scientific" are co-constituted (Felt et al. 2017), and an alternative path towards studying

heterogenous interconnectedness that contrasts with what ANT offers. The “problem of difference” and the paradigm of “ontological multiplicity” (43) direct contemporary theory of STS towards focusing on locating new foci of difference. Postcolonial/gendered/racialized power differentials offer an excellent foundation for mapping these differences and generating multiple “knowing spaces” (47) that might offer new/hybrid insights into varying sociotechnical contexts (Law 2008). I explore these insights (and the broader domain of the “Contemporary theory of STS” in the following subsection. Onto more history!

1.2 A Brief (and Relatively Simplistic) History of Science and Technology Studies (STS) – Part Two

There are clear, noticeable differences in the depth, breadth and in the way in which contemporary STS has been approached when comparing the wealth of literature produced by the field before and after globalization and postcolonial sensitivities had an impact on it towards the end of the 20th century. For instance, only a small portion of pre-1990s STS literature overlapped with class or race in the context of social inequalities, and a major reason for this was the underrepresentation of BIPOC scholars within the STSverse (Hess et al. 2017, 321-322). Globalization played a major role in altering these dynamics, as scholars from the global south began to participate in these conversations and present alternative, postcolonial viewpoints on matters that were centered around the discussion of enduring social inequalities (Arsel, Dasgupta, and Storm 2021). This is where a greater degree of assimilation between the axes of race, ethnicity, class, and gender occurred, and the impact of globalization became more noticeable. Naturally, the demarcation between “STS before globalization” and “STS after globalization” is not firmly articulated in any way, given that globalization is a process that simply cannot be attributed to one or two historical events. The shift from examining race, class, and gender as components of discursive formations in STS to placing

them at the locus of critiques of governmental, industrial, and transnational assemblages of power was a progressive one. It involved changes and innovations in methodological approaches, the emergence of perspectives from the global south, and the destabilization of hegemonic controls that had been instated by the domains of academia, centralized governance, and transnational businesses.

With the articulation of multiple postcolonial realities from across the global south, the need to study colonial legacies and social inequalities through a multi-sited and “comparative, global, and transnational methodology in STS” (Hess et al. 2017, 329) became one of paramount importance. Taking this need into account, STS scholars made forays into the asymmetries presented by differing geographies and publics. Persistent systemic inequalities were then examined from a relational perspective that accounted for the political dynamics between a city and the nation-state (Tilly 1998; Heller and Evans 2011). This contributed towards the decentering of the worries and interests of colonizers and monolithic corporations, and a deeper, more vested interest in populations that have been historically situated at the margins of both, research, and society. Here, I am referring to the subjects of queer, feminist, and postcolonial STS, whose concerns can overlap extensively with each other.

In order to best understand some of the key interventions within the field of STS in this period and simultaneously get an idea of where the field is headed (and how it informs drone studies), I prioritize two prominent, discursive logics that might prove to be useful to anyone seeking to predict what might lie beyond the horizon of present-day research. These are the same logics that I referred to at the beginning of this section, in connection with mapping a genealogy of drone studies. Through the usage of these logics, I yield to Laclau and Mouffe (Rear 2013) for their post-structuralist logics of “difference” and “equivalence”. I humbly recommend refashioning the latter as a logic of “convergence” in the hope that it would be accommodating of cases where the dissolution of social and epistemological divisions might have been unexpected, though the cases that I mention in this

answer are rather predictable. True convergence is often achieved through the application of intersectionality, which is far more complex than the presentation of a mere terminological or analytical overlap between two or more sub-disciplines. Intersectionality, for that matter, is connected to an interrogation of the sub-discipline's complexity (Keucheniuss and Mügge 2021); and it contains echoes of Niklas Luhmann's Systems Theory, as I shall briefly demonstrate in one of the sections below.

It must be noted that the application of these complementary logics is **not at all exhaustive or mutually exclusive** in any way; in fact I believe that they would be best accompanied by more rigorous forms of discourse analysis (Jørgensen and Phillips 2002) that might provide additional disciplinary vectors for the future of STS, but it goes beyond the scope of this dissertation to do so. The field of STS is headed in many directions, but a few of the ones that arguably merit greater attention (in connection with this dissertation project and the broader field of drone studies) can be understood through the summaries that follow. Through the employment of these two discursive logics, I attempt to preserve the heterogenous natures and the interrelated characteristics of feminist, postcolonial, and queer STS alike.

On traversing through a logic of difference. Many of the new "turns" in STS – feminist, postcolonial, queer – are arguably both, ontological turns, and epistemological turns as well. Focusing on ontological aspects alone (Jensen et al. 2017) is insufficient, for the logic of difference has been especially prominent in the varied epistemological differences put forth by these sub-disciplines within STS. Feminist, postcolonial, and queer STS challenge intellectual and ontological reductionism in a multitude of ways, often through the practice of positioning (Haraway 1988), which might cause them to overlap with each other. Mutual and disproportionate co-construction is often at the heart of boundary-making within STS, as Haraway and other feminist STS scholars have articulated in their defenses of the field's diverse perspectives (Fujimura 1998). The creation of equitable and ethical

futures is thus a priority for feminist STS, particularly as human-machine relations (Wagman and Parks 2021) and the politics of interventions (Asdal, Brenna, and Moser 2007) become more complex. Human-machine relations are being examined for their pervasive ties to surveillance, capitalism, body politics and physical/mental well-being (Berkhout and Zaheer 2021; Bianca 2021; Borenstein 2021; Fox and Spektor 2021; Liu 2021; Mularoni 2021). Another priority for feminist STS has been the inclusion of non-humans (i.e., plant and animal species) through multispecies research (Foster 2019; Gan 2019; Hernández 2019; Ives 2019) and the notions of an “interspecies relationship” (Kirksey and Helmreich 2010) and “interspecies intersectionality” (Weaver 2017). Feminist STS can be felt everywhere across the field; it would be immensely difficult for an STS scholar in the present day to not come across its interventions in the study of healthcare and medical practices (Fitsch and Friedrich 2018; Wesner 2018; Wiel 2018), organizational studies (Amrute 2020), and numerous other systems that they either structurally couple with, or interpenetrate in a Luhmannian (1991, 1995) sense.

A nuanced understanding of the co-production of technoscientific innovations alongside gender (Faulkner 2001) has defined many contemporary interventions by feminist STS in the present. In one such case, Faulkner’s studies of the ways in which “technology”, “technological artifacts”, “technical knowledge”, “technical practices”, and “working with technology” are gendered (89-90) has been critical for the development of feminist STS (Selwyn 2004; Wajcman 2007; Rode 2011; McLaughlin 2014). Faulkner continues to bear a strong, definitive influence on the direction of future of STS, where questions of agency (Spiel et al. 2019), identity (Rodriguez and Lehman 2017), elder care (Baudin, Gustafsson, and Frennert 2020), education (Frezza et al. 2018), entrepreneurship (Ozkazanc-Pan and Muntean 2018; Wang and Keane 2020), design (Rosner 2018), gender relations (Eckhardt et al. 2021), unemployment (Sahraikorpi and Bandi 2021), labor (Thoyre 2020) and other concerns pertaining to inequality and marginalization (Blomberg et al. 2021) emerge. Needless to say, Faulkner’s writings are but one vantage point amidst many others offered by scholars such as Butler

(2004), Harding (2004), Haraway (1992; 1994), Jasanoff (2013), Knorr Cetina (Cetina, Schatzki, and Savigny 2005), Merchant (1998), Suchman (2011), and Wajcman (2010). It would be sufficient to say that as long as gendered inequities and marginalization remains a concern, feminist STS would continue to strive for just and inclusive futures.

A thick interconnectedness lies at the foundation of feminist, postcolonial, and queer STS, and the ways by which they co-construct each other and address each other's shortcomings through the differences between them. Even so, these intellectual traditions are not without tensions of their own. As Harding (2009) indicates, postcolonial STS addresses the exploitative and overarching influence of colonialism and imperialism within STS in a way that most (western) feminist STS often does not. To put it directly: "For Western feminists, the relevant sciences have been almost entirely modern Western ones" (407), barring a few exceptions. Aside from the apparent differences driven by epistemological relativism, genealogical problems remain dominant, as feminist theorists and postcolonial scholars differ on the matter of how postcolonial theory came to be (415-417). Put simply, "postcolonial STS" emerges from the intersection of postcolonial theory, and the field of STS. In the face of an increasingly globalized world, the practices followed by western STSers were challenged by a "postcolonial predicament" in three ways (Samaddar 2012) – "the postcolonial imprint on knowledge formation, the salience of primitive accumulation even the when the postcolony develops, and the emergence of a 'precariat' and immaterial labor" (41). Postcolonial STS challenges hegemonic forms of theorizing by utilizing and producing a multitude of geographically, racially, and ethnically diverse ways of knowing, interrogating, conversing, and becoming. This process came to be known as the "provincialization" or "decentering" of western STS and colonial forms of theorizing (de la Cadena et al. 2015). Western STS had, at many times, proven itself to be incongruent with postcolonial agencies and subjectivities in a variety of ways, leading to the formation of tactile, non-essentialist approaches to STS such as "Asia as method" (Takeuchi 2005; Chen 2010; Anderson 2012) that could

arguably accommodate hybrid, transcultural identities, spaces, and processes (Hall and Gay 1996; Bhabha 2004[1994]). Such frameworks addressed the inadequacies of cold-war era “area studies”, which over time, had proven to be unsympathetic to transnationalism and its impact on different publics (Appadurai 1996). Moreover, these decentered, non-essentialist frameworks provided western STS with “contact zones” (Pratt 1991; 2007) that they needed in order to interpret “highly asymmetrical relations of power between the different parties of encounter” (Zhu and Qian 2015). The necessity of postcolonial interventions can be summed up by quoting Philip, Irani and Dourish (2012):

This postcolonial cultural–technical situation encompasses the entirety of the world we live in, shaped by the post–World War II atomic age, numerous mid-twentieth-century decolonizations, the Bretton Woods era, the 1970s oil crisis, post-Fordism, neoliberalism, new technologies and their attendant time-space compression, and new forms of global migration in which the flows of people, goods, and ideas took on formations different from those of previous eras of slavery, colonialism, and occupation...STS did take on the hard bastions of objectivity, transforming Euro-American sociology, history, and philosophy. However, much of the mythos of the Western origin stories of science and rationality, while being demolished in theory, manifested itself in practice, in a locational focus on Euro-American spaces of science. (Philip, Irani, and Dourish 2012)

An example of decentering such theoretical foci and standpoints emerges in Amrute’s (2020) conceptualization of “race-as-algorithm”, which explains how racial identities aid the inequitable production of economic value within the information technology (IT) sector:

Race-as-algorithm in the present day is tied to the long history of creating migrant casual workers in colonial and later periods where casual labor was used to replace slave labor on colonial plantations in the British Empire, and as quick labor to reconstruct bombed-out German cities through the guest worker program. Focusing on the historical relationship between casual labor and racialization shows that firms that value race as a source of creative vitality remain complicit in racism against Indian tech workers within and beyond their walls. (Amrute 2020, 907- 908)

Amrute’s postcolonial conceptualization of the algorithm complements how the racialized dimensions of algorithms have been examined (Chun 2008; Noble 2018; Benjamin 2019). The use of a historical precedent or the historical method itself is essential to postcolonial STS (which is precisely why I’m writing all of this), as it would contextualize the “transaction, translation and transformation of science

and technology” (Anderson 2009) and establish non-hegemonic, postcolonial histories of science that might inform specific and universal frameworks of knowledge alike (Arnold 2013). This is particularly important at a microsociological level, where the forces of globalization and systemic inequalities reveal themselves in many ways, and the “affirmative recuperation of subaltern voices” (398) becomes an absolute necessity. Héctor Beltrán (2020), Angela Okune (2020), Natacha Roussel and Ariane Stolfi (2020), Daniel Renfrew (2018), and Anita Girvan (2017) are but a few examples of scholars whose work falls within this ethos. For a more lucid understanding of ethical scientific engagements, the future of STS will have to further dissect the intricacies of “colonial scientific exchanges” and imbibe the intellectual and cultural productions of the postcolonial scientist and the postcolonial STS scholar (Kowal 2013). It is worth mentioning that there are differences between the terms “postcolonial”, “decolonial” and “anticolonial” (Subramaniam 2017), and that they all possess connotations of their own, but exploring them in detail is beyond the scope of my work here.

The act of traversing the world of STS through a logic of difference will eventually reveal Queer STS as one of its more recent entrants. Its identity has been provoked for definitive answers on precisely *what* constitutes Queer STS theory, and *how* one might apply the Queer STS “method” (Molldrem and Thakor 2017). It ought to come as no surprise that it (disputably) possesses the most porous boundaries of the sub-disciplines that I have discussed so far. As Molldrem and Thakor (2017) mention, a significant portion of what is deemed to be “Queer STS” is being canonized in a crowdsourced reading list present on google docs. In its current avatar, the list contains two sections – one dedicated to queer STS alone, and the other to “postcolonial queer” STS, which bears the semblance of a hybridity (Pieterse 2001) that I shall address shortly. Other non-academic content (fiction, film, journalistic articles, YouTube videos, etc.) – content that might be deemed marginal by some scholars - has been included as well. In its intersections with race (Johnson and Henderson 2005; Johnson 2016), politics (Cohen 2005), gender (Eklund 2011; Bivens 2017), sexuality (Foucault 1990;

Halperin 2002; Fishman 2004), technology (Kember 2002; Landström 2007; Phillips 2007), and postcoloniality (Briggs 2003; Arondekar 2005; Tortorici 2012; Abugideiri 2016), it becomes apparent that the identity of queer STS is still in flux. Even so, it is clear that queer STS utilizes asymmetry in order to instrumentalize the co-production of technology and gender and destabilize heteronormativity within STS and the sciences (Landström 2007). There are several other sub-areas that can be seen as either growing or prominent when STS is gauged through a logic of difference, but I have largely outlined those that are of conceptual and empirical relevance to this dissertation. In the interest of brevity, I shall now switch to examining the contemporary theory of STS using the discursive logic of convergence instead.

On traversing through a logic of convergence. Entanglements, convergences and the appearances of dialectical unities between the domains of feminist, queer and postcolonial STS are not uncommon on account of how intersectionality is often used to make that possible (Lutz 2015). These unities potentially signify the evolutionary step that follows their emergence as “conjugated subjects” (Anderson 2009). For example, in Pollock and Subramaniam (2016), “feminist postcolonial” views of technoscience are used to examine the centrality of power in issues of justice and epistemology. Another example would be a well-known reader on “queer feminist” science studies (Cipolla et al. 2017), where the queer feminist approach is explicitly developed in order to “challenge what ‘body-knowledges’ and materialities count as science” and to “affirm critique as a site of world-making potential” (9). Black feminist thought (Collins 1989) could certainly be viewed as yet another unity, given the wealth of literature that has been established under its aegis (Browne 2015; Doucet-Battle 2016; Bailey 2016; Bailey and Peoples 2017), some of which pairs itself with the concerns of STS. I call them unities, or more appropriately, dialectical unities, for they conceivably signal an increased level of complexity that cordons them off from the literature that bears ties with them; the emergence of these unities can be likened to Luhmannian sub-systems (1995). As they steadily move towards

acquiring a codified form of communication of their own, these dialectical unities will be able to distinguish between themselves and an external environment through self-reference, and eventually engage with self-reflexivity and self-reflection as well. The complexity of these dialectical unities would (possibly) signal the presence of “permanent, internal pluralities” (Harding 2009, 418) that recursively reproduce themselves in the image of a new canon for STS.

Some closing notes on the “contemporary history of STS”: The “New Materialist” (Tuin and Dolphijn 2012; Rekret 2016; Fox and Alldred 2016) turn is one that I have consciously avoiding writing about in this brief history of STS. This is primarily because the a few scholars (myself included) believe that the New Materialist turn is still very difficult to define (Gamble, Hanan, and Nail 2019), and is commonly misunderstood where its operationalization is concerned. I do, however, acknowledge it as an expansive project that would unquestionably inform future work within drone studies; a simple example emerges in the many connections that could be made between this dissertation and a recent article put out by Luque-Ayala, Machen, and Nost (2024).

With an understanding of where STS has traveled from (Mascarenhas 2018), one can certainly attempt to construct different futures for STS. The making and re-making of the many different possible futures of STS will be driven by a sense of greater inclusion, creativity, racial justice, interdisciplinary and transdisciplinary research, and the minimization of institutional constraints (Jasanoff 2016). Given the rise of populist politics (Kleinman 2020) and anti-science formations (Hatch 2020) and the way by which STS has been affected by them both, the future of STS simply must be intertwined with advocacy work and professional collaborations beyond the academy (Kinchy 2020). This is one of the key motivations for why I do what I do, and why I’ve written all that I’ve written here. Just as many of the reformatory sub-fields within STS have exhibited constructive relationships with different social movements over the past few decades, so must the future of STS

remain invested in “counter-currents” (79) that lie opposed to intellectually regressive regimes and their “hidden injustices” (Smith-Doerr 2020) if it is to remain secure.

1.3 On situating this dissertation project and its research questions

It is perhaps, most utilitarian to think about my “drone society” project as one that is firmly situated in the contemporary traditions and theories of STS, as I have delineated above. My dissertation makes extensive use of feminist and postcolonial STS in a variety of ways. Non-human agency is a core component of this project; take, for example, how the symbiotic relationship between cultural consumption and production in the drone society is intricately intertwined with issues stemming from algorithmic governance and the production of environmental knowledge.

At first, I believed that this complex interplay necessitated a focused exploration of three pivotal dimensions of civilian drone usage: technoleisure, technomascularity, and technonatural knowledge production. **Technoleisure** concerns the transformative influence of drone technology on recreational activities, while **technomascularity** affords an understanding of the relationship between gender and drone usage, with a particular emphasis on how technical competence or expertise potentially reinforces certain notions and performances of masculinity. Lastly, **technonatural knowledge production** relates to the impacts of drone technology on our understanding of the environment. By studying these dimensions (White and Wilbert 2010), I originally believed that a comprehensive and nuanced understanding of the drone society could be obtained, but I wasn’t fully leaning into the philosophy of abductive analysis at that time. Thankfully, these three themes only informed the formation of my initial research questions (designated as “Initial RQs”), which evolved over time (into “RQs”, listed below). These changes led me to a more expansive set of findings concerning hybrid networks of human and non-human actors, and to highlight how my process of inquiry evolved, I have described these changes in the following paragraphs. **I shall begin by**

describing my initial RQs, and then shift to a brief description of the RQs that guided my process of inquiry.

Firstly, I had reason to believe that the drone society represented the politics of unsustainability in a world where “scientific–technological–industrial modernity and its urban, consumerist lifestyles have been more firmly embraced than ever before” (Blühdorn 2013). This led me to think about studying the nature of the relationship between drones and leisure, or what I have called “technoleisure” or “technoleisurist lifestyles”. The sociological study of leisure (Moore 1897; Veblen 1912; Meyersohn 1969; Rapoport and Rapoport 1974; Wilson 1980; Kelly and Godbey 1992; Rojek 2000; Roberts 2015; Kelly 2019) remains relatively under-studied in the present day. In my opinion, the aforementioned theory of serious leisure (Stebbins 1982) could be further developed through the following questions:

- Initial RQ1: How do social networks and communities evolve within the context of drone-based technoleisure?
- Initial RQ2: How does the emergence of drone-based technoleisure intersect with broader cultural and economic trends?
- Initial RQ3: In what ways do civilian drone users navigate the ethical and social concerns associated with drone use for recreational purposes? Are there discernible patterns in how users approach these concerns, and if so, how do these patterns interact with other facets of their identity?

Secondly, as I had come across the term “technomascularity” in connection with construction and performance of masculinity through technology in contexts that are traditionally male dominated, I thought it would bear relevance to the world of civilian drone operators. Take for example, how the use of advanced drone technology in the production of first-person view (FPV) drone footage can be

seen as an act of masculine assertion and a means of demonstrating technical knowledge and mastery over the technology. However, technomascularity can also be problematic in that it may perpetuate gender stereotypes and exclude women from participation in this field. The emphasis on technical skill and dominance may create an unwelcoming culture for women and reinforce the notion that they are less capable or knowledgeable in the technical aspects of drone technology. Race would also be an incredibly important aspect of part of the study, given the racialized politics of civilian drones (Olson and Labuski 2018). With respect to technomascularity in the drone society, I had several research questions in mind:

- Initial RQ4: How do civilian drone users' identities interplay with technomascularity?
- Initial RQ5: What factors contribute to the fetishization of drones, and what can we learn about technomascularity and risk management from the fetishization of drones?
- Initial RQ6: Is technomascularity instrumentalized to exclude female, non-binary and transgender people from the civilian drone operator communities? If so, how?
- Initial RQ7: How do civilian drone users navigate the tensions between the militarized associations that people make with drone technology, and the often non-militarized contexts within which they are used?

Thirdly, it had become impossible for me to ignore the ways in which drones shape our knowledge of technonatural spaces. The concept of “technonature” (White and Wilbert 2010) has been around for well over two decades and is even being leveraged to conceptualize configurations of nature in the future (Lie 2022). Indeed, as Kull (2002) tells us, “Our nature is technonature, and our culture is technoculture”, and with the shifts in our understanding of technoculture in the contemporary moment, our understanding of technonature too, will shift. Technonatural subjectivities are likely to

remain a major topic of inquiry within the drone society, which is why I felt that it would be crucial to examine the processes of knowledge production that remain associated with it.

- Initial RQ8: How does drone imagery/footage on social media influence our perception of built and natural environments?
- Initial RQ9: How do civilian drone users conceptualize the relationship between technology and nature, and what is the impact of this conceptualization on their use of drones in natural environments?
- Initial RQ10: How do civilian drone users participate in debates surrounding the ethics and politics of technological interventions in natural environments, including concerns over environmental degradation and human intervention in ecological systems?

As is usually the case with many research projects, some degree of change in my line of inquiry was inevitable. In the due course of developing my research questions and engaging in fieldwork, it became incredibly difficult for me to disentangle drone piloting for professional purposes and drone piloting for recreational purposes only. The foci of each chapter changed, as my data led me from focusing on more narrow themes towards analyzing the networked structure of the drone society, and broader processes such as the process of “becoming” a drone pilot, or the ontology of “working as” or “being” a drone pilot. Some of my Initial RQs disintegrated and spread themselves across multiple chapters as smaller components of bigger questions. I reflected upon the experiences that I had access to through in-depth qualitative interviews and digital ethnography, and in the interest of more expansive data analysis, my initial research questions evolved and changed as follows:

- (In Chapter 1) RQ1: What is the drone society?

- (In Chapter 1) RQ2: How can the process of “becoming” a drone pilot be best understood? What are the underlying mechanisms (or sociotechnical negotiations) that drone pilots must engage with in the due course of “becoming” a drone pilot?
- (In Chapter 2) RQ3: What is the nature of work within the drone society?
- (In Chapter 2) RQ4: What are the characteristics of the relationship between precarity and drone-work (i.e., professional drone use)? Are there any novel forms of precarity produced by drone-work?
- (In Chapter 3) RQ5: How is drone media (i.e., drone photos, videos and data) instrumentalized by systems of mass media?
- (In Chapter 3) RQ6: How does drone media influence perceptions of built and natural environments? How can the consequences of this influence be understood in different contexts?

As a whole, the dissertation poses the following question: How does the integration of drones into society influence or transform different social dynamics, labor practices and media representations within contemporary socioeconomic and environmental contexts? Or to put it even more briefly, **how can emergent civilian drone culture be better understood?** I shall now describe the methods of analysis and data that were used in this dissertation.

2. Research Design and Research Methods

In this section, I begin by briefly providing a contextual overview of research design and method in STS before speaking of research design and methods in drone studies. I then proceed to write about the specific nature of the research design and methods used in this dissertation.

Research design and research methods in the field of STS have often been used in a way that does not directly employ a more traditional focus on qualitative methods, quantitative methods, or a mixed-methods approach alone. There is, instead, a focus on the “making and doing” of STS, where the act of “making STS” focuses upon how STS scholars (or STSers) are “constructing and maintaining” STS (Felt et al. 2017) through a variety of methodological approaches, and the latter act of “doing STS” typically relates to how STS is disseminated through sociopolitical and economic engagements (28-29). In a more conventional sense, one could perhaps, interpret the notion of “making STS” as the spectrum of methods that are understood as “STS methods” or the “methods of STS” (30). On the other hand, the dimension of “doing STS” could be seen as a combination of applied research design, public scholarship, advocacy, and civic/economic activity.

The acts of “making and doing STS” are complementary to each other and are bound by the reflexive concept of having STS as a method itself – a topic that John Law (2017) addresses through an overview of the epistemological interventions that STS offers. Characterized by the actions of “making and doing”, the logic of using “STS as a method” lies within being comfortable with the idea of epistemological and ontological differences, and developing an array of methodological approaches that might hold well against the backdrop of those differences (49).

Take for example, how Bloor’s (1991) principle of symmetry could, for example, be of deep significance to certain kinds of research in STS, for as Law (2017, 33) points out, the social practices and interpersonal exchanges that shape the nature of scientific “truths” and “falsehoods” are interpreted through the lens of the same methods. Ethnographic methods and the analyses of different narratives and histories lend themselves to these endeavors, but the process is often complicated by performative nature of scientific/social practices, and their situatedness in the physical world (39-40). By contrast, such an approach to research design does not apply to the devotees of Actor-Network Theory, for whom macrosociological and microsociological contexts are produced through a “web of

relations”, as opposed to any kind of “fabric of the social” (42). The same could be said for the postcolonial STSer, as multiple ontological realities (Mol 1999) are likely to be prominent amidst their analyses. Methodological approaches vary extensively within STS, as do the contexts or ecologies (Lee Downey and Zuiderent-Jerak 2017) that they applied within. As a result, the acts of “making and doing” imply the absence of any kind of fixed methodological templates or categories within STS. There are, perhaps, no authoritative or universally-accepted categories of methods that characterize the methods of STS, as the notions of “making” and “doing” cannot truly be separated from each other. It behooves any STSer to reflect on how the use of any specific method is rarely ever prescribed, and that methodological choices are often made at the discretion of the researcher. Concurrently, it is vital to recognize that within the STS community, “shared tenets, concepts, methods, and ambitions made possible a plethora of diverse investigations” (Schyfter and MacKenzie 2018). Methodological overlaps between these clusters thus ought to be expected and considered inevitable.

The categorization of the methods used by the field of STS could very well be a futile exercise unless the methods were to be contextualized by the clusters of “making and doing” activities that utilize them. Possibly, the first cluster could be framed in the context of *Boundary-crossing STS claims and practices*. Put in the simplest way, “Boundary-crossing STS practices infuse pedagogies, artistic creations, and a range of experiences designed for learners beyond the field” (Lee Downey and Zuiderent-Jerak 2017, 230). Work positioned within this cluster typically focuses on presenting perspectives from STS to different (and often non-academic) audiences and disciplines. As a result, the “elements of making and doing in this cluster tend to be strongly developed, whereas the ecological dimensions may prove to be less formative or consequential” (234). This would imply that the expertise of the STS scholar is of paramount importance within this cluster (244). Research that engages with boundary-crossing STS is typically pushed to evolve through the varying kinds of feedback that it receives, and is often propagated through a variety of ways that include writing for

journalistic outlets, providing professional testimonies and consultations, conducting workshops (Ruiz-Trejo and García-Dauder 2019), relaying pedagogical innovations, ethnographic research etc.

The second cluster could be thought of as the cluster of *Meta-activism, or meta-activist projects*. Lee Downey and Zuiderent-Jerak (2017) define the cluster of “meta-activism” as the set of “activities deployed by STS scholars to assist or support actors who may already be resisting, challenging, or seeking alternatives to dominant images in their fields” (235). Here, the performance of these activities alludes to “making and doing”, and the prefix “meta” being used to indicate that advocacy is not being actively pursued by STSers. Research that falls within this cluster appeals to a more specific audience of activists, policy makers, government officials, and academics who identify as being scholar-activists. The study of power relations, techno-politics, controversies, underdeveloped infrastructures of dissent and communication and social stratification are prominent within this cluster (244), which enables the study of STS as a social movement as well (Waks 1993; Hess 2015; Hodson 2020). Within meta-activist literature, it is common to see the use of historical analyses (Rowe, Gjata, and Roudbari 2020), ethnographic methods (Alsop and Bencze 2014), computational methods (Milan 2016), narrative/discourse analysis (Méndez Cota 2019), policy analysis and case studies (Kihara 2013), the method of “participatory action research” (Martin 2016), workshops (Kasprzak and Pickard 2019), and many other methods that are employed by the social sciences and humanities.

The third and final cluster of “making and doing” STS projects, *Experiments in participation*, distorts the demarcations between what the “field of STS” and the “practice of STS” through the development of alternative visions of existing technological and scientific paradigms (Lee Downey and Zuiderent-Jerak 2017, 239). While the first cluster of boundary-crossing projects builds upon frictions and synchronicities between different disciplines, this cluster of projects does the opposite, and utilizes internal complexities and “internal consistencies” to build new pathways for research (240). The STSer’s audience here is typically limited to a local audience of people that are relevant to

the ecology of the “experiment in participation” (241) but can be expanded out through the mechanisms and operations of dissemination. Typical approaches to such experiments have involved the following: “building devices, changing organizations, video-reflexivity, art installations, novel curricula, etc.”...with the “enactment of realities” (244) being a key operational characteristic. The theme of inventive methods is exemplified by the “different traditions of practice-based work—product design, data visualization, installation art and software development” (Lezaun, Marres, and Tironi 2017, 209). There is a focus on actively designing apparatuses that could serve the purpose of being the focus, mechanism, and occasionally, even the setting of such experimental research. Developed through a media art project and several years’ of participant-observation, Lilly Irani’s *Turkopticon* project (Irani and Silberman 2013) would be an example that would fit squarely within this cluster.

The logic of “making and doing” in STS is also beginning to bear witness the rise of the corresponding logics of “unmaking” and “undoing”, which debatably provide a more holistic look at the destabilizing potential of insights and perspectives from STS. These new logics have led to the emergence of new patterns of enacting STS as either “making and unmaking” (Biagoli and Jaszi 2011; Jackson and Buyuktur 2014; Salehabadi 2014; Rogers 2018; Aalders et al. 2021; Hees, Wanka, and Horstman 2021) or “doing and undoing” (Blaser 2018; Åsberg 2021), though it might be equally common to see patterns that focus solely on either “unmaking STS” (Treusch 2017; Pérez-Bustos, Martinez Medina, and Mora-Gámez 2018; Pieraccini 2018; Kama 2021), “undoing STS” (Sutko 2020), and even “remaking” STS (Groves 2017; Chilvers and Kearnes 2020). The emergence of such patterns is not unique to STS; they have often emerged through many disciplines and sub-disciplines within the broader social sciences and humanities (Freeman 1983; Bauman 1995; Rasmussen et al. 2001; Chan, Doran, and Marel 2010; Goldberg 2013; Giritli Nygren, Öhman, and Olofsson 2017) over the past several decades. It is quite possible that the emergence of these patterns in STS will have

consequences for how certain methods and methodological approaches are used, prioritized, revised, or abandoned by different clusters of activities. Contemporaneously, new clusters are quite likely to emerge, alongside the adoption of novel or reshaped methods and methodologies, making it even more urgent to have deeper conversations on the adoption and usage of methods in STS, and how they are reflexively understood.

So where does leave the project of the drone society in terms of making and doing? I would certainly categorize it as a project that is **predominantly a meta-activist project** by nature. This will become more apparent as the chapters following this introductory section unfold. Now, **drone studies** is an incredibly interdisciplinary field, largely bifurcated by the ways in which military drones and civilian drones have been approached by technical and non-technical disciplines alike. Given the novelty presented by the field, there is a need to establish novel epistemological points, which is precisely what abductive analysis (Timmermans and Tavory 2012; Tavory and Timmermans 2014; Rinehart 2021; Timmermans and Tavory 2022) assisted me with. The abductive process begins with the researcher identifying surprising or unexpected findings within the empirical data. These findings, often referred to as “puzzles”, prompt the researcher to search for explanations or theoretical frameworks that can account for the observed phenomena. The researcher then returns to the data, seeking further evidence to support or challenge the proposed explanation, leading to either the modification of existing theories or the generation of new ones.

For example, in her book *Aerial play*, Hildebrand (2021) employs interviews, participant observation and their innovative technique of “auto-technography”, where she argues for a relationality between herself and her drone, and the utility of examining their co-produced experiences of “seeing, moving and being”, amongst many others. From within the field of Sociology, Zuev and Bratchford (2020a) present an agenda and an approach for the “visual sociology of drones”, as I noted earlier. They tell us that the examination of “drone-mediated image-taking” and drone footage is

incredibly limited within the discipline (Zuev and Bratchford 2020b), stressing upon how sociologists simply haven't figured out "drone methodology" just yet. Indeed, fields such as communication, geography and media studies are far ahead of sociology in this respect; an interesting example of this comes forth through O'Hagan and Serafinelli's (2022) mixed-method approach that employs visual social semiotics and archival research to carry out a transhistorical analysis of the shifts from "old media" to "new media". Yet another one of their studies (Serafinelli and O'Hagan 2022) combines the use of visual social semiotics with qualitative interviews.

In order to respond to the research questions outlined in the preceding section, **I used a combination of qualitative interviews, participant observation and digital ethnography as my research methods.** Moreover, to supplement my usage of these methods, I also used the qualitative analysis software Atlas.ti, given its utility towards analyzing qualitative data obtained through mixed-methods approaches, and the integration of large language models (LLMs) for qualitative coding powered by artificial intelligence (AI). A hybrid approach to qualitative coding that involves both human and AI-powered coding is relatively new, yet there are studies that show that the two approaches strongly complement each other and collectively provide insights that one might not be able to fully provide without the other (Jiang et al. 2021; Gamielien, Case, and Katz 2023; Morgan 2023; Kirsten et al. 2024). There are, however, certain limitations that must be acknowledged as the use of LLMs presents the potential for the introduction of bias in the outputs generated. This is why a researcher must always audit them for inaccuracies and not rely upon them exclusively. It is crucial to acknowledge and address these limitations, ensuring transparency in the research process and a clear understanding of the role of LLMs in data analysis. Furthermore, researchers should be cautious not to rely excessively on AI-generated insights or automated coding and should always validate their findings with other data sources and methods. In the case of my dissertation, I validated Atlas.ti's automated coding using manual coding for primary/secondary data. By employing a robust and ethical

approach, the use of LLMs can enhance the overall rigor and depth of a research project, while still maintaining the integrity of research. It is my belief that the use of LLMs for research will be a common (and popular) method in the years ahead, given that it is strongly aligned with the idea of cyborg writing (Haraway 1988; Olson 1996; Gough 2004; Haraway 2010; Mandalaki and Daou 2021), and consistently situated within posthumanist theory. As hybrid epistemologies (Wilson 2009), cyborg epistemologies offer novel epistemological possibilities that this study seeks to consider, interrogate, and theorize about.

2.1 Research Sites

Between the end of June 2023 and January 2024, this project primarily involved the usage of one primary physical site in India (Pune, Maharashtra), picked for my familiarity with the city over the course of my life, and for a greater focus on the global south. In Pune, I focused my efforts to recruit informants for this study on employees and stakeholders of the several start-up companies and non-profits, who I steadily became acquainted with. I also recruited several freelance drone operators and hobbyists – many of whom I identified through social media and my personal/professional networks. All of my interviewees were Indian citizens, many of whom were based out of Pune.

Additionally, I visited several “secondary” physical sites in the United States in the latter half of 2023. These included the New York Public Library in August 2023, for publicly accessible materials. I also visited the Smithsonian’s National Air and Space Museum in Washington D.C. in September 2023, for their drone exhibit, and captured data in accordance with their rules for visitors. The data captured from both “secondary” sites complemented the analysis of some of the content that I had captured through several social media networks.

Regarding virtual sites of research, there were several that I made use of between June 2023 and May 2024 for the purpose of conducting digital ethnography. To clarify, digital ethnography (in

the view of this project) is best conceived as encompassing virtual ethnography and being broader in its scope. This resonates with what Hesse-Biber (2011) writes about in the context of how digital ethnography is not just about “virtual” targets, but the online and offline sides of virtual communities, the use of digital methods and computer mediated communication, and how it is an efficient means to capture heterogenous forms of communication and data. Over the course of this project, I was a part of over fifty open and restricted communities spread over across different social networks: Facebook, Discord, Reddit. Many of these concerned commercial drone usage in different cities across India and the United States. These communities made it possible for me to engage with professional and recreational civilian drone operators across the world and recruit those living in India as virtual interviewees whom I would interact with through Zoom, WhatsApp and other social media platforms. I also used Instagram to follow many public and private accounts of Drone as a Service (DAAS) companies, freelancers, hobbyists and manufacturers. I was also a part of the Indian Drone Racing League’s (IDRL) members-only groups on WhatsApp, and a member of the member-only Facebook groups meant for the US-based corporation, Pilot Institute. Additionally, I also spent time on the platforms YouTube and TikTok, treating them as virtual sites for research where drone media was readily accessible to me. In short, I strongly believe that the stakeholders of the transnational online communities that I was a part of furnished authoritative insights that informed my dissertation. I primarily used their perspectives to eke out a comparative basis for either validating (or invalidating) insights that I had acquired from my in-person and virtual interviewees.

2.2 Data Collection

In-depth qualitative interviews were primarily conducted through a combination of on-site and remote modes of work where I relied on Zoom for the latter. I conducted 29 qualitative semi-structured interviews in total for this project, which were recorded in the form of approximately 36

hours' worth of audio files. In order to structure the interview questionnaires themselves, I used methodological considerations offered by Brinkmann and Kvale (2014). A semi-structured style of interviewing allowed me to *defocus* questions in a way that was amenable to abductive analysis.

Purposive sampling was used in addition to snowball sampling (Bernard 2017) for the acquisition of informants. Snowball sampling has been proven to be an effective sampling technique within qualitative drone studies despite the potential presence of selection bias (Chamuah and Singh 2019, 2021; Wang 2021; Aydın and Çelik 2023). My interviews were expected to last between 60-90 minutes and were conducted either virtually or in-person depending on the interviewee's presence in Pune, and/or their personal preferences and availability. My shortest interview lasted approximately 40-45 minutes (I use ranges to include the time we spent on the interview outside of the length of the associated audio file that had been recorded). My longest interview lasted approximately 110-120 minutes. Four follow-up interviews had been conducted for additional clarifications on a case-by-case basis, though these were completely unstructured, conducted over a phone call, not recorded (unlike the initial interview), and typically between 22-34 minutes in length. All my interviews took place in English, but almost all of them had portions that had been conducted in Hindi; owing to how most of my interviewees and I shared Hindi as a common language. As a native speaker of Hindi, I translated these portions of the interviews into English myself, without the use of any translation software. Crucially, I have not "edited" my interviewees' words to match American English or British English, and I have intentionally retained the use of Indian English in my interviewees' speech.

My recruitment materials for participants included scripts that I had designed for one-on-one conversations, as well as scripts that I had designed to publicly recruit both in-person and remote participants through the different social networks that I was using.

For all my interviews, I used an external, multi-directional RØDE microphone that I attached to a 13-inch MacBook Air. When the microphone eventually stopped working, I borrowed a lapel mic

that I used for the remaining in-person interviews that I had left to conduct (there's a short anecdote concerning this, later in the dissertation). Where audio recording and transcription software was concerned, I used a subscription that I acquired through Rev.com (i.e., "Rev Pro"). Rev Pro uses AI to transcribe and summarize audio files and makes it incredibly easy for users to edit transcription files and label speakers. I had initially intended to use Otter.ai for the purpose, but I found that Rev Pro's transcription service worked much better with a wide range of Indian accents. At no point did I contract any other individual for the purpose of human-assisted transcription. Additionally, while all my interviews were audio recorded, only a few had been video recorded (on Zoom). No in-person interviews had been video recorded at any point of time, though I did take many photos before and after conducting them.

I used an iPhone 13 Pro to take photos, and occasionally used a Canon EOS Rebel T7 DSLR camera to take photos of a higher quality whenever I had the opportunity to do so. At certain field sites in Pune, I had been expressly denied the permission to take photographs, but at all the sites that I have taken photos at, I had received verbal permission to do so. When including screenshots that I had taken from public web pages and communities on my phone, I had a total of over 220 images that informed the analysis of my data.

I followed de-identification protocols within the study, particularly in cases where any sensitive information about a start-up or an established business might be shared. Pseudonyms were used for all participants in the study, and the names of almost all businesses with a few small exceptions. And though the interview questionnaires were constructed using the "Initial RQs" as guiding research questions, the "defocused nature" of the semi-structured interviews lent itself to a re-structuring of the primary research questions (as I showed earlier). The questions from the semi-structured interview questionnaires were accompanied by questions that captured relevant demographic information as well, though I have not explicitly tabulated this information in the interest of maintaining my

interviewees' anonymity. The drone industry in India is still nascent, and despite efforts to anonymize participants' identities, it would still be relatively feasible for their peers (and other stakeholders) to identify them.

Digital ethnography and participant observation was targeted towards the production of field notes, photos and videos that provided contextual information for the interviewees' responses. Interviewees and/or other participants were provided with consent forms via email. In most cases, participant observation at physical sites occurred when interviewees were in the process of operating their drones (for recreational or professional purposes), actively editing photos/videos taken using drones or demonstrating how they did so, and meeting with other drone operators, colleagues or professional/personal acquaintances in person. In cases where I conducted interviews in a drone operator's office space, participant observation only occurred only with participants who verbally agreed to be observed and/or asked questions. If there were other people were present in the office space who did not consent to being observed or had no knowledge of the study, data was not collected about them. Some interviewees were asked to share drone media in the form of photos, videos, maps, or other metadata. The data shared by them was de-identified/censored where necessary (if necessary, at all), and was not associated with the interviewees' identities in any way. All interviewees were modestly compensated for their time with an Amazon gift card. All interviewees had also been provided with an informed consent form that had been approved by the Institutional Review Board (IRB) for this study.

2.3 Data Analysis

Analysis of all the data that I had procured (through interviews, photos, videos and ethnographic observations) was based on the framework of abductive analysis. Abductive analysis is particularly relevant to the analysis of qualitative interviews, as it enables researchers to generate and

refine theoretical insights by moving back and forth between empirical data and existing theoretical frameworks. Coding for the qualitative data was based off the modes of analysis described in Timmermans and Tavory (2022). There was an initial stage of “open coding” of interview transcripts and field notes, similar to that of the approach recommended by Glaser and Strauss (2017). This was followed by a stage of “focused coding” where a theme with potential is first picked, and then re-utilized for a further round (or rounds) of open coding. This was particularly useful after follow-up interviews are conducted in the few instances that I took them, or when novel data came to light through a new interviewee. Eventually, this process led to the construction of an “index case” (Timmermans and Tavory 2022, 93), around which variation in other cases (and mediating factors causing those variations) are examined.

The utilization of a particular index case can come under question if it fails to explain (or inadequately explains) variance in the dataset, in which case, a new index case might be constructed. Thankfully I did not have to do this, as I believe that I reached saturation with the number of interviews that I conducted, but if I had a larger budget and/or a longer timeline to work on, it’s possible that I might have had to consider constructing a new index case with if variance in newer findings were not explained well enough by my index case. Indeed, if that were to happen, it could have pushed the dissertation towards a new avenue of data collection, and/or created additional avenues for future research beyond the dissertation that I am currently unaware of. The eventual goal of studying variation around the index case is to assist the emergence of analytic themes that would subsequently aid the process of theorizing and responding to the dissertation’s key research questions (114).

3. Chapter Outlines

In Chapter One of this dissertation, my focus lies on responding to RQ1 and RQ2 listed in Section 1.3 of this Introduction. The nature of my data and the method of abductive analysis led me towards structuring an understanding of the drone society through the lens of Actor-Network Theory (ANT). Within this chapter, I use ANT to highlight several key sociotechnical negotiations that often define the relational ontology of “becoming” (and to some extent, even “being”) a drone pilot. I also provide an analysis of how the process of “translation” (a concept within ANT) works within the drone society, while prefacing the knowledge that the many different components of the process of translation are ongoing processes that change constantly through the relationality that they present. From a theoretical standpoint, this chapter lays a foundation for all the analysis that follows it.

In Chapter Two of this dissertation, I approach RQ3 and RQ4 by first speaking of the essence of drone-work. By establishing larger social and institutional contexts and speaking of the drone society as a “complex predatory formation”, I reach into contemporary scholarship concerning drone capitalism, and highlight the pressing need for further investigations into the precarious nature of civilian drone-work. This chapter argues for three novel markers of precarity within the domain of civilian drone-work and elaborates upon the respective sources of precarity that result in the formation of those markers.

In Chapter Three of this dissertation, I leverage my responses to RQ5 and RQ6 to reconcile two major theoretical frameworks: Bruno Latour’s Actor-Network Theory, and Niklas Luhmann’s Systems Theory of Communication. By doing so, I simultaneously highlight the vitality of studying how systems of mass media utilize drone media, and I explain how drone media can be used to produce a socially constructed version of reality, as seen through a comparison of first-order observations and second-order observations concerning different categories of drone media.

In the Conclusion for this dissertation, I revisit the overarching question that is posed by this study, and briefly speak of the implications that my findings have for public policy, and for the field of drone studies.

Chapter One

Aerial Journeys: On the Relational Ontology of Becoming a Drone Pilot

1. Introduction

We are already living within a drone age (Coley and Lockwood 2015), where the drone exists as a fractionally coherent object (Jablonowski 2015), binding pluralistic lived experiences and perceptions on one hand, and monolithic discourse (such as the militaristic use of drones) on the other. Representations of the drone's machinic agency range from references to a god's eye view (Burrows et al. 2015), to a bird's eye view, bound to the human, making them more-than-human through remote sensing technologies, amongst others. Between these theological references, metaphysical agencies, and chimeric representations of human-drone interaction (2015), much is left to be said about what a "drone society" really is.

In their study on drone policing, Coliandris (2021) opened a line of thought concerning the development of the concept of a drone society. Hill (2019) simply considers the drone society to be a worldview, a framework for rhetorical analysis, while other scholars such as King (2020) liken it to a surveillance society where the very existence of a "civilian" drone operator itself is questioned. Such approaches are arguably limited in their scope, as they fail to articulate the ways in which a drone society might exist as a viable network of human and non-human actors, and as a utilitarian framework of sociological analysis.

This chapter designates the idea of a drone society as a series of continuous connections between heterogenous elements – as a deployed network where a connection might lead us from one to local interaction to "other places, sites, and agencies through which a local site is made to do something" as Bruno Latour (2007) would put it. By using the adjective "social" in a Latourian sense, I am most certainly connoting that there is in fact, a drone society which can be thought of as a trail

of associations between its heterogenous elements in its moment of existence, and not as a pre-existing, apriori entity that exists to begin with. The purpose of this chapter is to trace those associations by speaking of group formations, of uncertainties, to highlight a network of civilian drone operators (or drone pilots) as constitutive of a drone society. The point of a drone society, to paraphrase Whitehead (2010), is “that it is self-sustaining; in other words, that it is its own reason”. That being said, I use this chapter trace a drone society in India; which I believe to be one of many networked drone societies that exists across the world.

If this sounds confusing, you might wish to skip ahead to the very end of this chapter for a clarification, but you’ll miss out on the connected traces of many heterogenous elements along the way. In the process of following the traces of a drone society across a flattened topography, I follow the blueprint for Actor-Network Theory (ANT) that Latour had provided in *Reassembling the Social* (Latour 2007), using the infra-language of ANT to articulate the negotiated existence of the drone society. That being said, no use of ANT would be considered complete without considering the contributions of Michel Callon (1984; 1986; 2007) and John Law (2009). Much like the networked entanglements that ANT seeks to disentangle and trace, ANT itself, could be said to be entangled within the works of several scholars, while being simultaneously situated within Latour’s *Modes of Existence* (AIME) framework (Latour 2013; Edward 2016). Given the numerous ways in which ANT could be misinterpreted (Latour 1996), it would be prudent to pause for moment and go over a brief description of actor-network theory:

“Actor network theory is a disparate family of material-semiotic tools, sensibilities, and methods of analysis that treat everything in the social and natural worlds as a continuously generated effect of the webs of relations within which they are located. It assumes that nothing has reality or form outside the enactment of those relations. Its studies explore and characterize the webs and the practices that carry them.” (Law 2009)

I will begin this task of tracing connections by detailing several ethnographic themes through different vignettes. In doing so, I will eke out elements of discourse, agency, hybridity, symmetry (of treatment

towards humans and non-humans), and most importantly, performativity. A focus on these five traits will remain consistent throughout this dissertation. In the end, this dissertation is an actor as well – an analytical report that will actively translate, mediate, and potentially transform all the relationships that it depicts. The key purpose of this chapter is shed light upon the process of becoming a drone pilot (a term I use interchangeably with “drone operator”), which I argue, is characterized by multiple, entangled sociotechnical negotiations within a network of human and non-human actors, where agency is distributed across technologies, regulations, social practices, and individual motivations. Such sociotechnical negotiations occur all across the drone society, though in militarized contexts (and drone warfare in particular), they might be best framed as sociotechnical “struggles”, or “technoscientific struggles”, as Iván Char López (2024) frames them.

To clarify, my use of “sociotechnical” does not imply that I am referring to the Tavistock school of sociotechnical systems theory (Kaghan and Bowker 2001). In contrast to the Tavistock school, ANT (as developed by Latour, Callon, and Law) approaches the social and technical as inseparable and is particularly amenable towards the act of making the “social” more visible in a technical space (Gumede and Tladi 2023). ANT is very much a description-heavy sociological approach towards studying such technical spaces, with the understanding that the “social” is also used to designate the “natural” and the “material” (Baron and Gomez 2016). As an explanatory heuristic (Walsh et al. 2017), ANT has been described in a multitude of ways, with “actant-rhizome ontology” (Latour 1999) possibly being the most accurate way of understanding it. A well-defined “theory” would be the least appropriate way to understand it. By drawing directly on multiple sources, Table 1 below highlights a few key concepts from ANT for the sake of clarity, and the anxieties that are often caused by the absence of any kind of conceptual unity within the body of literature concerning ANT.

Table 1

A FEW CRITICAL CONCEPTS FROM ACTOR-NETWORK THEORY

| CONCEPT | DEFINITION | ASSOCIATED PROCESSES |
|---------------|---|--|
| Actant | The distinction between “actants” and “actors” is somewhat fluid and difficult to establish, but in essence, an “actant” resembles the potential that a human or non-human entity might exhibit in different contexts as an actor. Latour (2007) pulls this term from the study of literature. | Arguably, there are no processes associated with the “actant” until it is attributed a figurative or non-figurative role (Latour 1994). |
| Actor | “An actor is, according to the concept of ANT, ‘not the source of action but the moving target of a vast array of entities swarming towards it’” (Jansen 2017). It is the product of an actor-network. As Callon (2007) says, “It is precisely because human action is not only human but also unfolds, is delegated and is formatted in networks with multiple configurations, that the diversity of the action and of the actors is possible.” | “Actors are not quite the same from situation to situation. Rather, they are transformed in their movement between practices. Actors are found in different yet related versions, and networks develop through actors’ transformational interactions” (Gad and Bruun Jensen 2010) |
| Actor-Network | An Actor-Network designates “related actors in a heterogeneous network of aligned interests” (Jackson 2015). “Actors have to be and propose their ontology while at the same time being part of other ontologies. Only in this way can we conceptualize something like a relation between different actors... The connection between different actors has to be a real translation. This means that the relation between actors has to be conceptualized differently from the perspective of the network and the perspective of each actor” (Jansen 2017) | Actors must pass an <i>obligatory passage point</i> , or a situation that has to occur for all actors to be able to achieve their interests, as defined by focal actor(s) (Callon 1986; Olla, Atkinson, and Gandcheva 2003). The boundary of a network can be related to its level/degree of convergence (Callon 1990). See more on convergence below. |
| Intermediary | “An intermediary is a messenger that ‘transports meaning or force without transformation’, providing information and connections but no more” (Goodchild and Ferrari 2024). Additionally, “Intermediaries are actors that can be counted as stable; as a <i>black box</i> , where knowing the input is tantamount to knowing the output. There is less certainty with mediators” (Pollack, Costello, and Sankaran 2013). | Intermediaries are unidirectional, they simply act facilitate introductions between different actors. They can possess different forms, such as text or media, storage devices, consumer goods, human beings, or even money (Callon 1990). |
| Mediator | “Mediators are technologies that do not function as passive objects and that do | “Mediators transform, translate, distort, and modify the meaning or the |

| | | |
|--------------------|---|---|
| | not simply pass on some effect from one actant to another” (Bueger and Stockbruegger 2017). | elements they are supposed to carry” (Latour 2007). |
| Translation | Translation denotes “the way actants are enrolled, mediated, and redefined in processes of network formation and stabilization... ANT views ‘the social’ as a matter of how actants, human or nonhuman, exchange properties and capacities as part of networked translations that constitute, change, stabilize, or dismantle sociomaterial worlds.” (Blok 2019). Translation is, in short, an act of power (Barry 2013). | “The activities through which heterogeneous actors associate with one another and by which they constitute, order and dissolve actor-networks are known as problematization, interessement, enrollment and mobilization” (Abdallah, Malik, and Chaudhry 2020). I have described these in greater detail in Table 4. |
| Convergence | “Convergence measures the extent to which the process of translation and its circulation of intermediaries leads to agreement” (Callon 1990). The level/degree of convergence of an actor-network is the point to which “any one actor’s activities fit in easily with those of the other actors, despite their heterogeneity” (Callon et al. 1992). | “Convergence has two dimensions: <i>alignment</i> and <i>co-ordination</i> ... A successful process of translation thus generates a shared space, equivalence and commensurability. It aligns. But an unsuccessful translation means that the players are no longer able to communicate. Through a process of disalignment they reconfigure themselves in separate spaces with no common measure. Translations thus both flow through and are held in place by intermediaries...” (Callon 1990). |
| Irreversibility | Irreversibility can be understood as a condition where an actor’s embeddedness within a “bundle of interrelationships” makes it impossible to disentangle it from other translations. Indeed, it is the interrelatedness of translations that creates irreversibility because it is usually more difficult to redefine a whole array of actants than only a single one (Schulz-Schaeffer 2006). As Callon (1990) says, the more numerous and heterogeneous the interrelationships the greater the degree of network co-ordination and the greater the probability of successful resistance to alternative translations. | “ <i>Normalisation</i> makes a series of links predictable, limits fluctuations, aligns actors and intermediaries, and cuts down the number of translations and the amount of information put into circulation... With normalisation or standardisation comes the possibility of quantification... The more precise and quantified these standards, the more a successful translation becomes irreversible. A network which irreversibilises itself is a network that has become heavy with norms” (Callon 1990). |
| Inscription Device | Defined in <i>Laboratory Life</i> (Latour and Woolgar 1987), an inscription device is “any item of apparatus or particular | Speaking in performative terms of scripts/scenarios, notes from Latour (1992) highlight the following |

configuration of such items which can transform a material substance” into a usable *inscription*, such as a figure, or a diagram, and is thought of as being “sociological by nature”. Thereafter, the “inscriptions are regarded as having a direct relationship to ‘the original substance’”.

processes: “I will call the retrieval of the script from the situation *description*. They define actants, endow them with competences, make them do things. We call the translation of any script from one repertoire to a more durable one *transcription, inscription, or encoding*. We call *prescription* whatever a scene presupposes from its transcribed actors and authors. We call the way actants (human or nonhuman) tend to extirpate themselves from the prescribed behavior *de-inscription* and the way they accept or happily acquiesce to their lot *subscription*. We call *pre-inscription* all the work that has to be done upstream of the scene and all the things assimilated by an actor. We call *circumscription* the organization in the setting of its own limits and of its own demarcation...*ascription* the attribution of an effect to one aspect of the setup...*conscription* this mobilization of well-drilled and well-aligned resources to render the behavior of a human or a nonhuman predictable.”

NOTE: Structure adapted and expanded upon from a similar table by (Gumede and Tladi 2023).

The process of “becoming a drone pilot” is most certainly not a linear straightforward process, nor is it a standardized process. People have many varied perceptions about what a drone pilot is, or what it takes to become one, particularly in a civilian context. There are multiple trajectories that could be followed with respect to becoming a drone pilot, each of which rests upon many different forms of formal and informal learning through theory, praxis, and community. Such processes necessitate “thick” ethnographic accounts (Geertz 2008). A case for this approach has been made in (Tummons 2022), who studying the complex processes of “becoming” and “being” a cycle technician. To that effect, this chapter focuses exclusively on the “aerial journeys” of individuals who are (or who to seek

to become) active controllers (or operators/pilots) of drones (Tezza and Andujar 2019), as opposed to those who exclusively engage with them in a passive way, such as an act of observation.

But wait! What is a sociotechnical negotiation, you ask? The key component of the argument that I make in this relational process of “becoming” a civilian drone operator? I reserved the best definition for the end, before we “take off” on many different aerial journeys to observe the sociotechnical negotiations that they present. A *sociotechnical negotiation* highlights a “tug-of-war” between actors, and a successful sociotechnical negotiation is one that is not necessarily marked by the actions of an actor with the best possible solution or idea, but one that has the capacity to rally the greatest support towards themselves (Sarker, Sarker, and Sidorova 2006). Identifying key actors involved in different types of sociotechnical negotiations is crucial, and I highlight several in Table 3. In Table 4, I summarize the ways in which the process of translation provides an understanding of how negotiations and alliances solidify the formation of the drone society. It is vital to remember that the formation of an actor-network such as the drone society is dynamic, complex, and ever-changing; the drone society will continue to shift between varying states of complexity over time. Moreover, the use of ANT requires a certain level of perspicacity, which is why a briefing on its theoretical elements was indispensable at the outset, even though this chapter eventually only utilizes the process of translation to provide an empirical basis for its argument. Papadopoulos, Radnor, and Merali (2011) follow a similar approach by providing a breakdown of the vocabulary of ANT before using it for what might arguably seem like microsociological context, in contrast to what might come across as the macrosociological context that I sought to trace, but in the end, Latour would dismiss any kind of distinction between the macro and the micro. Indeed, as Latour (2007) says, “Scale is the actor’s own achievement. ‘Size’ and ‘zoom’ should not be confused with connectedness”. ANT will continue to evolve, just as the overarching framework of AIME will continue to do so as well.

2. Aerial Journeys

2.1 Infrastructural Negotiations: A look at legal and regulatory compliance.

In July of 2023, and at the beginning of the monsoon season in Pune (India), I took an auto-rickshaw to my first research site: Capybara Technologies, a start-up company that had its office a few kilometers away from where my family lived. Ten minutes into the ride to their office, the driver glanced at my face (and quite possibly my beard), then my name on the ride-hailing app that lay open in front of him, and then finally proceeded to ask me with a healthy dose of suspicion – “*Aap Hindu ho kya?* (Are you Hindu?)”. I nodded and affirmed with a certain level of distaste for the question, not because I felt like I was abandoning my irreligious leanings, but because I felt that the question itself was possibly couched in some amount of islamophobia. I looked back at my own phone, and I noticed that the driver had a name that gave away his identity as a Hindu. In that moment, I was reminded of the importance of “fitting in” and using it as a strategy for ethnographic access (Hannerz 2003; Reeves 2010; Van Maanen 2011; Grant 2017), studying “sideways” (Hannerz 2006; Plesner 2011) and acquiring social currency. I was back in India after nearly four years of being away, mostly due to the events of the COVID-19 pandemic. Perhaps I had forgotten to fit in the way that I used to, I thought to myself, though I hadn’t forgotten the necessity of doing so. Indeed, if tobacco could serve as social currency (Rich and Xiao 2012), surely some amount of performative political solidarity (Scholz 2008) would help me with some of my interviewees, especially if they were politically conservative.

Founded in 2020, Capybara Technologies had its office in a small apartment complex. My two interviewees, Akhil and Ishan, both in their late twenties, greeted me enthusiastically, and seemed very eager to discuss the nature of their work. Their demeanor gave away a great deal of curiosity about the nature of my inquiry as well; being engineers, they disclosed that hadn’t ever really had much of an engagement with the social sciences – much less a social scientist. I was able to reach out to them through an old friend of mine from high school, and as it turned out, Ishan had been at the same

school with us, albeit after my time there. Institutional associations and my history with Pune made it easier to open up a conversation with them about a wide range of topics. The two had never really used drones prior to beginning working with them professionally and had sort of stumbled into the industry owing to their interest in automobiles. Capybara Technologies' first project involved mapping a heritage site for the Maharashtra State Archaeology Department.

Akhil: So, uh, it was basically in ruins. We were recruited by a trust, and the trust wanted to analyze the, uh, extent of damage to the structure and basic survey they can use. So, uh, we, so there's a friend of ours who worked in, uh, who used to study in Pune University, uh, for Archaeology. So, through him we got to know the state archeology department director. And through him we got the project that was basically our first commercial project using drone. We have done one project before that, but it was purely GIS (Geographic Information Systems) not using drones.

As of July 2023, Capybara Technologies offered services pertaining to surveying, mapping, and building inspection, with additional plans to expand into formal training.

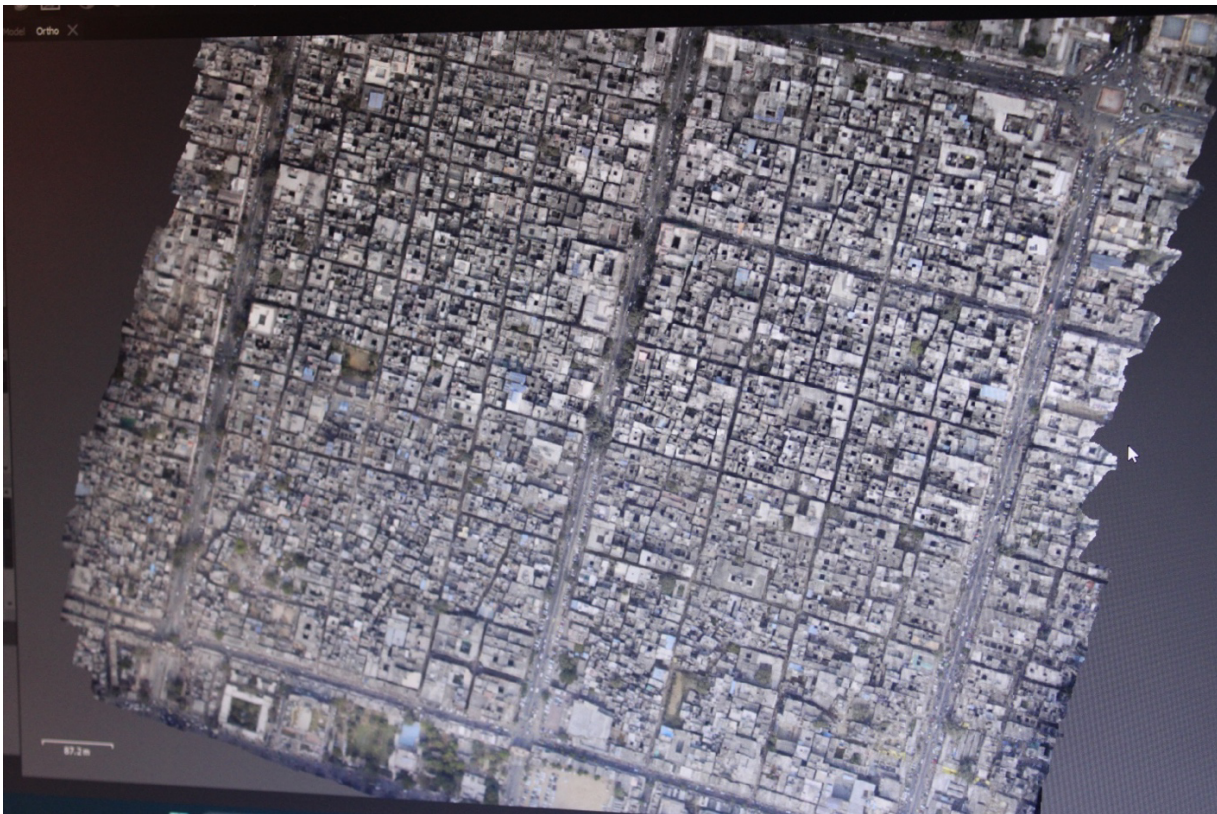


Figure 1: An orthomosaic map that Akhil and Ishan had been working on for a client. Credit: Author's own.

It is worth noting that at the time of this interview, neither Akhil nor Ishan had a Remote Pilot Certificate (RPC) for commercial UAS operations, as required by the Directorate General of Civil Aviation (DGCA) in India (Dubey 2021b; 2022).

Interviewer: So, what are the biggest challenges you face in each of those three areas (surveying, mapping, building inspection)?

Akhil: First would be India's uncertainty towards formulating policies. Like, they come up with some draft and then they don't launch the draft. They try to, uh, write something else. There's no certainty. There's a lot of legal loopholes, right? You cannot fly, uh, everywhere. You have to take permission. Sometimes you get permission, sometimes you don't get permission because right now you have to take permission from the local authorities...like the nearest police station. *Woh toh unke upar rehta hai...unke dena hai ki nahi dena* (In the end it's all up to them, whether they wish to give it to us or not), sometimes they don't understand what it is for...

Ishan: And it varies from client to client as well. So, imagine if we are doing it for government – the government people – obviously not the government, uh...you know what it is that I'm talking about. They help you out with the permission for their projects, of their own concern. Very important. That really matters to their work. But when it comes to commercial developers, people who are privately into infrastructure development, there is a big gap between securing permissions and working on the operation itself. But still, uh, the government institute, which recognizes the entire drone process, they, uh, are not really putting it at first. They are not *regularizing* the entire process of the survey to be done, if permissions are to be taken. How really people can approach them, the people who are really in contact with, in contact with the people who are from defense, so they're usually get a part where you can follow the protocol as to get the permission done.

Spearheaded by Amber Dubey, the Former Joint Secretary at the Ministry of Civil Aviation, the “Drone Rules” of 2021 were the product of “over 18 months of effort involving several ministries, NITI Aayog, security agencies, academia, startups and industry bodies” (Dubey 2021a). Dubey, an alumnus of the MBA program at the Indian Institute of Management Ahmedabad, was neither a civil servant, nor a politician, but a consultant with a career spanning three decades, who as of March 2024, was working as a Senior Advisor at McKinsey & Co. in Gurugram, India. The social reality that the drone rules sought to weave and create was very different from the ways in which reality operated within the drone society. Akhil and Ishan were amongst the majority of civilian drone operators in my

interview sample who did not possess an RPC. Despite being “built on a premise of trust, self-certification and non-intrusive monitoring” (PIB Delhi 2021a), the rule of *jugaad* (or “frugal innovation”) – a multidimensional concept that has numerous books and hundreds of articles written on it already – towered above any policy or law that the government could come out with in the context of regulating civilian drone operations. Akhil and Ishan told me about how they had outsourced the labor of regulatory compliance to their business partner Sushil, who possessed an RPC, but more than often, they would ask their clients to seek permissions for drone operations from the authorities directly.

Sixteen minutes into our interview, my strategy of “fitting in” began to pay off. As I sat on a chair facing my interviewees in their utterly humid living-room-turned-office space, Ishan spoke of his “hack” with respect to working in “Red Zones” – areas which are essentially ‘no-drone zones’ within which drones can be operated only after a permission from the Central Government (PIB Delhi 2021b).

Ishan: So, the way we’ve been operating...we have our compliances arranged. My dad worked in the Army, so I happen to have some of his connections and some insights into how to get permission for the areas where it’s really tough for people get the permission done. So, like as you know, half of Pune is all army establishment, right? A lot of area belongs to the Army and to the Air Force Station. There are five different commands. So, uh, my father-in-law – he’s an Air force officer and he was in Air Traffic Control and he’s been a part of the DGCA. So he knows all the guidelines and the parameters...which we also consider...and that is how we operate in the area where it is actually a big no-no...a red zone area that is...but there are a lot of compliances that you have to really follow and the permission and the *letter* you drop matters a lot.

Akhil: We haven’t faced cops...yet.

Access to the best drones on the market mattered a lot. Both Akhil and Ishan were very vocal about the technical superiority afforded to them by drones manufactured by Shenzhen DJI Sciences and Technologies Ltd. (or simply, DJI).

Akhil: Another issue is the availability of a proper drone. Like for example, we mostly use DJI, but since it’s a Chinese company, there’s a grey area. They’re mostly banned now. Now they’re

banned from being imported, but there's still a few of them in the market. So, we use a DJI drone, and the government wants us to use Indian drones... "Made in India" drones. But all the drones that are available in domestic market right now are not up to mark basically, as they're not agile, not user friendly, they cost way too much like, uh, for example Ideaforge, *unka* (their)...Ninja or some drone was one that we were looking at.

Ishan: Rhino and Ninja.

Akhil: Ninja...even *they're* not at par with DJI, but they *still* charge more than 12-15 Lakhs for that, while DJI comes for 1.6 Lakhs and...

Ishan: Being very honest with you, uh, Phantom 4 Pro v2 which we are using. So, the basic thing is it is very compatible. It's very user friendly. The purpose, what it really sought is not taken into consideration by the people who are making drones in India. Because when you are, so imagine climbing a mountain, 250 acres of land is not a joke, you can't carry such heavy drones up. Even when you tell people that it's only two persons' work to do. It is not possible. You need a team to do that...to carry such drones. But this is where DJI has really got a good market, right? And uh, the user, if I believe...*aapne DJI ka drone dekha hai* (you've seen a DJI drone)...if you have used one, you know what I'm talking about...it's like playing a video game.

Akhil and Ishan chose not to mention *how* they had acquired their fleet of DJI drones, but as I learned later from several of my other interviewees, a healthy, thriving grey market of importers and distributors existed in different cities across the country. Some of these importers would smuggle consumer drones into India, store them in warehouses or at other undisclosed locations, and sell them through brick-and-mortar storefronts for cash without issuing a bill of sale. Other importers would simply buy parts that could be used to build drones, including components produced by DJI and other Chinese manufacturers, and sell them online to hobbyists or professionals directly under the label of a "local hobby store". Some, apparently, did both. Infrastructures in the drone society – whether market infrastructures, urban infrastructures, digital infrastructures, or bureaucratic or legal infrastructures – are the product of sociotechnical negotiations. Such infrastructures – particular those within nations across the global south – are often incomplete, transient, and full of uncertainties that can present many different possibilities (Guma 2020).

2.2 Serious leisure: An inspection of negotiations with individual motivations and resource allocation

There are many different pathways into drone usage for hobbyists and professionals alike. In contrast to the experiences that Akhil and Ishan narrated to me, there are individuals who are introduced to drone piloting as a hobby. Others are introduced to drones through another closely related hobby or professional interest, such as photography, or travel, or an amalgam of the two: travel photography. For the sake of simplicity, I use photography as a catch-all term here that includes drone videography as well, since the majority of the drone photographers in my sample would often use their drones to record videos as well. There are three distinctive arguments to be made here. **Firstly**, it is difficult to discern between a recreational drone pilot and a professional drone pilot, for as my interview sample implied, it is fairly common for a drone pilot to consider themselves to be a part of both categories. **Secondly**, while there most certainly are drone pilots who fly either recreationally or professionally, what might distinguish one from the other (apart from the pursuit of financial gain), is the concept of serious leisure. The concept of serious leisure can certainly influence the allocation of resources (of all kinds) towards the use of drones for either recreational or professional purposes.

To speak of serious leisure, would also mean having to speak briefly about casual leisure, and other closely related concepts. Casual leisure has been defined as “immediately, intrinsically rewarding, relatively short-lived pleasurable activity requiring little or no special training to enjoy it” (Stebbins 1997). Stebbins’ work on casual leisure follows his pivotal work on serious leisure (Stebbins 1982), where he defined serious leisure as a form of self-expression, self-fulfillment and self-identification that remained straddled between work and casual leisure. Its three types - amateurism, hobbyist pursuits, and career volunteering – were spoken of as interrelated. In contrast to casual leisure, an engagement with serious leisure would present a pronounced degree of perseverance to be associated with it, specialized training, durable benefits (Stebbins 1980), a distinctive ethos, and a tendency to pursue (or possess) a career in the endeavor that is being spoken of. Aside from serious leisure and casual (or unserious) leisure, there is also the domain of project-based leisure, which is said to be a

“short-term, moderately complicated, one-shot or occasional though infrequent, creative undertaking carried out in free time” (Stebbins 2005).

Put together, the three forms (casual leisure, serious leisure, project-based leisure) make up the **Serious Leisure Perspective (SLP)**. I do not employ the specific categories that Stebbins outlines for each form of leisure, but **I use SLP as an actor that specifically delineates work from non-work**. By doing so, I provide an empirical basis to address certain critiques of it as a macrosociological analytic (Veal 2021) and reiterate SLP’s suitability as an analytical concept for complex social worlds, although Stebbins (2021) has already done so in great detail. Its strength (and its suitability) as an actor emerges from Stebbins’ agreement with the view that the distinction between work and leisure has become increasingly blurred, and that these two domains of life have become intertwined to the extent that many individuals often possess a liminal existence between the two, causing the spectrum between work and leisure to be understood as a singular domain of life (Rainoldi, Ladkin, and Buhalis 2024). **Actors are not to be conceived of as “fixed entities but as flows, as circulating objects, undergoing trials”** (Latour and Crawford 1993). **They are indeed capable of existing as recreational pilots engaging in “play”, and as professional drone pilots engaging in “work”, depending on the negotiations they are engaged in within the drone society**. This form of existence arguably captures the essence of many of my interviewees’ experiences as a professional and/or recreational drone pilot, and arguably dismisses the need for distinguishing between “work” and “play” while embracing the fluidity that SLP has to offer.

The third argument, as has been illustrated below, emerges with respect to the allocation of economic resources towards the activity of being (or becoming) a drone pilot, even if it were for a short period of time. SLP bears loose ties to conspicuous consumption (Stebbins 2014) and given the average price of entry-level commercial drones in consumer markets across the world, it wouldn’t be

inaccurate to state that the act of engaging with drone piloting can certainly be an act of cultural and economic elitism.

Dhruv, a recreational drone pilot in his late twenties, had grown up using all kinds of cameras. His father owned an entire array of cameras that he'd gotten to use as a teenager, and as he sat in his bedroom in Navi Mumbai, he told me about how his interests in adventure photography pushed him to experiment with different kinds of cameras. A designer by training, he told me about how he bought a DJI drone off Amazon during the early days of the Covid-19 pandemic, at a time when the regulation of drones in India occurred under the ambitious Civil Aviation Requirements of 2018 (PIB Delhi 2018) – the predecessor to The Drone Rules of 2021. In the midst of telling me of how he (and a group of friends that he flew drones with) had been frustrated with the “fifteen-meter height restriction” on his unregistered drone, he also spoke of how they bypassed that limit using third-party software.

Dhruv: ...We then started using that because that app allowed you to bypass, uh, that limit. So, once we got hands on that app, then we could basically go to up till...wherever. Like then there was no limit. And yeah, the first time the drone went up like that far up, it was a little scary because, like, once you can't see the drone, then it gets a little scary because you don't know what's gonna happen. And even before that, like, uh, till we didn't figure out, uh, the height limit, like the third-party app, we would actually go hike up hills to be able to get that high up because it's fifteen meters from where you start flying. So, if you're on top of a mountain, then fifteen meters is already quite high up. So that's what, that's the hack that we would use. But we soon got around, uh, to using the third-party app.

For Dhruv, YouTube videos offered him all the information he believed he needed. He'd told me about how he'd made some money from shooting videos of vacation rentals, but he didn't really care much about being a part of a larger community of civilian drone operators. The drone was simply one of his tools – he was a designer and a photographer first. What the drone did for him, however, was grant him access to a version of Mumbai that he seemed to romanticize. It became a medium for him to observe and even curate an aerial perspective of the city that excluded infrastructure and publics from his voyeuristic gaze. Indeed, the medium is the message (McLuhan 2008 [1964]); the ability of

the drone to effortlessly transcend physical barriers redefines what we know about the social world, particularly norms concerning visibility, mobility, and access, regardless of its use case.

Dhruv: Yeah, so even when you're just consuming, uh, drone footage online, it just gives you a completely different perspective of any natural, uh, environment or even like a city. If you look at city drone videos also, like, I've seen so many drone videos of Bombay and I was just like, damn, Bombay looks like Hong Kong man. Like <laughs>, Bombay does not look like Hong Kong from the ground, but it looks like Hong Kong from the top.

Interviewer: So, what did that make you feel about Bombay? I mean, having lived here for so many years, how did drone footage change your perspective of the city?

Dhruv: The first time that I saw a drone video of Bombay, like *main* Bombay, like *South Bombay* and Lower Parel over the Sea link, I was just like, oh shit, so *this* is what Bombay looks like, what the fuck? <laughs>. I was totally surprised. I was just, like, Bombay does not look like this from the ground floor at all. So yeah, it just completely changed my perspective. I still say this to a lot of people: Bombay below the 20th floor is a different Bombay. Bombay above the 20th floor is a different Bombay. If you're above 20th floor, you see a completely different Bombay. Planes usually fly over like, the slums in Bombay. When you're landing in Bombay, you're seeing a lot of slums. So yeah, that way looking at South Bombay from the bird's eye view that the drone lets you have, yeah, I was just like, this is just like Hong Kong man. Bombay has leveled up.

The shift from “Bombay” to “Mumbai” in the mid-1990s is something that Arjun Appadurai has spoken of as a sign of the “decosmopolitanization of Bombay” (Appadurai 2000), while others approached “Mumbai” and “Bombay” as two distinctive categories of social analysis that co-existed at the same site (Rao 2006; McFarlane 2008). As a postcolonial megacity, the city offers you a choice that is, at the same time, wrapped up within the politics of provincialization on one hand (Varma 2004), and neoliberal urbanism on the other (Banerjee-Guha 2009). Even with such a description, I risk engaging in the oversimplification of “choosing” to live in a city that you would either call Bombay or Mumbai. There are prominent tensions over the use of public space. Just as the movie *Slumdog Millionaire* (Boyle and Tandan 2008) registers a certain level of disdain and a diminished level of tolerance for vagrancy, poverty, and the visibility of slums (Baweja 2015), Dhruv's articulation of his privileged access to aerial mobilities skirts over an engagement with their existence and other matters of public acceptance (Eißfeldt and Biella 2022). Indeed, “drone cities” (Jensen 2016) take social

segregation to another level, both literally and metaphorically. Contemporary megacities like Mumbai have moved past the vertical politics of flyovers that “privilege the mobilities of the privileged” (Graham 2018), as the mere existence of civilian drone operators reveals a new vulnerability in its kinetic condition, or the “movement and the place-making of its residents in the form of festivals, rituals, impromptu bazaars, and events” (Mehrotra 2007), aside from a new epistemology of the privileged urban-dweller that could potentially shrink and marginalize the city in discrete moments (Brenner and Schmid 2015).

In the time that I spent immersed within digital communities of civilian drone operators in the United States, it didn’t take me much time to realize that many big cities such as New York City arguably restrict such “drone mindedness”, or the mix of “vertical attunement and situational curiosity” (Hildebrand 2021) through what many deemed to be overwhelming number of bureaucratic procedures (NYPD 2023). Mumbai isn’t very different in this sense. Unmanned traffic management (UTM) in both cities, or both countries for that matter, is mediated by digital platforms that effectively automate airspace authorizations. Unfortunately, both platforms – B4UFLY (Federal Aviation Administration 2024) in the U.S., and Digital Sky in India (DGCA 2024) – are known to present drone operators with inaccurate information (Ackerman 2019). Despite certain similarities, comparing them more holistically would be like comparing apples to oranges, and a more holistic critique of both apps goes beyond the scope of this chapter.

Dhruv’s comments on the purchase of a drone were more reflective and were responsible for making me think more carefully about the ties between SLP and conspicuous consumption. Moreover, I doubt that anyone in my sample of interviewees would have self-identified as working class within an Indian context. This would be a major point of difference between drone operators in India and the United States, as my insights from having spent time in online communities made me believe that

a sample from the latter would have been more likely to present me with more diversity in terms of social class.

Dhruv: I know a few people who just bought a drone just because, like, it was like, trending. Because like, to them it's like buying a new iPhone without knowing anything about an iPhone. "Like, okay, everybody has an iPhone. I'll also buy an iPhone because I have the money." They're gonna fly it a few times and then it's gonna be lying in their rooms.

Interviewer: So, you're saying that it's more of a status symbol for them. It's not really something that they're, you know, actively going to chase as a serious hobby.

Dhruv: Exactly. And somebody who's actually going to use one seriously, like say a photographer who's actually doing professional photography with making money off it, he is gonna be sensible and responsible about it because that's his source of income. You're not gonna mess around with your source of income.

In contrast to Dhruv, Sourav – a Kolkata-based advertising professional in his early forties – presented a very different perspective on the use of his resources towards drones, and a more conscientious outlook with respect to being trained to be a licensed drone operator. His interest in drones emerged through a project he had been working on, where he was responsible for producing an ad for an amusement park. A drone operator had been hired to work on the shoot, and Sourav's proximity to the operator and his equipment got him thinking about working with a drone by himself.

Sourav: So that is when I went to Delhi, and I started my drone training there because I was very intrigued with this industry because I always had the nick for cameras. So, since I saw a flying camera and I could take it to 120 meters (400 feet), I always wanted to just go about flying a drone for just as a seasoned pilot, not professionally, just to play around with. So, I invested about a one lakh rupees for a drone, which was like a toy drone. It was a Chinese company, DJI, which I invested in and just to shoot mountains, just to shoot things and try out my hand on this fancy gadget. Things got a little interesting and that is when I started thinking about how to take it further to the next step. And that is when I contacted IGRUA, there is this university called IGRUA, which is called Indira Gandhi Rashtriya Uran Akademi, based in Delhi. So, I got my pilot license from there. It was a month-long course where I learned how to build drones, how to repair drones, how to fly drones, how to be in limits when you fly and not get deviated from the rules and the procedures, what you need to follow when you are doing something like this. Because it's really very difficult for the government, especially for Indian government, to make people understand that it's a flying object and it can have serious issues when it comes to accidents and things like that. So, I did my course in 2021. It was a rotorcraft course and the (drone) category was small, that is what I started with. Drones have a lot of categories: nano, small, medium, large. So, I started with small, and the category was called VLOS (Visual Line of Sight).

Interviewer: That sounds amazing. Could you tell me about what your educational background was in this respect? You mentioned that you came from an advertising background, you mentioned that that's where you were working primarily. Did you have any experience with engineering, robotics, electronics in any sense at all?

Sourav: Not by far. I didn't have any experience with electronics...you have to understand and study physics when you're doing this course. There's an examination, there's a practical, there's theory, there's a lot of other stuff. It was not an easy affair, especially since I'm over 40. When you try to learn things like aeronautical theory, geometry, handling geographical data and a lot of other stuff at my age, it doesn't come easy. I saw young pilots...like 20, 21, 22 years old who were there with me and they were eyeballing me. "Who is this old guy with white hair on his beard, come to get this work?". <laughs> So it wasn't an easy affair. But then I was pretty adamant about wanting this. I wanted this because I was very, very intrigued with this gadget, you might say.

It is easy to see how and why the serious leisure perspective *matters*, as there certainly is a major difference between individuals who fly *casually*, and those who fly *seriously*. In the case of the latter, it is often difficult to disentangle the element of possibility concerning a career that might be associated with a hobbyist/voluntary pursuit, or conversely, the possibility of a hobbyist/voluntary endeavor that is closely associated with a career. What affirms the pursuit of drone piloting as a form of serious leisure is a heightened level of investment in drones and drone-related paraphernalia, beyond what might simply be observed when a drone is simply being purchased as a status symbol. The allocation of resources (financial, temporal, mental/emotional, etc.) certainly seemed more measured and equitable for those pursuing drone piloting as a career and/or as a form of serious leisure, across the domains of training, licensing, purchasing hardware or software, networking, or working with different kinds of data, to name a few.

Interviewer: So, do you just fly drones for work now, or do you still fly drones recreationally?

Sourav: Well, I used to fly recreationally when I was starting out. Now it's just that you have to understand that there is manned hours, there is wear and tear of the drone. There is wear and tear of the battery...because the battery, when you buy a battery, it's a very expensive battery. Also, you need to be careful that the battery will only be functional for 90 flights, 90 or a hundred flights. So, you have to be very careful where you're using your drone and whether it's useful for your work or whether you're just generating content. I do fly. It's not that I don't fly for recreation. I have another drone called an FPV drone, it's a first-person view drone, that's a different kind of a drone. Drone has many categories, I dunno if you're aware of this, but one is a regular consumer drone, which will fly like a normal airliner like a

commercial airline. It flies very stable. Now FPV flies like a jet plane, you can do flips, you can dive from a building, you can dive from a mountain, you can topple the drone, you can do a lot of stuff. If you YouTube “Tesla drone”, “Tesla factory drone”, you’ll see a drone, a really small drone, which is flying about inside a factory and capturing very, very minute details or very, very minimum pathways there are. And you have to just go through and stick a start and you attach a GoPro or you attach a DJI fitting in there. So there are many things, it depends on how and what you want to fly and where.

At the time of our interview, Sourav was in the middle of applying for a course that would certify him as an instructor for aspirational drone pilots and allow him to work at a Remote Pilot Training Organization (RPTO). He was also, of course, a travelling photographer like Dhruv, and had flown his drones across at many different sites across India.

2.3 Gender Dynamics and Inclusion: Negotiations with enduring stereotypes

In July 2023, I found myself taking an uber to the office of an RPTO in Pune, which had a sizeable presence across the country. I had reached out to an instructor via LinkedIn a few days before, an individual who worked for an RPTO in question. Two days later, she invited me over her office to do the interview. Upon finding my way through a labyrinth of offices in the building where they had their premises, I was greeted by a very corporate-style front desk and reception area. The receptionist checked me into their visitor’s log under the watchful gaze of a security guard and made me wait in a small meeting room where I was offered refreshments. This could’ve been an office space for any other kind of new-age tech startup, I thought to myself, as I examined its aesthetics and interiors. Arrays of computers lay compartmentalized within numerous little cubicles, while corner offices laden and executive-style chairs and imposing desks framed them from different angles. As I learnt later, this was where they had their local sales and marketing department. Priya, my interviewee, walked in at that moment and escorted me to her while making small talk. She was a local of Pune and had studied electrical engineering while she was in college. Her interest in drones came from her academic pursuits, and from developing prototypes for drones that she had designed for her undergraduate

research projects. As a professional drone operator in her early thirties, she had worked in all kinds of capacities – from spraying pesticides on farms, to mapping highways and archaeological sites, assisting with disaster management, vaccine delivery, crop analysis, and filmmaking as well. She had also been responsible for training several hundred licensed drone pilots over the past year alone.

Interviewer: At the time when you were thinking about joining the industry as a professional, what were the thoughts that were going through your mind?

Priya: So, at that point my mother, father were like, “No *beta*, go into IT field, you’ll get good salary”. My father was working in an automobile company, and he prompted me to work at its R & D division. I was like, I don’t want any references or anything like that...I want to pursue drones. And at that time in 2015 there were no drone career into drone sectors. So I was like fair enough. So I did one...one and a half year of freelancing. I used to do sales...solo stuff. I used to sell my product. I used to get the requirements from the Indian market. I used to build them, I used to sell them. I did a small startup kind of stuff without getting into loss but whatever I invested, I got it back. But that thing comes at a very initial stage. You don’t have that many contacts and then you lag behind instead of learning your standard. And that’s why I got into industry. So you get contacts also, you try to learn advanced technology because drones are very costly and it’s not easier for a single person to purchase all expensive technology.

Priya went on to tell me about the challenges of working at small startups within the Indian drone ecosystem, and how a lack of funding was the most common threat to their business models. During the time that she had spent at different startups and her current employer, she had embedded herself within various professional communities consisting of various government officials (including those from the military and the DGCA), non-profit managers, and of course, the employees and owners of several drone manufacturing companies, as well as drone-as-a-service (DAAS) companies. She spoke of a group on the instant messaging platform WhatsApp, where multiple stakeholders within the Indian drone ecosystem would converge in order to deliberate upon regulations and the ways in which they could be amended. She admitted that female representation was inadequate, and mostly limited to back-end data processing and GIS work, as opposed to the act of drone piloting. “But these are trends that are changing”, she said, in reference to Prime Minister Narendra Modi’s impending *Drone*

Didi Yojana (literally, Drone Sister Scheme) for women who were primarily agriculturalists, or a part of women's self-help groups (Pandey 2024).

A month after my meeting with Priya, Prime Minister Narendra Modi made a declaration concerning *Drone Didi* on the 15th of August 2023, while the scheme was formally launched in November later that year. The scheme intends to support the Central Government's support to 15000 women through training, licensing, and the provision of drones, and had approximately 1261 crore rupees (or approximately 15.12 million US dollars) allocated for its use between 2024-26. As of March 2024, very little has been (academically) written about the *Drone Didi* scheme (Chauhan 2024), or its possible ties to other related Central Government schemes, such as the Survey of Villages and Mapping with Improvised Technology in Village Areas (SVAMITVA) scheme (Thara 2022), an ambitious rural land mapping project that intends to “provide a ‘Record of Rights’ to village household owners through the issuance of legal ownership cards (i.e., property ownership cards/deeds) to the property owners” (Ministry of Panchayati Raj, n.d.). Later in the year around December, Ritwik, a forty-something Director of Photography at Freebird Productions in Pune told me about how he had been the only male student in a class of ten individuals at an RPTO in Hyderabad that was doing its best to support *Drone Didi*. The nine women that he had trained with belonged to community of farmers and had mentioned to him that *Drone Didi* was the only reason that the training program at the RPTO had been accessible to them. Though the efficacy of the *Drone Didi* scheme is yet to be observed and measured, its initial impact has certainly been noticeable.



Figure 2: An agricultural drone at Priya's office that was to train students. Credits: Author's own.



Figure 3: Another training drone at Priya's office, pictured with its batteries. Credits: Author's own.

“The machine doesn’t understand gender”, said Priya, as we walked through the second floor of the RPTO’s premises, where I noticed students being taught in classrooms and trained on simulators. The second floor also doubled up as a storage room for all their drones and other technical equipment. I noticed a few women sitting at different terminals, using flight simulators while an instructor stood behind them, monitoring their progress. The sight was somewhat novel for me, given what I had heard from some of my other informants. Akhil and Ishan, for example, had never worked with any female drone operators, and had expressed concerns regarding the ways in which it might not be safe for a female drone operator in India to spend several days hiking in the wilderness by herself with a heavy payload. Sourav didn’t personally know any either, though he did mention that he followed one on Instagram, and that he had observed a female drone instructor in his cohort at IGRUA during his time there. That being said, Sourav did preface the conversation with a certain level of apprehension and sexism concerning female drone pilots.

Sourav: Shiv, I have not come across any female pilots as of now. However, I am connected to a few on Instagram, not few...I think just one. I'm connected to this girl from the south (of India) and she flies a drone. But again, having said that, yes, it is a male dominated market as of now. And in India...you know how it is like in India, you see a girl driving a car and you suddenly get a little jittery and think that, “Oh my god, I should not go near her.” <laughs> So maybe that factor comes in when they're any female drone pilots around. However, I'd definitely like to see more women fly drones because they are mostly stable in their head when they're flying or because this lady I know she was with us in the course when we were doing our pilot, the drone pilot course from, and she was the most stable drone pilot. I remember clearly our hands were jittery, our hands were shaking sometimes because there were different menus which you have, which they make you do. There are different numbers you need to draw on air, you need to draw a few things to show that you are stable, you can fly well. But that lady had her hands very, very stable. I clearly remember that. So having said that, I feel women should definitely try this because they're more responsible than men.

In my contemplations upon drone operators as figures of mobility, and my conversations on them with an associate of mine, I was introduced to the metaphor of the flâneur. Drone operators bear some similarities to the flâneurs of the nineteenth and early twentieth centuries. Some scholars would argue that they (the flâneurs) were sociologists and philosophers who possessed a certain intimacy with the urban experience that enabled them to leisurely navigate through urban cityscapes with their

drones and “abandon themselves to the sight of the moment” (Jenks and Neves 2000). As spectators or voyeurs within the city (or in spaces beyond the city, for that matter), drone pilots possess similar agencies, as they can craft a representation of the world through the lens of their drones as they see fit. Think of them as *neo-flâneurs*, if you will: Individuals who map the city from an alternative perspective – one that isn’t that of the State, and one that the (Indian) State seems to value very dearly, if the SVAMITVA scheme had to be an indicator of its interest.

Drone operators also designate a shift from the agency granted by pedestrian mobilities towards creative practices (Coates 2017), towards aerial mobilities and their ties with the production of knowledge, art, discourse, and community. Indeed, the flâneur was a “man of the crowd” (Tester 2014), much in the way that many of my male interviewees had implicitly expressed themselves to be through their social media accounts, or our conversations, for that matter. Most crucially, however, flâneurs were dismissive of women’s perceptions of the city and their “baser senses”, having designated them as a lower class (Boutin 2012). Historically, they have been known to constrain the flânerie and leisure of women in many ways (Dreyer and McDowall 2012), while in the contemporary moment, they would quite possibly come across as being resolutely “unself-aware, and in need of sensitivity training” (Kwak 2023).

As flâneuses, women were either hypervisible or invisible in their engagement with flânerie (Boutin 2012). The hypervisible *neo-flâneuse* of today would be quite likely to maintain a prominent social media presence. Indeed, two of the three female drone operators that I had interviewed (Ritika and Prerna – both in their mid-twenties) had a significant number of followers on their social media accounts. On the other hand, the invisible *neo-flâneuse* might be more likely present a more subdued online persona, to “fit in” with a broader range of publics as Priya did. Unlike Ritika and Prerna who were most certainly branding themselves as a filmmaker and an FPV drone racing pilot respectively,

Priya presented herself as a jill-of-all-trades, as a *neo-flâneuse* for whom invisibility might have meant being very much like a chameleon (D'Souza and McDonough 2006).

Ritika, a psychologist and filmmaker in her mid-twenties was the anti-thesis to what Akhil and Ishan believed female drone operators to be capable of when it came to working with drones in India.

Ritika: I grew up in the wild, but a lot of my friends or say girls...they don't grow up the same way that I do. I played a lot more outdoors than a lot of boys or girls my age did. There's this common misconception, conception, what do we call it? Say for example, girls can't drive. Oh, boys can drive better than them, but where does this really come from? I accept that a lot more women are not as great with their motor skills as boys are, but how does it happen as humans, we are all born equal, but how do guys have better motor skills? In terms of drones as well, it's the motor skills that give them a better leverage in terms of how they are filming, et cetera. This happens during the childhood. The social circles between boys/men or girls/women are such that when they're kids, boys are always playing outside. They're going out, they're falling, they get hurt or they're fixing things or they're fixing their bicycle and stuff like that. Where more often than not, a lot of girls are playing indoors. So, when you're outdoors, very naturally your motor skills get developed and they sharpen over time. And when is the time that usually girls are getting out of their house? Maybe after they're fifteen, or when they're finished the school and then they're hitting junior college...and there's a time when they're say the first get a hold of a scooter, for example...and that's the time when they're young adults who haven't developed their motor skills like boys usually have. That's the reason it's hard to develop your motor skills then when we have crossed a certain age. And it reflects in a lot of other things in terms of how women are using technology or how are they driving on roads. It's overwhelming. Imagine picking up someone from the wild, like a feral child for example, and bringing them to the urban city, they're going to be overwhelmed. It doesn't mean that they're incapable, but they have just not been introduced to the kind of stimulus that will hone their motor skills or things in a certain way. So, I think for women to enter this field, we need to start everyone young. We need to push kids outdoors a whole lot more. We need to train their motor skills in every way and that will reflect throughout life.

Interviewer: You mentioned earlier that people refer to you as “that drone girl”. I'm wondering, has using a drone influenced your own perception of your own identity in any way?

Ritika: It gave me confidence in the sense that something that I was doing for leisure was being noticed by people and I didn't even realize it. I didn't know that people knew of me or my work, or anything about me at all for that matter. I would just shoot something, and I would post in online. So, I was like, oh my God, I guess I'm good at this. As a visual storyteller, you want to inspire or showcase something unique to people, and that was, I could see that happen...that was very comforting. So, I think that just gave me more confidence, for lack of a better word, to keep doing what I'm doing and yeah, work on it basically.

Data that I had acquired from the Digital Sky website on the 9th of July 2023 indicated that of the 5166 drone operators possessing remote pilot licenses at the time, only 261 were listed as female, 7 were

listed as “others”, and four did not have any information on their gender listed at all. Table 2 below outlines these descriptive statistics. 70 of the 261 RPCs that had been issued to women at the time had been issued by IGRUA, which had also been the first RPTO to grant a woman an RPC in 2022. At no point did any of my interviewees mention transgender or non-binary individuals.

Table 2

GENDER DISTRIBUTION TABLE FOR REMOTE PILOT CERTIFICATES ISSUED BETWEEN MARCH 24 2022 AND JULY 9 2023

| GENDER | NUMBER OF DRONE OPERATORS | PERCENTAGE OF DRONE OPERATORS |
|------------|---------------------------|-------------------------------|
| Male | 4894 | 94.7348% |
| Female | 261 | 5.0522% |
| Others | 7 | 0.0013% |
| Not listed | 4 | 0.0007% |
| Total | 5166 | 100% |

SOURCE: Data was acquired from the Digital Sky website.

2.4 Technical mastery: An expression of negotiations with age and craftwork

When it comes to flying drones, age is an important variable to take into consideration. For Priya, there’s a marked difference in the ways by which she noticed herself educating younger drone pilots, versus those who were older. Younger drone pilots were often influenced by what they would see drone pilots post on social media, and more than often, their interests would remain rooted in FPV culture, which none of the RPTOs catered to in any way. Courses offered at RPTOs would focus almost exclusively on the use of more conventional, commercially available drones, which did not offer younger pilots the opportunity to fly in the way that an FPV drone would. Clearly, age wasn’t just a determinant for the preferences an individual would have when it came to different types of drones, but also their perceptions concerning what “technical mastery” meant with respect to flying a particular type of drone. Priya often found herself having to instruct her younger students to be more

respectful in their handling of a conventional drone. “I often tell my students that if you take care of the drone, it’ll take care of your work”, she told me.

But age mattered in other ways as well. For Sourav, it wasn’t just a social barrier towards getting along with his classmates at IGRUA but also an issue that affected his manual dexterity and his ability to incorporate “muscle memory”. Ritwik made very similar comments with respect to his age and his ability to fly. Age shapes our bodily experiences and our socialization within different contexts, and often serves as an organizing principle for social communities (Calasanti 2005; 2009). It was difficult to ascertain whether or not age would lead to the marginalization of older drone pilots in a labor market, particularly because of how professionals were careful about sharing information concerning their work with different clients, but with respect to the process of learning how to become a drone pilot, age was responsible for creating certain distinctions.

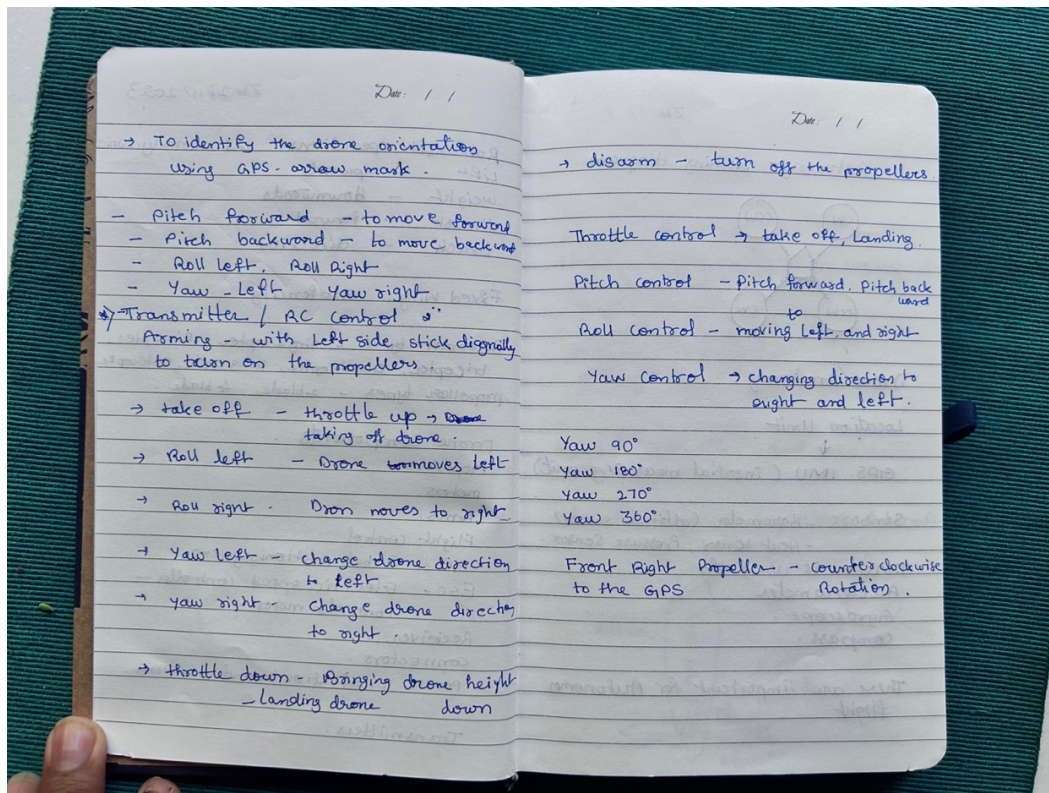


Figure 4: Notes that Ritwik maintained during his time at the RPTO. Credits: Interviewee's image, permission to use granted.

One of these distinctions can be observed in how my interviewees displayed varied attitudes towards regulations and regulatory authorities; older pilots such as Sourav and Ritwik were far more conscientious than their younger counterparts, who would often look for ways to exploit regulatory loopholes. Older pilots often played the role of community leaders and moderators as well; Sourav ran a Facebook group for local drone pilots in his city, which had close to a thousand members, while Kapil, a drone pilot in his mid-fifties, operated an online drone community with several hundred members as well. He was very particular about articulating a certain level of compliance with regulations that were in place, quite possibly to indicate a level of technical mastery in his profession.

Kapil: Now what happened was with National Highway Authority of India... somebody had seen one of my videos and they contacted a common friend in the group, and he happened to know that I was already, you know, doing this on a regular basis. So, he said, Kapil, some inquiry has come. Would you, you know, kind of interact with them? I said, why not? So, this gentleman was based in Pune, and the project was in Bangalore and several parts of Bangalore, almost about seven different, uh, locations, which we had to do. And he connected with me, and I said, yes, I'm willing to do it. And I mean, I am a professional pilot. I'm a certified pilot. I'm registered with the DGCA, on the Digital Sky platform. I've got my UIN number for my drone, and yes, I can fly. And, uh, so he said, okay, these are the, the commercial aspect of it, and this is what we can pay you.

Age could also be seen as being responsible for differences in the ways by which FPV culture (and civilian drone culture, more broadly) was perceived and understood. For younger drone pilots aged 18-35, FPV drones offered a certain kind of lifestyle that was synonymous with freedom from institutional oversight and commercialization. FPV drone communities represent an under-examined set of cultural collectives; their comprehension of the idea of “technical mastery” could certainly be thought of as being multi-dimensional, and the ways by which they pursue the art of piloting FPV drones is wildly different from what an RPTO might consider “ideal” or appropriate. A survey of over 500 FPV drone pilots by Tezza, Laesker, and Andujar (2021) reveals that an overwhelming number of FPV drone pilots recommend learning on smaller FPV drones (with propellers that are under two inches long), using simulators, engaging with the art of building FPV drones, and participating within an FPV community. FPV piloting offers a pronounced degree of intimacy with a drone, as pilots use

a headset to see exactly what the drone’s camera is pointed at. It also includes learning how to fly in different modes: angle (a beginner-friendly mode where the drone returns to a horizontal orientation when the control sticks are let go of, and there’s a limit to which the drone can tilt), acro (or acrobatic mode, where the pilot has full control over the drone’s orientation), and horizon (an intermediate mode which combines angle and acro in order to permit self-leveling when the control sticks are in “neutral”). Indeed, this is far more complex than learning how to fly a conventional drone, as the “intuitive determination of the body’s spatiality seamlessly integrates the drone’s sensor feedback” (Jablonowski 2020), establishing what could only be thought of as an “embodiment relation” - a relation that incorporates material technologies into bodily experiences (De Preester 2010).

Commercially built FPV drones such as the DJI FPV drone or the DJI Avata were looked down upon by almost every FPV pilot that I spoke to. FPV pilots either used custom, built-to-order (or a BTO drone, as Beesley (2023) puts it), or those that they had built themselves at home. That being said, it is usually the case that many conventional BTO drones are built by mid-size or large commercial organizations, but many FPV-BTO drones in India come from small businesses, or sole proprietors. Most drone pilots who had built one by themselves spoke of how an education in engineering had been useful to them, or how they had to learn everything from scratch due to a lack of technical expertise concerning electronics and/or aviation. There was unquestionably, a certain sense of pride that most of them experienced upon completing a successful build, and I don’t think I’ll ever forget what Sourav said to me in that respect.

Sourav: I have a studio at home and if I did a video call with you from over there, I would've had the liberty to show you how I build my drones...there's a lot of soldering involved. You have to do a lot of soldering, you need to know a lot about physics. If you are from an engineering background, it'll really help you. And if you're not, then YouTube is your friend. And yes, I learned how to build a drone. It was not FPV that I learned how to build, but it was something like a normal consumer drone. But then that helped me with the basic understanding on how a drone flies and what you need, what kind of components you need to have. It's very interesting too. You'll forget everything in your life. I guarantee that you forget everything... it's better than sex.

The market for components for civilian drones – FPV and conventional – is consistently evolving. Changes in the kinds of components that are made available to FPV pilots have a large impact on what they can do with their drones, and the kinds of “flying styles” that they could engage in, define, or adopt. I say “style” here for there are indeed many different styles that can be followed when flying an FPV drone: freestyle – which is akin to aerial skateboarding, and focuses on creative expression, maneuverability, and acrobatics; cinematic – which prioritizes smooth, stable, and visually appealing footage; and racing – which prioritizes control for high-speed maneuvers. The build of an FPV drone can vary extensively depending on which style it is being used for. There are communities for each particular style, though members from one often spill over into another, and each style has witnessed the growth of subgenres of styles within them over the past decade. Familiarity with different styles was often an indicator of technical mastery over FPV drones.

Vishesh: ...because there are styles, like *shang*, for example, you should note that down. *Sbang* is a style of flying. So if you just YouTube, like, “sbang”, you’ll see that it’s a style which just evolved out of nowhere. It comes from a style of flying called Juicy...it’s called juicy flying. Now a layman would probably see no point in that at all. They’d be like, what the hell is this? What’s the whole point of this? But for a pilot, it’s like a super cool thing that you can do as a pilot. It’s something that...it’s like an inside thing that only another pilot would be able to appreciate. It’s not something which anyone else would be able to appreciate at all. With FPV, you have the underground thing, and then you have the mainstream stuff. You have racing, you have cinematic, you have juicy, you have bando flying (flying in abandoned buildings), and you have building diving, and you have so many subsets of FPV, and each one of these is a specialization in itself.

Vishesh, a Bangalore-based media professional in his mid-thirties, also spoke about how picking a particular style can often define an individual’s pathway into FPV drone piloting.

Vishesh: So when a pilot gets into FPV, right, they basically have two options. They can either be like a freestyle pilot, which is just playing around with your drone, doing flips and roll and exploring tricks with your drones and all that. And then they can think about getting into the cinematic or the professional aspect of it where you’re trying to get smooth footage and you’re not really showing off your flying skills there. I was more drawn towards the recreational side of it, where flying involves skill and you need to be quick, your reflexes need to be quick. It’s sort of like you’re pushing yourself to be faster and your reactions have to be faster and faster to do tricks which are ever-increasing in complexity. You could start by doing a split test - a split test is a move where your drone does a half flip before leveling back. It’s pretty much like a “fighter pilot” sorta move. So that’s one of the basic FPV moves that you do. And then you

gradually move on to inverted yaw spins, an inverted yaw spin is where your drone does a half flip in the air, and then you do a spin on the yaw axis. So these are all very cool looking moves that you can do with an FPV drone. And when I started off flying these, this is the kind of stuff that I used to do. I would say I have not limited myself to a particular discipline because I've dabbled in all the different, I would say "styles" of FPV. Freestyle is something that I started with. And then I got into cinematic flying. Cinematic flying is where you basically get smooth footage, which people enjoy watching something which is pleasing to the eyes. And then I got into racing with IDRL. IDRL is the Indian Drone Racing League. I'm sure you've heard of it.

Between flying FPV drones as a form of art and building FPV drones as a form of art, some of the FPV drone pilots that I spoke to only validated the former, while other validated both. Rajiv, a twenty-year-old college student from Chennai, spoke to me about how he had been building FPV drones over the past six years, and how he considered it an art form. Aside from building and selling FPV-BTO drones, he has worked across multiple different industries, including the Tamil movie industry. Most of the components he would use were imported from China.

Rajiv: I do think it, of it, uh, think of it as an artistic form, you know. It's an artistic process where the, you know, the soldering, uh, you have to get it perfect. You know, the round shiny solder blobs, right? And the wire, you, how you, how you route the wires, how you, you know, uh, do the cable management on the inside, the drone, and how well, uh, uh, you make it and how, uh, how aesthetically pleasing you make it is what matters. Honestly, if you look at me, I'll be one of the few persons who enjoys building drones rather than flying them. Repairing broken and crashed drones, uh, and making new ones is more appealing and interesting to me than flying them flying, you know? I've done plenty of flying and it's good fun, but when you are building one, it's, it's like, you know, a Bob Ross painting, a beautiful painting, scenery painting where you make the drone as aesthetically pleasing and as clean as possible. It's like, you know, uh, you might have come across PC builders, uh, you know. It's much more like that. And those people, like, you know, like putting together, you know, beautiful white, uh, or colorful fans, your beautifully clean PC builds, hiding the cables, putting in, you know, lights and aesthetically pleasing stuff in. So it's definitely like an artistic process and, uh, you know, a flowy state, state, uh, state of flow for me.

Interviewer: Do you, do you have any particular trademark, you know, like a particular feature that shows that your drones are your drones?

Rajiv: Yes. Yes, yes, yes. I do. I could honestly say that my solder jobs are the cleanest solder jobs you'll be ever seeing in your life. Soldering is very nasty and, uh, often the hardest part about, you know, learning to build a drone. It's where you make or break the drone. So if you do a sloppy job...if, uh, you know, the components are not built as they should be, it blows up. Uh, you know, there's no safety features, uh, like, you know, it'll catch fire, right. And then a lot of nasty things can happen. Few of my friends who were interested in this process started out without any guidance, and they burn a lot of drones. So they just, you know, give up and,

you know, turn to me and they'll be like, "Hey, uh, you make it for me!" And so the trademark for me is my cleanest job of soldering. And honestly, if one of those, uh, many drones that I made comes across my eyes I could immediately, you know, recognize it, uh, just by the soldering job, that it is one of mine.

Craftwork has always embraced the use of technology, and soldering has long been spoken of as an art with its own principles (Judd and Brindley 1999; Humpston and Jacobson 2004; Pakhchyan 2008). Excluding an investigation into the art of building drones from an analysis of technical mastery over drones would be erroneous, as the survey by Tezza, Laesker, and Andujar (2021) revealed. When craftwork is perceived as a manifestation of problem-solving, it exposes the ability to perform a skilled diagnosis (Marchand 2016). Drone-makers who know how to produce an operational prototype or product possess the privilege of partial perspectives (Haraway 1997) concerning technical mastery over drones, much like the individuals who fly recreationally or professionally. I have not spoken of the role of videography or photography here, though it should be mentioned that video/photo editing play a crucial role in constructing perceptions concerning an individual's technical mastery over the use of drones. I will address this in Chapter three in greater detail, for it also concerns the drone's ability to engage in storytelling, and its potential to perform and transform different geographies (Jackman 2023b; Fish 2024). But in short, technical mastery in the context of drone usage should not be understood as a list of checkboxes that could simply be ticked off; negotiations with the variable of age and engagements with the practice of craftwork are merely two of many possible ways of understanding it.

2.5 Innovation and creative use: Perspectives from negotiations with different use-cases

Concerns about the ethical use of drones can often arise from various use-cases that have absolutely nothing to do with the militaristic use of drones, or more commonly critiqued matters like those of surveillance and privacy. It was in the first week of August in 2023, when I found myself within the premises of a non-profit organization that worked on wildlife rescues and conservation

within the State of Maharashtra. Ashish, one of the co-directors of Infinite Pawsibilities, was showing me around. He had been working there for several years now and had started his career there as a volunteer shortly after he had lost a dog, as a way to cope with his loss, and to be closer to animals and to nature. A local of Pune, Ashish was in his late twenties and was a well-known mountaineer who had never really used drones until he recognized the utility of a thermal drone with respect to wildlife rescue operations. The use of a thermal drone had proven particularly useful for tracking animals at night, as most of the animals they rescued were nocturnal. After showing me around their on-site veterinary clinic and introducing me to a few of his co-workers and volunteers, we sat down in his office to discuss his engagements with drones. Having learned to fly drones and integrate thermal instrumentation through online resources and rescue operations, he believed that the use of drones for wildlife rescue and conservation will continue to grow, given its efficiency.

Ashish: The use of our drone started coming in because in and around Pune, majority of these leopards are living in sugarcane fields...these are not your forest leopard...these ones live in sugarcane fields because it's the safest place for them to live in since there's enough food and water for them throughout the year. So they prefer living in these. And then when people go out to work during the night, they come across these animals, the reason being that most of these animals are nocturnal. So even if there was any conflict or any situation where we had to go and rescue these animals in the night, it is completely impossible for us to locate these animals on foot because it's not the safest thing to go into the fields at night. So that's how the entire idea of bringing in a thermal UAV came into our heads and then eventually we purchased it.

Ashish and his colleagues had also used their drone to track the movements of elephants, the *gaur* (or Indian bison), and other animals over time, so that they would be able to predict their movements and the sizes of herds in a given area over time. Most of their data was shared with the Maharashtra Forest Department, and they often had the support of local authorities during particularly dangerous rescue operations. Data from their drone also assisted with allaying locals' fears about what they were dealing with, and he would often use thermal imagery to show villagers that most of the times, animals simply wished to be left alone. His biggest concern, however, was the fact that it would be relatively easy for anyone, especially poachers, to purchase a thermal drone, which is why he was very protective about

what he had learnt about animal behavior and tracking. This knowledge was sacred to him. There had also been times when the use of a thermal drone had prevented unnecessary human intervention. Local villagers in Karad, Maharashtra had reported sounds from an animal that sounded injured, but upon investigation, Ashish found that it was a pair of mating leopards that had been responsible for the commotion. For Ashish, preventing or mitigating human-wildlife conflict was a priority from the purview of wildlife conservation, and his drone had been instrumental in aiding his efforts. Following our conversation, he showed me where they rehabilitated various endangered species, and where they had currently been housing an injured leopard. This was possibly the only time during my fieldwork where I felt a deep sense of mortal dread, for when I stood ten feet away from the leopard, its eyes locked a predatory gaze upon me that I had never really experienced before. Ashish clapped me on the back and told me that the leopard had been very well-behaved before proceeding to show me out.

To Ashish, the drone was a proxy for an animal, a “drone-animal” that permitted him to track and rescue other animals. This is a reference that I have only seen human-drone interaction scholars state very recently (Wilson-Small et al. 2023; Cauchard et al. 2024). The applications of drones in the cases of wildlife monitoring and conservation (Burke et al. 2019), tracking (Vayssade, Arquet, and Bonneau 2019), counting (Francis et al. 2020), identification (Petso et al. 2021), studying group/individual behavior (Schad and Fischer 2023) are well-known, but have received little sociological attention beyond the deviant context of poaching (Fish 2021; 2022; Fish and Richardson 2022).



Figure 5: Ashish's thermal drone has assisted Infinite Pawsibilities with rescuing over 2000 animals.
Credits: Author's own.

Other novel cases for innovative/creative drone use appeared across numerous interviews. For example, Rajiv, who had worked as a drone videographer for several factories, found that the opportunities permitted him to be as creative as he'd want to be. As an FPV drone pilot, he found that the cramped interiors of factories possessed the potential to generate numerous flight paths. Furthermore, he treated the interior of a factory like a canvas that was "waiting to be painted". The video shoot would be preceded by extensive maintenance by the factory's staff, and he had the freedom to request the owners to have the floors acid-washed, for lighting to be fixed as he'd want it, and for the walls to receive a fresh coat of paint. The machinery and the factory's workers would also be setup at different locations, exactly as he'd wanted.

For Vishesh, innovation and creativity manifested in the adaptation of flying styles that he'd seen on YouTube, which he discussed in the context of flying in India. Bando was different in the western world, and different in India, not just for architectural reasons, but also because of urban design, socioecological considerations, the availability of components, and the composition of the social groups he'd often fly with. Bando flying, like many other FPV styles, was rooted in local norms and practices. As an rSport, or robotic sport (Standaert 2021), FPV drone piloting producing a usable, localized form of knowledge through epistemic communities (Meyer and Molyneux-Hodgson 2010) such as the Indian Drone Racing League, or other informal communities of practice.

Another unique use-case appeared in an interview with Rushil, an industrial designer and videographer in his late thirties. I had interviewed Rushil at his residence in Pune in December 2023, during my second fieldwork visit to India. Rushil had an entire fleet of FPV drones with different propeller sizes at his disposal, and a state-of-the-art home studio that he'd setup within his apartment, where he lived with his dog and cat. Outside of the work that he had done for a few clients who worked in adventure sports, Rushil was mostly a recreational drone pilot. He did, however, introduce differently-abled children to FPV drones at a summer camp for autistic children, and had spoken to me briefly about the potential of using drones for therapeutic and assistive purposes. Indeed, there is much evidence to support the notion that drones – particularly FPV drones – can encourage social interaction for individuals with autism (Mangina et al. 2016), improve accessibility in physical environments (Chi, Sha, and Zhang 2023), assist communication therapies in children as young as four years old (Kim et al. 2013), and encourage complex-problem solving across a variety of age groups (Herodotou et al. 2019).



Figure 6: Rushil's home studio set-up. The screen on the left has an FPV group on Discord lying open. Credits: Author's own.



Figure 7: Rushil's dog stayed with us for the duration of the interview, and clearly took the concept of multispecies communication a bit too literally. Credit: Author's own.

Though I did not acquire access to his footage or photos from his time at the camp, he did show me videos of himself with one of the camp's organizers as they helped a young child with flying an FPV drone and using its VR headset. My time with Rushil had been incredibly rewarding; between our interview, playing a game of Star Citizen on his desktop afterwards, and eating a couple of plates of *pav bhaji* near NIBM road afterwards, I understood that his love for aviation was the sole reason as to why he chose to innovate. From building drones for work and recreation, to flying spaceships in Star Citizen on a custom-built flight simulator, to teaching children with autism, he was consistently using innovation and creativity to transmit his love for aviation elsewhere. His goal for the near future was to secure a private pilot's license and to restore an old bush plane that he had planned on purchasing.



Figure 8: Rushil's fleet of FPV drones. Credits: Author's own.

2.6 Social integration and communities of practice: Negotiating with sociotechnical publics

“We have a webbed network of freelance data analysts that we collaborate with”, said Akhil, when I had asked about him who he collaborated with most often. He spoke about how it was feasible to outsource data analysis to speed things up when he and Ishan had been pressed for time, particularly when they had to travel to field sites in different states at short notice. “And sometimes, it works the other way around”, he added. “Sometimes they acquire the data, send it to us...we process it, and then deliver it.” No concerns were stated about the protection of intellectual property, and it was quite possible that none of Akhil and Ishan’s clients knew anything about these informal collaborations, or the ways in which their data was being exported or analyzed.



Figure 9: Screenshot from a professional drone pilot community. Credit: Author's own screenshot.

My fieldwork revealed a range of communities that existed within the Drone Society, for professionals and hobbyists alike. Outside of the informal freelancer network Akhil mentioned to me, there were more generic, city-based groups of the kind that Sourav operated on Facebook that were publicly accessible to anyone who joined them. RPTOs had their own exclusive “alumni” networks, which Priya briefly spoke to me about. Upon finishing a course with them, you would be given access to their internal network of drone pilots. Most RPTOs used existing social media infrastructure for this purpose, as opposed to any proprietary platforms – a trend that I noticed in the United States as well, particularly on Facebook. I have personally been a part of the Pilot Institute’s international and regional groups, which I only had access to once I had paid to take one of their courses. The Pilot Institute is an online drone school that offers courses that cover many different use cases for drones but is arguably best known for its course on the FAA’s Part 107 license for commercial drone operators in the United States, a counterpart to the DGCA’s RPC for drone pilots in India.

Outside of the “private” groups meant for the alumni of RPTO training programs, there were many drone pilot groups on social media that were meant for recreational meetups, professional networking in the drone industry, or both. While many of these groups would often state that they were meant for drone pilots in a particular city or region of the world, their membership would often be a lot more diverse. Their presence on social media made many of these groups transnational by default, as anyone with an account on a platform like Facebook could apply to join them. Many of these groups were also public, though a handful of them would require you to answer a few simple questions before you would be allowed to join.

The IDRL maintained two sets of communities – a freely accessible community on its mobile app, which was largely oriented towards enabling community-driven troubleshooting and a secondary market for FPV drone parts, and exclusive communities on WhatsApp, Telegram, and Discord that could only be accessed through their premium “IDRL X” membership. These were more carefully

curated for the purpose of enabling transactions between trusted premium buyers/sellers, and communities of practice for novices.

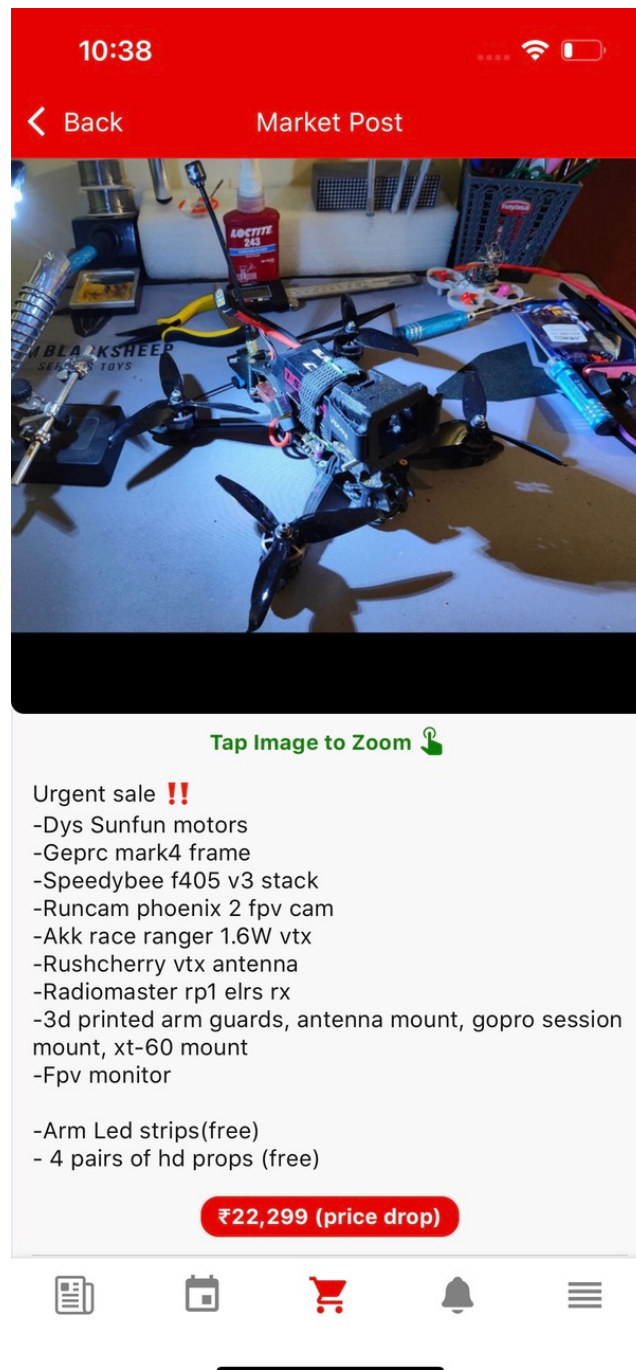


Figure 10: Screenshot from the publicly accessible IDRL iOS app. Credits: Author's own screenshot.

However, the most elaborate community that I came across was an FPV community known as “The Flying Squad”, which at the time of writing this chapter, had over 1100 members on its Discord group. In addition to having channels dedicated to its own marketplace and the development of local meet-up groups in various Indian cities, The Flying Squad had channels that discussed the use of simulators, collaborative projects, “crash stories”, FPV memes, and lastly, a resource page for reliable local hobby stores that I discussed earlier in this chapter. As a freely accessible Discord group, it arguably did more for building and sustaining drone cultures than many of its corporate-backed contemporaries did.

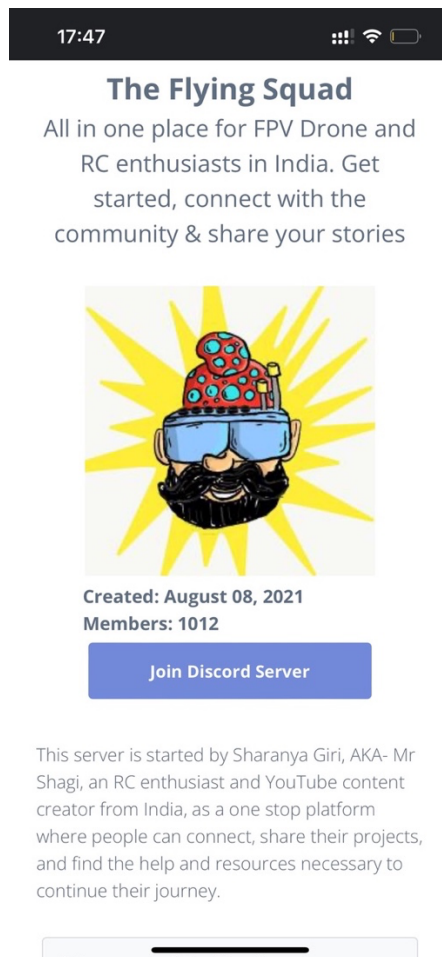


Figure 11: Screenshot of the sign-up page for "The Flying Squad" on Discord, which is a “discoverable” community. Credits: Author's own screenshot, taken on December 21, 2023.

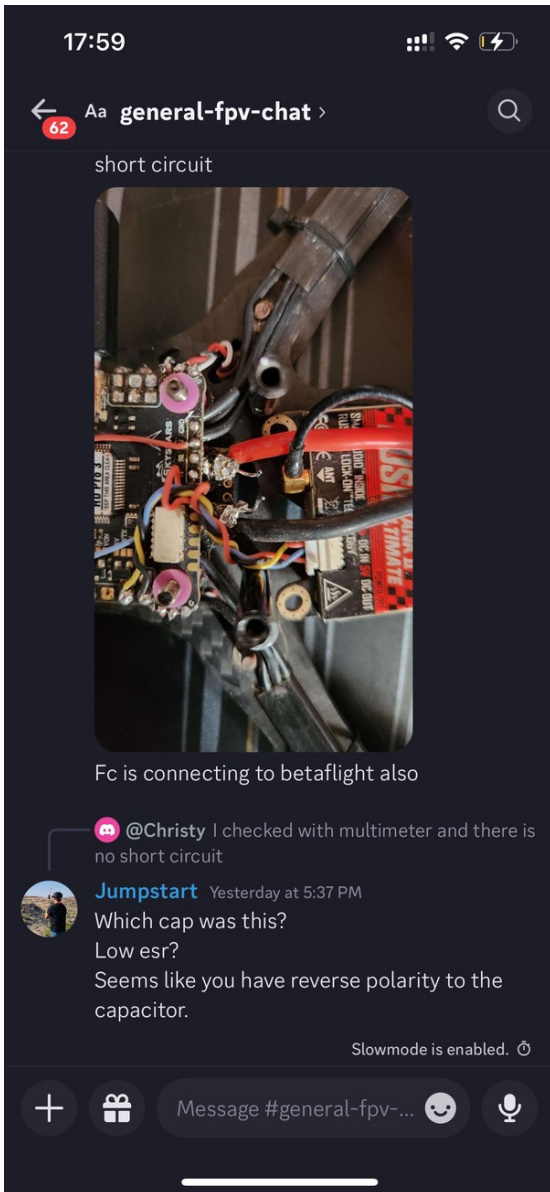


Figure 12: Members of “The Flying Squad” help each other with troubleshooting FPV drone builds. Credits: Author's own screenshot.

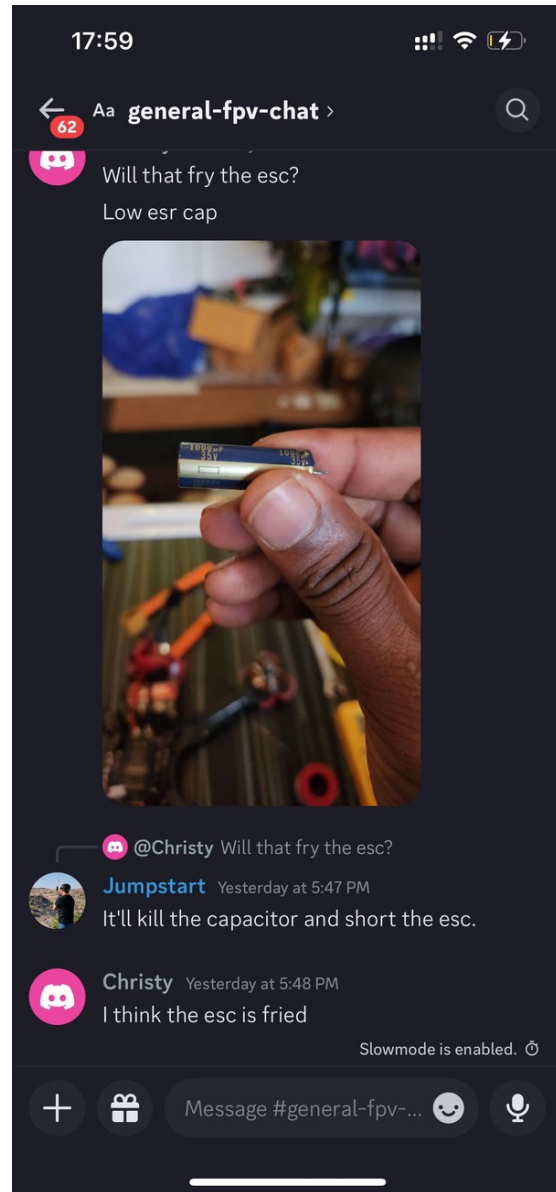


Figure 13: Conversation similar to the one shown in Fig. 12, also taken from “The Flying Squad”. Credits: Author's own screenshot.

As a caveat, Vishesh told me that the bulk of the online drone communities in India mostly consisted of male engineering students, and that I would find little to no diversity across them. This wasn't a statement that I found the time to test through a survey, though I will certainly consider doing in a future project. Rushil mentioned another downside of these communities despite the norms and

rules that many had in place – a pattern of “undercutting”, where professional drone pilots would often try to poach clients from each other through less-than-competitive rates for their respective services.

Vishesh: So, uh, it's, it's been a bittersweet experience.

Interviewer: Tell me more.

Vishesh: For one, uh, like, uh, Indians are quite resourceful. We love to use the term *jugaad*. So when it comes to building something or solving a problem, we are very good at it. And people (in online communities) are quite, uh, cooperative when somebody wants to figure something out, or, uh, if people want to get into the hobby...we would, uh, really help each other out. So that's a good thing. Um, the other side of this is...because we are so resourceful, um, we undercut our own market.

Interviewer: What do you mean by that?

Vishesh: So, there have been instances where, uh, let's say there's a client who wants a specific shoot done. We would, uh, try to raise the bottom that if somebody sees quotes, there's some general idea of a base rate. Okay, so if I'd do the shoot for you for say, 40k (40,000 rupees) for the entire day or say, 30k a day, somebody would get to the client and be like, you know, I can do it for 15k a day. Or then somebody would, uh, get to them after that and be like, you know, I can do it for 5k a day. Um, it does come from our, uh, general tendency that, uh, we *don't* want to think about the community. We are very shortsighted in that regard. For that short-term benefit we are sort of harming the entire professional ecosystem.

The absence of a widely accepted professional code of ethics and any kind of formalized standards for services makes it difficult for professional drone pilots to secure a sustainable living wage for themselves; precarity is something that they constantly negotiate with – not just in India, but in countries with more mature drone ecosystems like the United States as well. It isn't uncommon to see professional drone pilots complaining about how their prospective clients had absolutely no idea about how to make a compensatory offer for their services, and how it was common for them to be shocked by how “expensive” their services would turn out to be. An exception applied to DAAS companies, which arguably had more agency than individual freelancers and small business owners. A large majority of them had representation in the Drone Federation of India (DFI), a “non-government, not-for-profit, industry-led body that promotes and strives towards building a safer and scalable

unmanned aviation industry in India” (Drone Federation of India 2022). As of April 2024, the DFI offers five kinds of membership plans – one for students, another for professionals, and three for corporate entities with differing levels of revenue. While almost none of my interviewees spoke to me about the DFI, one of them – Vicky, a member of the DFI in his mid-thirties – spoke candidly about its role within the Indian drone ecosystem.

Interviewer: Could tell me a bit about the Drone Federation of India's contributions to the larger drone ecosystem in the country?

Vicky: The Drone Federation is basically an industry body. It doesn't do any competing business with the industry. All it does is facilitates conversation between industry and industry. So, industry talking to industry...it facilitates conversation between industry talking to regulators, and industry talking to academia. It's kind of this bridge between these three key pillars. And the idea is to be able to...when it started off...the idea was to be able to just support the information gap that existed in the government as they were building regulation. All the guys who were building regulation had no idea about either operations or technology or understanding of the drone. They were just, you know, building regulations off the back of regulations that they had seen in other parts of the world, without really understanding what they were regulating. And the Federation played a very, very strong role in making sure that could be given to all the right stakeholders. And when I say all, I literally mean all the stakeholders that were involved in any way in writing that regulation...were handheld in their learning and understanding of how the industry works, what the industry needs, how the technology works, and how the different elements of the technology need to be incorporated in the thinking of the regulation. So that's kind of where it started and what it did. And I think in the early few years we were able to do a really, really good job of that. I think the good part is that the few people that started it all came with very, very high integrity, because it was very easy for an institution like this to start getting misused for personal gain. But I think very strongly as a culture and a philosophy that we set up from the start was that this is the voice of the industry. So even if it doesn't suit a few of us individually, it doesn't mean that that's not what happens. What happens is in the larger interest of the industry. And I think we've been able to do a really, really good job of that so far.

At present, the DFI is run by an independent secretariat that has its office right next to the Ministry of Civil Aviation at the Air India Building in New Delhi. Their office had been granted to them by the Ministry directly, partially in recognition for their contributions to the Indian drone industry. Vicky told me about how safety and security had been prioritized in the formulation of regulations, and how privacy had generally not been given much attention. He also informed me about how civil regulations didn't matter to the military, particularly when it concerned services or sales from civilians or corporate

entities. Even so, civilian drone regulations had to be passed through the Ministry of Defense and the Ministry of Home Affairs before being approved. Vicky had interesting comments to make in this respect.

Vicky: *Yaar* (buddy), unfortunately, in our country, the concern was less about the ethics around drone usage. So, believe it or not, privacy has not been a very big part of the regulation regulatory conversation. It's more been around safety and security than around privacy, because privacy generally in our country is slightly lesser important than it is in the rest of the world. I mean, we end up putting CCTV cameras anywhere. We have road cameras anywhere we want. I mean in Europe...U.S....you can't put a camera on the street without putting a signboard before that saying that a camera is coming. So that mindset doesn't exist here. So, privacy and thoughts around ethics of drones was not really a big concern. As the regulation got built, the primary concern was, okay, how do we manage safety and security? Because essentially, unfortunately anybody who was involved with the regulation was not trying to build the regulation with the idea of, oh, let's bring in a new innovative technology. That wasn't the inspiration of building the regulation, the inspiration of building the regulation of, okay, a technology is now come, we are now lagging behind. What can we do to save our asses to make sure that if something goes wrong tomorrow, it's not our ass on the line. The incentive of the regulators of creating the regulation was, and not just was, but always is very lopsided in terms of why it's happening. And that's why it took so long. It took from 2018...a ban...to 2021...a really pathetic regulation...to then, sorry, 2020...a pathetic regulation...and then 2021, something that was still workable. Literally, we had to work hard to get the whole regulation repealed and rewritten because the first regulation that came out was so bad.

An early theory of social integration tells us that for “social integration to prevail, and a cohesive unit to develop, its members must be concerned with attracting each other” (Blau 1960). This theory spoke of the role of competitiveness between members as an inevitable pathway towards social differentiation. The ways in which I have spoken of how civilian drone operators often demonstrate technical expertise relates to this, and plays a role in social integration as well, as they define the many varied roles that drone operators identify themselves with. Novice. Intermediate. Recreational drone pilot. Commercial drone pilot. FPV drone pilot. Drone photographer. The list simply goes on.

However, social integration isn't exclusively about the formation and evolution of online drone communities, or the emergence of roles/identities, communities of practice, non-governmental organizations, norms, practices, or regulations alone. What must also be given due consideration is the public acceptance of drones, which varies depending on the context in which they are being used.

The public acceptance of drones (or lack there-of) is an enactment or collective performance in itself. Whether or not the performance leads to something positive or negative would be entirely dependent on context, but as Barad (2003) says, the “observer” and the “observed” are ontologically inseparable. In terms of *relata*, no *relata* exist until the moment of the phenomenon of being a person who either comes across a drone observing them or observing something else. What follows is a performance that could potentially signify a limitation of ANT: that actants/actors are never equal (Baron and Gomez 2016). I have two anecdotes come to my mind when I think about highlighting this. The first comes from a segment of my interview with Rajiv, who was telling me about a time when he and his friends were flying FPV drones near a village on the far outskirts of Chennai.

Interviewer: Could you tell me about whether you ever had any, uh, privacy or safety related concerns when flying? Has that ever affected your drone usage in any way?

Rajiv: I had one incident, but honestly, that's particularly why we travel, uh, carpool and travel about one or two hours away from the city into some remote place. I could recall one incident where we were flying really far away in a rural place, but it was a completely empty ground of about a hundred acres, which is personally owned by one of my FPV friends. He invited us to go to that place. And we had, you know, two cars and we set up like, you know, umbrellas and tables and stuff, and it was kind of a picnic spot, so we brought food as well. So, there was, uh, this one, uh, moment where we all pulled out our extra aggressive racing drones, and we were like, honestly, just, you know, pushing it to the limits. You know, it makes a lot of sound when we do that. So, uh, I think a passing group of women, uh, ladies just happened to hear us, and they were like, “What are you doing here?” <laughs> I know it's completely ridiculous, but they said, “We heard the screams of a woman, so we wanted to know if there are any problems here”. It was the sound of the drone...it screams, it's, it's a screeching noise since the props (propellers), uh, run at *really* high speeds, so it makes a screeching sound. I could honestly see why that would be an issue for some people. But yeah, then in response to them, we were like, no, no, this is just our drones, and we are just having fun over here. We did a small demo for them, but they still didn't seem convinced <laughs>. I think there were about six to eight of us that day, so I could see why they would think of us as a threat since we it was a ground quite far away from any civilization, but, uh, yeah, that was the only incident, uh, that happened. We usually try to inform the locals or we, uh, you know, recruit some local kids to come along with us, and they are usually very excited to, you know, witness this. So, when we do that, it usually dissolves the suspicion of us, uh, uh, doing anything shady.

The second anecdote concerns the phenomena of being surveyed without consent. Akhil and Ishan told me of a time when they had been recruited by the local authorities of a Maharashtrian city to survey a few acres' worth of land where slum dwellers had built their tenements. They spoke of how

they had been provided with “protection”, and how they had to finish mapping the area as quickly as possible before the slum dwellers knew what was happening. During the interview, the estimated that they had found approximately 400 tenements within the area that they mapped, most of which were demolished by the local authorities in the month that followed, under the premise that they had been encroaching upon public property. Through the entangled agencies of the drone operators, the drone, geospatial data, drone imagery, and the local authorities, the otherwise “invisible” slum dwellers were enrolled into a complex network of relations that reconfigured material dimensions their social existence. This is reminiscent of what Latour (2007) says about “action”: “When we act, who else is acting? How many agents are also present? Action is not done under the full control of consciousness; action should rather be felt as a node, a knot, and a conglomerate of many surprising sets of agencies that have to be slowly disentangled.”

Lastly, in a way that is as Latourian as it can be, something must be said about how integration between “human environments” and “drone environments” is a part of social integration (or sociotechnical integration) as well. Whether autonomous or not, the risk posed by the failure to recognize robotic social agency can create many different issues for drones that are embedded within the sociotechnical topographies of public spaces and natural environments alike (Thomas 2019). Human-Drone Interaction is a steadily growing field, and I examine one of its facets in the third chapter of this dissertation.

3. Tracing the Drone Society

In an article written under the pseudonym “Jim Johnson”, Bruno Latour demonstrates how social relations are prescribed back to us (humans) by non-human entities, while adding that if the study of social relations were to exclude non-humans in any way, it would be indistinguishable from a study on baboons (Johnson 1988). Social relations, or *social links*, are detected through the presence

of properties or elements that are *social*; they bind actors – regardless of their size - together into a society that is constrained by the larger society that they exist within (Strum and Latour 1987). In the due course of seeking out social links between actors and tracing the drone society, this chapter sought to do what Latour might have: the ways in which actors achieve social links through performative frameworks, in their respective searches for a “drone society”. No singular actor can ever hope to see the whole, and that applies to this dissertation (and me, as a researcher) as well. In Table 3 below, I have attempted to outline what became visible to me within the drone society as an actor within it, but I must specify that the categories noted are not mutually exclusive. Overlaps do occur in reality. The drone society is itself an actor, or actor-network, more appropriately, as it a hybrid entity that contains many actors within it. Once an actant comes to possess agency through the shape that its network appropriates to it, it becomes an actor that modifies an existing state of affairs (Bueger and Stockbruegger 2017).

TABLE 3

ACTORS AND ASSOCIATED SOCIOTECHNICAL NEGOTIATIONS IN THE DRONE SOCIETY

| CATEGORIES OF ACTORS/NEGOTIATIONS | ACTORS | SOCIOTECHNICAL NEGOTIATIONS |
|-----------------------------------|---|---|
| Infrastructural negotiations | Drone policies and regulations, Bureaucracy, Algorithmic Systems, DGCA, Ministry of Civil Aviation, Digital Sky, DJI, RPTOs | Understanding/adhering to local and national regulations; Obtaining necessary permissions from local authorities or from Digital Sky; Securing an RPC |
| Economic Resources | Serious leisure perspective, Hobbyist practices, Business assets | Budgeting for drone equipment; Accessing affordable training/resources; Performing the role of an invested hobbyist/professional |
| Gender Dynamics | Gender norms, Gender stereotypes | Initiatives to support the visibility of women in the drone ecosystem (e.g.: Drone Didi); Technomasculine performances |

| | | |
|--|---|--|
| Technical mastery | Drones, Hardware, Software, YouTube, Online simulators, Age | Acquiring technical skills; adapting to evolving drone technologies; fixing/building drones; demonstrating expertise |
| Innovation and Creative use | Different industries, Jugaad innovation, Use cases for drone technology in other countries, Local socioecological considerations, Drone cultures in other countries | Exploring the application of drone technology beyond recreational and “traditional” professional applications; Localized knowledge production; Formation of epistemic communities or communities of practice; Developing unique use-cases |
| Social integration & Communities of Practice | Online drone communities, Social media platforms (Discord, Facebook, WhatsApp, etc.), Drone Federation of India, Indian Drone Racing League, Drone imagery/footage/data | Participating in online communities; sharing experiences; sharing data; discussing concerns pertaining to issues like privacy, ethics, and regulations; Attending meetups; Industry events; Identifying with a particular “identity” as a drone pilot; Public acceptance of drones |
| Ethical and moral considerations | Ethical guidelines, Community norms, Privacy, Surveillance | Questioning/evaluating a client’s use of data from a drone mission; Decision-making in situations where an individual’s privacy is accidentally violated; Treatment of data between multiple parties; Violations of community norms |

SOURCE: Author’s own.

NOTE: ANT highlights the many sociotechnical negotiations that define the relational ontology of becoming (and being) a civilian drone pilot. None of these categories are mutually exclusive, nor should this table be considered exhaustive.

From a different set of vantage points, or a different point of entry into the actor-network more appropriately, the contents of Table 3 could be reassembled differently, as “things without inherent qualities cannot belong to any categories” (Gad and Bruun Jensen 2010). Actors exhibit certain properties because of how they exist in relational spaces, as I have mentioned and implied earlier in this chapter.

I arrive finally at Table 4, which presents a broad conceptualization of how the process of translation works within the drone society, with the acknowledgement that all its phases – including

problematization – are ongoing processes that change constantly through the relationality that they present.

Table 4

MOMENTS OF TRANSLATION WITHIN THE DRONE SOCIETY

| PHASE | DESCRIPTION |
|---|--|
| <p>Problematization, or the ways in which an issue becomes indisputable to relevant actors</p> | <p>The identification of actors and roles: Diversity emerges within the drone society, with the emergence of recreational and professional aspirations amongst different actors (individuals, government agencies, technology firms, drone manufacturers, non-profits, etc.) concerning drone technology, each with their own OPPs that are specific to their roles. For example, as actors, bureaucratic agencies and regulatory authorities witness the need to regulate a new technology (civilian drones), and the formation of policy becomes an OPP for them. Much in the way that Callon (1984) speaks of the fishermen’s long term economic interests, actors within the emergent drone society must: 1. Know how they must be enabled to perform their respective roles as hobbyists, professionals, or regulators in the drone society, and 2. Recognize that cooperative relationships can benefit each other.</p> |
| <p>Interessement, or the ways in which actors are locked into different roles during problematization to ensure participation through alliances/negotiations</p> | <p>Locking of actors into roles: “Each entity enlisted by the problematization can submit to being integrated into the initial plan, or inversely, refuse the transaction by defining its identity, its goals, projects, orientations, motivations or interests in another manner” (207). Efforts are made to synchronize the efforts of different actors. For hobbyists, the creation of communities matters the most, while for professionals, the need for enrolment in relevant training programs becomes essential. For bureaucrats and regulators, the formation of an effective policy for drones is crucial above everything else. The manner by which Priya spoke of a WhatsApp group being used by the Indian government to bring together RPTOs, professional drone operators, hobbyists, military personnel, and other government officials can be seen as an attempt to impose stability upon the roles and capacities of different actors, as could the enactment of the drone regulations themselves. Most importantly, “social structures comprising both social and natural entities are shaped and consolidated” (211) during this phase.</p> |
| <p>Enrolment, or the use of explicit agreements, regulations, or laws to solidify roles assigned to different actors during interessement</p> | <p>The assignment of defined roles: Roles are further solidified through formal/informal agreements and multilateral negotiations. Drone regulations now define the differences between recreational and professional piloting along with corresponding legal requirements, while many online (and offline) communities have their own norms and practices in place. RPTOs, local authorities and various arms of the government act as mediators within the process of enrolment by providing resources, training, and guidance. RPTOs are enrolled as guarantors of quality and compliance once legal requirements and safety</p> |

standards are set in place by regulatory authorities – an OPP for the RPTOs would be having to meet these standards. An OPP for recreational pilots would also be having to comply with certain legalities, such as the registration of a drone (depending on the kind of drone that they possess or wish to possess), while for professional pilots, an OPP would be the acquisition of an RPC. Certain kinds of drones are enrolled as well, into different types as defined by policy, while others are actively excluded. Resistance from certain actors may or may not emerge during these processes, and a “grey market” can certainly be thought of as a site of resistance for many different actors.

Mobilization, or the representation of groups of actors to ensure alignment with the “goals” of the drone society

The mobilization of allies: The final stage of translation sees actors collectively performing their roles within the network, in line with their respective goals. Hobbyists become ambassadors of responsible flying, or a particular flying style, or a particular skillset, such as the building of drones. Professionals work across an array of real-world projects. On a macrosociological level, the perceived “goals” of the drone society will vary depending on who is being considered a focal actor, though it (i.e., the drone society) is now self-sustaining, and as an actor-network, “its own reason” (Whitehead 2010). Callon (1984) brings up pertinent questions in this respect: “Who speaks in the name of whom? Who represents whom?” Indeed, with the kind of fracturing that can be traced within the drone society in India, entities such as the DFI, IDRI, Ministry of Civil Aviation and professional/recreational communities of practice represent a variety of vested interests that might either align or compete with each other. Ultimately, every actor’s involvement or performance in real world scenarios fulfills the network’s goal and validates their respective role, while also serving as proof that the network is functioning as intended. The network continues to expand through the interestment, enrolment and mobilization of new actors.

SOURCE: Author’s own.

Lastly, there is a need to discuss the “limit” of the drone society that is being traced. Where does it end? It is obvious that political boundaries don’t matter, as foreign drone cultures/societies and corporations bear roles within the “drone society in India”, as “global” actors that are deployed within the “local”. For Latour (2007), “no place dominates enough to be global, and no place is self-contained enough to be local”. The network ends at the point where it fails to provide any additional traces that need to be followed. In the due course of performing fieldwork for this dissertation, data saturation indicated that I had enough data to obtain new findings and potentially provide an empirical basis for the replication of this study (Fusch and Ness 2015), but in no way did it dictate that I had reached the

ends of the traces that lay in front of me. With new actors – human and non-human alike – entering the drone society each day, the drone society is certainly growing consistently. The “drone society in India” could very well coalesce with drone societies elsewhere – all actor-networks, coalescing into a singular drone society, but I neither have the time, nor the money at my disposal to follow all those connections and trace them.

There is also the matter of evaluating convergence. As Callon (1990) says, “a totally convergent network would thus be a kind of Tower of Babel. Everyone would speak their own language, but everyone else would understand them.” The drone society, as empirical evidence shows, has not achieved that level of synthesis or convergence just yet. It’s far too utopian, and I honestly doubt the existence of any actor-network that could meet that criterion. Many translations fail and lead to disalignment. Chapter two of this shall reveal more on what can be understood through these disalignments, as they arguably signify multiple modes of existence. Disalignment can thus be re-framed – from an instance of failure to a moment of negotiation and mediation between different modes of existence.

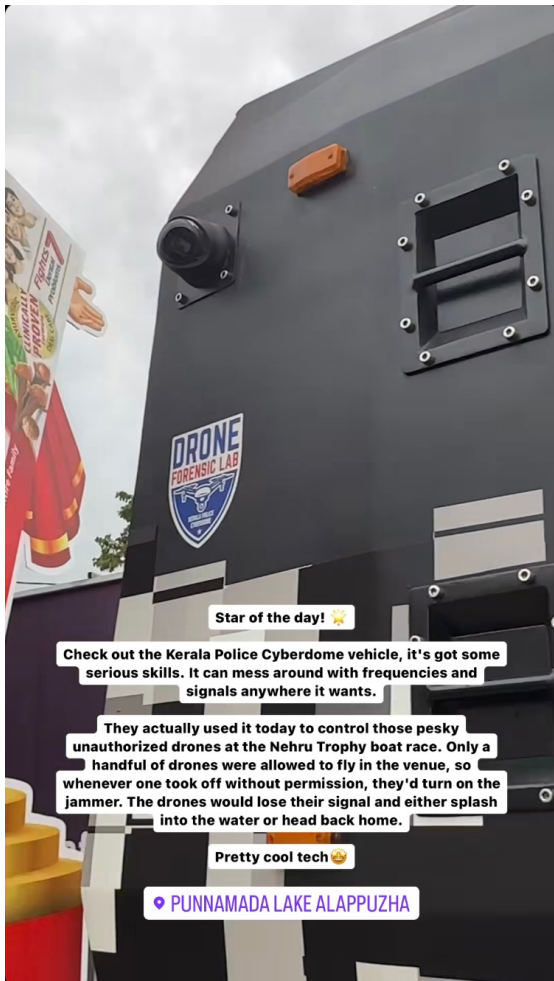


Figure 14: Anti-drone infrastructure in Kerala, India (1). Credits: Author's own screenshot.



Figure 15: Anti-drone infrastructure in Kerala, India (2). Credits: Author's own screenshot.

Chapter Two

Hovering at the Edge: Precarity in the Lives of Professional Drone Pilots

The subsistence of a drone pilot is always exposed to a variety of risks within the drone society, which remains hostile to their existence through its legal, bureaucratic, algorithmic, and market-based mechanisms. These risks tend to be magnified within the domain of drone-work, which is complex, and should not be simply understood as the act of simply being a drone operator for work, as it has many nuanced aspects that are specific to the use of drones in different industries (Ljungblad et al. 2021). The drone society can, in Saskia Sassen's (2017) words, be thought of as a complex predatory formation, where predation is masked (or black boxed) by a certain level of complexity that masquerades as simplicity. The convoluted nature of a complex predatory formation can often create barriers towards the acquisition of expertise and knowledge that could be used for effective policy interventions (Timcke 2021).

In this chapter, I demonstrate how such barriers manifest in the form of precariousness that can often be associated with different forms of drone-work. Precarity, in its many different shades and varieties, prevents individuals from acquiring expertise and financial stability, amongst many other things. It impacts competence, creativity, individual agency, and professional development (among many other things), and thus prevents individuals from being participative stakeholders in their own governance or focusing on becoming experts in their chosen craft (Balsiger et al. 2020). The end result is that policy interventions become siloed and fail to account for the needs of many. Examples of this can be observed in some of the shortcomings of existing drone regulations in India, which had been highlighted in the preceding chapter. As a complex predatory formation, the drone society presents many novel markers of precarity that have not been accounted for by existing studies. I highlight three

such markers in this chapter (along with the novel sources of precarity that they indicate), following a discussion on the nature of drone-work in an era of technocapitalism.

1. The Essence of Drone-Work

In this section, I elaborate upon what I deem to be the essence of working with drones from a phenomenological standpoint. The actions of a drone are bound to the operator through complex, tacit forms of knowledge, which are situated within, and defined by, a nexus of technology, society, and the natural environment. Within this nexus, drone pilots are very much like worker bees within a beehive, feeding their UAVs with instructions and data for specialized work, much in the same way that worker bees sustain the existence of drone bees for specific purposes. Information and agency are distributed as the “more than optical” gaze of the drone (Jackman and Jablonowski 2021) signals a destabilization in the idea of the drone being autonomous (Graae 2020). The autonomy of drones is, after all, perceived, and attributed to them – autonomous drones simply don’t exist (Benjamin 2022). By using the parallel between a beehive and the actor-network of the drone society (which I described in Chapter One), I eke out certain characteristics of the experience (or essence) of working with drones, prior to discussing the nature of drone-work in the era of technocapitalism. It is within technocapitalistic thought that the unnatural fantasy of the autonomous drone can be found, heralded by the state and/or corporate entities.

As I attempted to seek out the earliest usage of the term “drone society”, I came across an interesting article that had appeared within an issue of *The Colorado Statesman*, dated November 6, 1909. The author, May Kreckler (1909), wrote of the altruistic duty of helping others in face of intricate divisions of labor and specialized forms of work (though they did not use the words “drone society” together).

As our society waxes more intricate labor divisions and specializations increase. The members of the community discover that they need the others in order to complete their

own lives. They cannot live to themselves alone. And they discover those who do not help hinder. Wherever there is a drone, society is impoverished by the measure of the work he might contribute were he busy. And whenever there is a poorly trained worker society loses to the degree of this inefficiency (4).

This altruistic ethos was also reflected in what I have found to be the very first series of instances of the term “drone society” being instrumentalized and used (as a single term), which was at a hearing of the Arizona State Department of Economic Planning and Development on July 19, 1978, concerning retirement, work, and lifelong learning:

Senator Church: Do you know what the average retirement age of the Federal employee is today?

Mr. Babson: I don't know.

Senator Church: It is 58.3 years.

Mr. Babson: If they are really in retirement. But as we heard in our earlier dialog; this is not often the case.

Senator Church: Many of them are not.

Mr. Babson: Many of them are not, so they are going on to other forms of production of income, which should be considered in your overall retirement philosophy, in my opinion. So, I think we have a fundamental question of just how much "nonwork" can a society support. I like to refer to the concept of "a drone society," which is likened to the hive of bees, where you have a group of workers and a group of drones - drones don't do any work, they don't bring in any honey, they just "consume" and have "fun and games" with the queen. That may be the sort of society we are building in the United States. (Arizona State Dept. of Economic Planning and Development 1978)

The report on the hearing goes on to describe a “drone society” as a society where access to productivity comes at a premium and is accessible to those who possess highly automated resources and by extension – the capacity to produce, while the rest of the population simply consists of non-workers who endlessly consume. In other words, the act of retiring from work was being equated with the act of joining a “drone society”, where an individual could have as much time for leisure as they would want to as a non-worker.

How and why is this older conceptualization of the “drone society” relevant? There are two reasons for that: **Firstly, it matters that the drone (and here I refer to a UAV, not the male bee) itself cannot do any work on its own.** Even “fully autonomous” drones perform tasks that are given to them by systems that have been instructed or directly coded by humans. The actions of a drone are

the product of tacit knowledge possessed by a human operator; the two simply cannot be divorced from each other. Multi-billion dollar companies like Amazon recognize this; the Prime Air delivery service has structured its internal knowledge management system to incorporate tacit knowledge as effectively as possible (Na 2023), so as to turn it into more “explicit”, codified forms of knowledge that can be easily transmitted between its employees.

Within the context of professional drone-work (or simply, drone-work), space and time have a profound effect on the validity, reliability, and reproducibility of tacit knowledge. It is impossible to disentangle the nexus of technology, society, and the natural environment within what has called the “technonatural present”. The technonatural present is an emergent, ever-changing conceptualization of the present where actions and interventions can define or reconfigure futures with implications for an understanding of how digital mediation reshapes human interaction with nature while simultaneously influencing ecological politics and concerns (Searle et al. 2023). Enacted within digital ecologies – spaces where technology mediates the ties between nature and society – the technonatural present allows us to consider the spatio-temporal specificities of the relations between humans and non-humans. Such spaces characteristically emphasize upon the vitality of process, flow, dynamism, and complexity (Taffel 2019) between various actors. Take for example, the way in which a traveler’s perception of a countryside on a train ride is filtered by the presence of the train in a given place, at a given point of time (Jørgensen 2014). In a similar way, the act of operating a technological artefact such a drone (or even the act of watching drone footage, for that matter) presents a highly subjective, spatially and temporally-bound experience. Within these digital ecologies, there are many distinctions between experiences of nature that are either “accompanied by” the use of a digital artefact (such as a drone), embedded “within” a digital artefact (such as a social media platform), or generated “through” a digital artefact (such as a virtual reality headset or an augmented reality headset).



Figure 16: Amazon Prime Air drone on display at the National Air and Space Museum at Washington, D.C. Credits: Author's own image.

Such spatiotemporal complexities make the nature of work seem fraught with intricacies given how the end product or output is not necessarily “predictable”. Within the digital ecologies of the drone society, humans and non-humans experience the technonatural present as they preconfigure technonatural futures. In the due course of navigating these digital entanglements, they are also confronted with the need to concurrently assemble technonatural histories that provide vital historico-cultural and material contexts (Searle, Turnbull, and Adams 2023); as historical precedents for some

kinds of drone work might simply not exist. Drone pilots are not merely operators of technological artifacts, but mediators that are situated within these entanglements that lie at the blurred boundaries between digital and natural worlds. In a Latourian sense, their bodies (as social actants) exist at the interface of things (Newhauser 2020). Be it within the context of capturing scenic landscapes or monitoring environmental changes, their experiences represent a unique fusion of technology with nature, embodying the essence of technonaturalism, which I shall explore in greater detail within the next chapter of this dissertation through the lens of “drone media”.

I shall now move on to my next set of points concerning the essence of work in the drone society. **UAVs are useless by themselves and cannot be understood without the actions of a larger social or institutional context, much in the way that drone bees are useless by themselves.** Without the context of a beehive, the life of a drone bee simply cannot be understood. A beehive symbolizes principles of altruism, cooperative labor, and decentralized organization (Ford 2015), and drone bees do not actively lend themselves to these socialist mechanisms in the way that worker bees do (Howell and Usinger 1933; Reyes et al. 2019). They do not forage, nor do they actively maintain the hive or work towards defending it (Currie 1987); and so, it can be said quite simply that drone bees depend on worker bees to feed them. In a similar way, the existence and manipulation of a UAV – be it for work or recreational purposes – cannot be understood beyond the ontological framework of the drone society. In the book *Drone*, the author Adam Rothstein (2015) speaks briefly about the drone bee as “a male bee, stingless, with large eyes, good only for fertilizing the eggs of the queen” as he delves into the history of how the term was appropriated by the military before World War II (Teschner 2013). There are several similarities that lie between drone bees and their technological counterparts beyond the mere “insect-like” traits that the former lends to the latter. Some of these similarities include performing specialized functions (mating in the case of the drone bees; surveillance, photography, videography, mapping, delivery etc. in the case of UAVs), exhibiting

dependency (upon worker bees in the case of drone bees, and human operators for UAVs), a short lifespan (due to the limited life of batteries and electronic components in the case of UAVs) and at times, even expendability.

Whether it's through professional activities, recreational pursuits or both, the role of a drone pilot exists as a part of an actor-network that parallels the cooperative and specialized functions of a beehive. Arguably, drone pilots correspond to the worker bees just as their drones correspond to drone bees. Moreover, just as a beehive operates on principles of cooperative labor and decentralized organization, the contemporary drone society exhibits similar characteristics: **collaborative knowledge sharing, community-driven innovation, and a decentralized network of enthusiasts and professionals.**

As I empirically demonstrated in Chapter One of this dissertation, pilots, through their drones, contribute to societal functions such as environmental stewardship, creative expression, and even civic engagement in surveillance and monitoring. The roles of the drone and the pilot are not just functional or performative, but symbolic of larger societal trends – the emergence of human-drone agency, algorithmic mediation, the creation of new bureaucratic infrastructures, and the formation of novel collectives and collective endeavors. The drone society challenges traditional notions of work, leisure, and community, signifying a shift towards a technonatural future where digital and natural ecologies coexist and reshape human experiences, processes of labor and social structures (Searle et al. 2023). Questions of agency, identity, intentionality, and risk remain relevant to these reconfigurations, and lend themselves to the formation of new ontological frameworks where the necropolitical fantasy of the autonomous drone is a constant threat towards efforts to decenter its actions and bring in greater social accountability (Benjamin 2022). It is, therefore, vital to evaluate the importance of drone capitalism in this regard, while simultaneously assessing the considerations it offers towards an understanding of labor within the drone society. A brief examination of drone capitalism reveals that

the extant literature has almost entirely ignored the precariousness that comes with drone-work, particularly within the global south. Data from my fieldwork sheds light upon this.

2. Drone Capitalism: What we know so far about how little it speaks of precarity.

Drones dehumanize the relational assemblages that they are a part of, making it difficult to discard the perilous notion of them being autonomous and accountable for their actions; what must never be overlooked is that the ‘unmanned’ element of the UAV often denotes anonymity, as opposed to the UAV’s perceived autonomy (Benjamin 2022). The fantasy of the autonomous drone possibly helps in explaining why there are hardly any papers written about the precariousness of drone-work. If the contributions of drone-workers are obscured, it would be very likely that any precariousness and value associated with their work would be eclipsed by the perceived actions of the drone.

The term “drone capitalism” was first used by Graf (1983) to describe a form of capitalism that was dependent on both state and foreign capital, exhibiting parallels between what I had said earlier about the relationship between drone bees and worker bees. The term was later used by Cheney, Lair, and Kendall (2013) as a way of referring to the distance between organizational structures and a “global, consumerist capitalism” much in the way that drone pilots in the military were “distanced” from drone warfare as a strategy to reduce the state’s level of accountability in the theatre of war. It was Richardson (2018), arguably inspired by Andrejevic (2016), who was the first to directly employ and define the term in the context of the drone society, and as a form of technocapitalism (Suarez-Villa 2001; Wajcman 2006; Suarez-Villa 2012; 2016). Described by Richardson (2018) as an “emergent phenomenon within capitalist realism (Fisher 2022)”, drone capitalism can be understood as an ironically pervasive and elusive relationality between labor, (drone) technology, algorithmic systems, capital, value, and life. These relations are imagined as being continually reconfigured by its affective and material dimensions across both space and time, with the end result of these reconfigurations

being the exploitative transfer of affect, mood and emotion into the domain of autonomous labor and remote sensing. Richardson speaks of algorithms as the black-boxed scaffolding of remote sensing systems, and of the ways in which algorithmic culture (Seaver 2017) acts in tandem with the techno-affective dimensions of labor to shape both economic and cultural facets of life within the drone society.

A critical comment from Fish (2018) highlighted some of the more serious limitations of Richardson's work, particularly the ways in which it incorrectly spoke about how drones "restrict" the human body. Fish also criticized how Richardson brought in incompatible examples from the domain of IoT technologies and conflates military drones with consumer-grade/civilian drones – a mistake that Jackman and Brickell (2022) incorporate into their writings as well. Perhaps the most utilitarian point of Fish's critique was the fact that Richardson made little to no use of primary data for their 2018 article, though it is worth indicating that their later work (Richardson 2020) made a more convincing assertion about how the idea of militarized perception is embedded within both, military and civilian drones, despite how the two are functionally distinct. Interestingly, in Fish and Richardson (2022), the two scholars worked collaboratively, stating that "drone performativity generates assemblages of human and nonhuman actants entangled at material-discursive and onto-epistemological levels" – an argument that further validates my use of ANT in the preceding chapter. It initially surprised me that they chose to not use ANT, but then I noticed the many constraints of their article emerge through binaries concerning drones, use-cases, drone operators, histories and agencies that relied far too heavily on the notion of co-production. Such approaches might be *less amenable* towards a de-centering of the drone's political and ontological positions in the drone society.

The discursive formations that I have discussed so far were what led me to think about whether or not any other articles on drone capitalism would mention how the work of drone operators is consistently exposed to various degrees (and sources) of precarity. Further investigations into the

literature left me feeling thoroughly disappointed. In the many different works that referred to drone capitalism (Pinto 2021; Klauser and Pauschinger 2021; Cugurullo et al. 2023; Jackman 2023a; Jackman, Richardson, and Veber 2024; Horst, Sargent, and Gaspard 2024), there were no in-depth, empirical investigations concerning sources of precarity for civilian drone operators.

My purpose behind bringing up drone capitalism was to highlight the pressing need for articulating conversations on the precarity of civilian drone workers against the backdrop of drone capitalism. Indeed, if the use of concepts such as platform capitalism or surveillance capitalism can benefit the process of conceptualizing the many varied social, economic, and cultural dimensions of precariousness in gig work, then drone capitalism might prove to be useful as well. Gig work is dehumanizing (Gupta and Gupta 2023), and the performance of drone-work as gig work, possibly more so. The work of most civilian drone workers is akin to gig work, particularly in the case of drone workers who aren't full-time employees working at DAAS companies. The gig economy is being increasingly disrupted by the presence and use of drones, and the intersection of platform capitalism, surveillance capitalism and drone capitalism is one that would arguably define how the overarching, panoptic framework of technocapitalism is understood in the near future.

3. The Precarious Nature of Drone-Work

The precariousness of work is often best understood as an intersectional concept. Take for example, how precarious delivery workers are often thought of actors that are enrolled into the sociotechnical elements of a platform that denies them the benefits and security of full-time employment while subjecting them to mental, physical, and/or emotional harm within a city. In the due course of imagining them in this way, it becomes incredibly difficult to not think about how these harms and compounded by markers of identity such as gender, socioeconomic status, race, ethnicity, caste, etc. (Popan and Anaya-Boig 2021). While the scrutiny of individual identities offers one

approach towards understanding how harms to gig workers (and the level of precarity they're exposed to) are compounded upon, precarious mobilities have a long history of being understood through structural factors as well (Massood and Wojcik 2021), which are what I mostly focus upon in this chapter. The case of drone-workers is not very different, though of course, it must be acknowledged that there are differences between the degrees (and kinds) of precariousness that freelancers and full-time employees at DAAS companies are exposed to.

For the sake of clarity, I turn to Wong and Au-Yeung (2019) for the definitions they utilize concerning precarity and precarious work, which I found to be compatible with my analysis of drone-work:

Campbell and Price (2016) suggest five domains for conceptual clarity in expanding the scope of precariat and precarity studies. First, 'employment precariousness' refers to job quality and characteristics associated with insecurity, low pay, unemployment risks and so on (Kalleberg 2018). Second, 'precarious work' refers to different employment relations and forms, such as the varieties of atypical and non-standard employment. Third, the concept 'precarious workers' focuses on a particular workforce segment experiencing various kinds of precariousness along with their own perceptions and responses (Vallas and Christin 2018). Fourth, the thesis of the 'precariat' defines the political agency of a new class who is endlessly stuck in the lowest end of labour market and insecure employment and calls for new organising strategies instead of traditional unionization (Standing 2011). Finally, 'precarity' is taken as a way of life which is characterised by a state of precariousness expanding from employment to other spheres of life (Campbell and Price 2016). Wilson and Ebert (2013) highlight the precarity experienced, perceived and interpreted by workers based on their everyday life in 'precarious work-societies'. (Wong and Au-Yeung 2019, 3)

In this section of the chapter, I review three markers of precarity for drone-workers: Drone Insurance, Repair-work, and Market Competition. The existence of each marker, I argue, highlights different sources of precarity, but by no means should these markers be understood as mutually exclusive in any way. Such an analysis also speaks to the need of highlighting sectoral differences within precarious work within the global south (Mosoetsa, Stillerman, and Tilly 2016), but a more exhaustive inter-sectoral analysis goes beyond the scope of this chapter, as does a more through comparison between the forms of precarity faced by drone-workers in the Global North and the Global South.

3.1 Drone Insurance as a Marker of Precarity: For Occupational Risk, Personal Safety, and Regulatory Challenges

I focus on highlighting drone insurance as the first major indicator of precarity within drone-work in India, because of how attentive drone insurance policies are towards the minutiae of operational protocols and safety in challenging conditions across many different contexts. As Tarr, Smith, et al. (2021) have written, the “key insurable risks for drones remain first-party loss, including damage to drones and accessories, and third-party liability for personal injury and property damage”. The necessity for drone insurance in India (and more importantly, the government’s mandate for it) underscores the occupational risks involved in operating drones for professional purposes. Moreover, a dependence on insurance to mitigate those risks highlights the dangerous conditions under which professional drone pilots often work. Lastly, the necessity of purchasing drone insurance might also act as a barrier that limits competition and employment within the larger drone ecosystem, as certain use-cases might be more economical to insure, while certain others might not. I associate drone insurance with three sources of precarity: occupational risk, personal safety, and regulatory challenges (which aren’t exclusively marked by drone insurance, as I implied earlier). Elements of all three can be found in the case study that I detail below.

In November 2023, I was lucky enough to receive Rakesh’s contact information from my interviewee Vicky, who told me that Rakesh would give me a perspective on drone insurance unlike no one else possibly could. Rakesh, a middle-aged entrepreneur in his mid-forties, was the one of the two interviewees I had who scheduled a date and time for our meeting almost two months in advance. Both of them arguably possessed a greater deal of financial stability than most of my interviewees, as the other drone-workers I reached out to would only schedule an interview a few days out from the point of time when I’d contacted them. Aside from Rakesh and Vicky, the large majority of my interviewees would often have no idea concerning where they would be located a week or two later, or whether or not they would even have internet access in the places where their work would take

them. Rakesh and I met virtually over Zoom in January of 2024, at a point when he was at a city in Western Europe, and I was spending the academic term working remotely from Minneapolis, MN. A statistician by training, he had worked in finance for many years before pivoting towards being entrepreneurial in the Indian drone ecosystem.

Drone insurance, as Rakesh informed me, was a relatively new industry in India, though it had already been documented and studied from the purview of risk, regulation, and the creation/underwriting of compatible insurance products in other geographies (Tarr, Tarr, et al. 2021). However, most of these studies focus on sites located in the Global North, such as Australia, the United States, and the United Kingdom, to name a few. Within India, drones are (quite ironically) being used to supplement innovation within insurance products in other industries, such as agriculture (Chamuah and Singh 2022), but there is little academic work being done on the nature of drone insurance products/policies themselves. The absence of clarity in drone regulations had made it difficult for insurance agencies to undertake larger investments within the Indian drone ecosystem, but these dynamics began to change steadily in 2020 (Press Trust of India 2021). Rakesh was amongst the first entrepreneurs to recognize this, and he worked on creating a business that essentially partnered with largest insurance companies (as an insurance agent) to provide drone insurance products to DAAS businesses and professional drone pilots across India. As per Part 10 of the Drone Rules of 2021, drone insurance is mandatory for commercial use within India, but none of my interviewees possessed any such policies at the time when I had interviewed them.

44. Insurance. — (1) The provisions of the Motor Vehicles Act, 1988 (59 of 1988) and rules made thereunder shall apply, mutatis mutandis, to the third party insurance of unmanned aircraft system and compensation in case of damage to life or property caused by such an unmanned aircraft system: Provided that a nano unmanned aircraft system may operate without third party insurance. (2) A person operating a unmanned aircraft system may use an insurance product specially designed for such operations, as and when such insurance product is approved by the Insurance Regulatory and Development Authority of India. (Dubey 2021)

One of the main reasons that the majority of DAAS businesses and professional drone pilots don't possess any kind of drone insurance is because of how drone insurance policies in India simply do not cater to DJI drones. Rakesh's company, FlySafe Indemnity Pvt. Ltd., avoids insuring DJI drones simply because they consider DJI drones to be illegal assets in India. As of early 2024, most DJI drones in India are currently being sold without any kind of invoice or documentation, as they are often procured through the black market.

The ban on DJI products, however, didn't mean much to many of my interviewees. Arguably, most drone pilots in India – those with RPCs and those without them - still use DJI drones. As of April 26, 2024, approximately 4225 of the 21628 drones with issued UINs (Unique Identification Numbers) on the Digital Sky website were listed as DJI drones. It is difficult to discern what the actual number would be, as many of the DJI drones that were issued UINs do not use "DJI" as a prefix, and simply write down the model number instead (E.g.: Mavic Mini, Air 2, Mini 2, etc.). A search with the keyword "DJI" produced a list of 4225 DJI drones that had been issued UINs, but this excluded all the DJI drones that had been registered without the prefix. That being said, there are quite possibly over 300,000 unregistered DJI drones in India, if Priya's estimates are to be believed. As an instructor at an RPTO, and as a drone professional with nearly a decade's worth of experience, Priya's estimates were informed by their interactions with multiple stakeholders across the industry.

Another reason as to why many of my interviewees didn't seem interested in purchasing drone insurance was because of it wasn't cost-effective or necessary for their work, and how, more than often, they would find that the local authorities weren't very informed about drone regulations to begin with. Many of them took advantage of this, with the understanding that it could possibly mean having to bribe the local authorities at some point if they were to be approached for an assessment of regulatory compliance.

The informality – and often, the illegality – of drone operations within certain industries informed Rakesh’s decision to offer insurance only to certain kinds of drone businesses/professionals.

Rakesh: So...insurance can happen when we can cover an asset if it is within the law of the land. Right now, most people...not everybody, you know...they're buying illegal drones, uh, be it agriculture side, be it DJI, or because they're using a drone that doesn't have type certification. And we never issue insurance if a drone doesn't have a UIN either, which is mandatory. So that is the tipping point, right? It is impossible to ensure an illegal asset. Now, there is a domino effect which can bring all those entrepreneurs or even a large organization into a legal soup. How? Take for example, a company which is doing a survey for a government agency, okay? They are taking those images using an uninsured drone, which means that the image or data acquisition is happening through illegal means. Now they are acquiring some products, digital or physical...most probably digital products...and delivering it to the government after acquiring it in an illegal way. So that's a huge risk what, uh, today's, uh, drone ecosystem is carrying...just to save, uh, some, some few hundred bucks. And this is not because they don't understand the implications.

From the perspective of someone selling drone insurance, Rakesh classified his clients into three broad categories: B2B (Business-to-Business) clients, B2C (Business-to-Consumer) clients and B2G (Business-to-Government) clients. Drone manufacturing companies and DAAS companies largely fell within the purview of his B2B/B2G clients, with the latter being split up further into multiple different categories based on the services the company provided (surveying, agricultural spraying, etc.). Freelancers often fell into all three categories but made up only a small percentage of his clientele.

Rakesh: Now when I talk about B2B or B2G as a category of insurance products, manufacturers need insurance for a variety of reasons. It is not only about the end products...the drones getting insured...it's a lot more about how they store a large number of lithium batteries, which is extremely risky. They need fire insurance, a directors and officers liability insurance, a product liability insurance, transit insurance, so on and so forth. And those terms were very easy to build into insurance for automobile companies, but when you go to the underwriter and say, okay, I'm manufacturing drones, I need insurance, they'll tell you to buzz off because you're storing lithium. <Laughs> So those are the real problems of the ecosystem. Now, second, I can give you another example, for DAAS companies, right? For them, transit cover...they're basically taking a drone or multiple drones from A to B over long distances somewhere...what happens? The drone gets damaged during a transit.

Interviewer: And that's often a cost that a business owner would have to cover. Their client is probably not going to cover it in any way.

Rakesh: And that's 80% of their business assets in most cases, right? Cinematographers and other freelancers bear similar financial risks. So FlySafe Indemnity recently launched a pilot accidental cover for drone pilots. Now drone pilots, you will not believe that number of snake bites that happen in India. What we have received in terms of claims, I have not received in, in my entire career...I've never seen. These guys are going for agricultural spray during this season. The snake bites are humongous. And these guys, they don't have any insurance coverage. They're out of business...lying in hospital...and you know, they're, uh, I, I don't know! So those, those are the areas that you see, when you really go deep into the drone ecosystem and understand a client's insurance needs...drones are a pretty small part of it. The needs of every sector in the drone industry are different.

Interviewer: I was wondering...in terms of sectors...if you could tell me which one has been the most challenging to work within India.

Rakesh: Drones being used for surveying are the hardest to insure, and brokers tend to mis-sell products to them because they're simply not as financially literate as they should be. When you are actually insuring a survey drone, you have to be mindful that they are actually three parts to it. The first part is the drone itself, which is insured under aviation policy. If you have that, it means you're eligible to take off from the land. Then there's the camera, which is attached...which is an additional camera...that does not come under aviation policy, that comes under electronics insurance policy. Now, usually the electronic insurance policy is null and void as soon as the drone takes flight. And then there's third-party liability. The definition of third-party liability...nobody understands in India. Think about how a 25 kilo drone is flying at 400 feet. If it crashes, the kind of kinetic energy it'll generate would be enough to break rocks below. People don't understand this! It could be a human, it could be a car, it could be a house, it could be anything that it crashes on, right? But the survey drone has been particularly challenging to insure because of two reasons. Firstly, it's really expensive, and it crashes a lot. The cost of repair is also extremely high. You have to understand the unit economics of insurance. So, when an insurer is actually insuring a drone, they're taking...so if the premium is, say 4% of the drone's value, that means that the insurer is taking 96% of the risk, right? Compared to agricultural drones which are present in larger numbers, survey drones are really limited. Insurers are not willing to insure those drones, they've been put on a comprehensive cover, the, you know, "bumper to bumper cover"...the way we call it in India <laughs>.

It goes beyond the scope of this dissertation to address the many varied specificities of drone insurance products, but to sum it up briefly, the two broad categories are third-party liability insurance (which is mandatory), and (optional) comprehensive coverage packages with multiple add-ons that concern the personal safety of the pilot, amongst other things. On-demand insurance and plans for varied periods of time (ranging from a few hours to a whole year) are usually what a pilot or a business seeking insurance coverage would come across.

At FlySafe Indemnity, Rakesh was doing his best to curate an online community of professional drone pilots that he would remain consistently engaged with and had approximately 15,000 members within it at the time we spoke. The need for more comprehensive forms of professional training was something that brought up many times during our conversation, as he felt that the training imparted by RPTOs was “nothing more than a joke”.

In addition to being a catalyst for community development, FlySafe was also a heavily data-driven organization, as Rakesh told me. The company owns a publicly accessible, patented “risk scoring” dashboard that allows drone pilots to estimate a risk score for drone operations based off their location, the date and time on which they would be flying, the purpose for which they would be flying, and the drone that they would be using. Its algorithm utilizes over two hundred different risk-related variables, as Rakesh informed me. The risk score generated for a particular drone operation (or series of operations) could then be used by insurers to price premiums for different policies, and would benefit pilots as well, as they could use those scores as a factor within the pricing of their services for different clients. Through the use of its dashboard and its underlying algorithmic system, FlySafe is, in essence, shaping the ways in which professional drone pilots and DAAS companies were pricing their services in India. At the same time, it is actively providing other insurance companies with data that they could use to underwrite drone policy and interpret risks for actuarial modelling. The absence of historical data for a new industry is typically a basis for the conservative pricing of policies, which is why drone pilots and DAAS companies often end up paying more for insurance against risks than is required of them (Tarr, Smith, et al. 2021).

The cost of drone insurance premiums/policies could disproportionately impact professional drone pilots in India someday. While some would have more financial backing if they’re an employee of mid-size or large DAAS company, or a freelancer with multiple government contracts, many others could be exposed to a form of economic and regulatory precarity that affects their operational costs.

Table 1 below summarizes how drone insurance acts as a marker of the three aforementioned sources of precarity.

TABLE 1

DRONE INSURANCE AS A MARKER OF PRECARITY: OCCUPATIONAL RISK, PERSONAL SAFETY, REGULATORY CHALLENGES

| SOURCE OF PRECARITY | DESCRIPTION | EXAMPLES |
|-----------------------|---|--|
| Occupational Risk | Risks associated with the actual operation of drones, including potential damage and accidents. | The need for comprehensive insurance coverage indicates high operational risks. As Tarr, Smith, et al. (2021) have written, the “key insurable risks for drones remain first-party loss, including damage to drones and accessories, and third-party liability for personal injury and property damage”. |
| Personal Safety | Risks to the physical safety of drone operators during their work. | Rakesh’s mention of snake bites affecting drone operators in rural/agricultural settings. FlySafe Indemnity’s personal accidental coverage plan for drone pilots underscores very real physical dangers faced by drone pilots. Many of my interviewees described different kinds of injuries that they had sustained in the due course of operating their drones. Yuri, whom I speak of in the next section of this chapter, told me of how he had been bruised on his spine by a quadcopter, and how his biggest fear concerning drone piloting was hitting another person with a drone or dropping one on them from above. |
| Regulatory Challenges | Precarity stemming from the complexities and uncertainties of legal and regulatory frameworks that drone operators must navigate. | Rakesh discussed the challenges of complying with the regulatory requirements of mandatory third-party liability drone insurance, which many pilots fail to fulfil due to how they possess “illegal” DJI drones as uninsurable business assets. |

SOURCE: Author’s own

3.2 The need for Repair-work as a Marker of Precarity: Skill Development, Technological Accessibility and Financial Instability

I examine the need for repair-work as a marker for precarity because of how the decision to repair a drone (as opposed to replacing one) could potentially indicate a strategy to maintain a low cost to revenue ratio (CRR), and a low operating leverage. It could, concurrently, indicate a lower level of purchasing power that a freelancer might have in comparison to a larger DAAS company, and by extension, reveal the extent to which the likelihood of their drone being damaged makes their livelihood a precarious one. After all, drones are consistently damaged in the due course of recreational and professional use alike and replacing them is an expensive affair. It thus makes sense that the need for repair-work is often greater for those who live in a state of precarity.

For the many obvious reasons that the previous section of the chapter conveys, there are no authorized service centers for DJI in India. Those with the ability to ship them to Singapore or Dubai often do so for more extensive repair-work on more expensive drones that are worth the investment (to them), and several of my interviewees told me of instances where they had done so at great personal cost. People who can't afford to do so end up availing the services of local technicians who make a living for themselves by repairing and/or building drones for other people within their local communities. Several of my interviewees, particularly those who built their own FPV drones, ended up doing extensive repair-work for their peers or professional acquaintances and had become indispensable to them over time. Rajiv, whom I spoke of in the previous chapter, was one such person, though repair-work was far from his primary source of income. The few individuals who spoke to me about performing repair-work as their primary source of income were known by all the local drone pilots in a certain city (or a certain part of a city); they existed in an oligopolistic continuum with other individuals and small businesses who provided similar services. Demand for their repair-work could probably be thought of as inelastic, and there were always more clients for them to work with. Akhil and Ishan had been kind enough to direct me towards Sudhir, a drone repair specialist in his twenties who lived in Pune, who often did repair-work for them. It wasn't easy for me to get a hold of him,

though. Sudhir was constantly on the move due to the demands of his work with many different clients and remained unavailable for an interview despite my consistent efforts to schedule one with him. We did, however, speak briefly over the phone and via text on several occasions, where he excitedly told me that he had many different stories to narrate about how people had crashed their drones. It wasn't just surveyors, mappers, agriculturalists or FPV pilots who'd approach him, he said; he'd often get to work with individuals who flew drones for almost every recreational and professional use-case in the country. "*Summer mein power-line inspection waalon ka drone repair ka demand zyada rehta hai...aur winter mein shaadi waale photographers ka...survey waalon ka demand toh saal-bhar constant rehta hai* (In the summers, people using drones for power-line inspection usually need to have their drones repaired a lot more...in the winter, it's the wedding photographers who need my services most...and the folks who do survey-work constantly need to have their drones fixed)", he told me.



Figure 17: A damaged DJI FPV drone at Sudhir's repair store. Credits: Informant's own. Used with prior permission.

My conversation with Sudhir brought up two important factors that would act as determinants for the need for repair-work. The first factor was the weather, particularly the Indian summer, which was notorious for causing lithium batteries to overheat and stop working. In some cases, overheating could even cause them to explode and render a drone useless. One of my other interviewees – Prashanth, a twenty-something drone pilot from South Karnataka – told me of how the temperature over the course of a day would determine the hours during which he would work on power line inspection projects. It would be near impossible for him to fly after 11 AM in the mornings during the summer months, and he would often lose several hours during the day. Power line inspection work couldn't be done after dark either, so he would only have a window of a few hours in the morning, and a shorter window in the evening to get a client's work done.

Interviewer: I was also wondering if you've done any kind of work with the government also at any point?

Prashanth: Yeah, I got one time opportunity to work for the government project, but the pay scale is not that great. It was in Hyderabad. So...it was a power line project to monitor and to take closeup shots of the power lines...high tension power lines...and goal was to cover at least four or five kilometers a day, but the project was not paid on a per kilometer basis. There would be like three or four towers...and between any two towers there would be about six lines, six power lines. We needed to take a closeup shot of each power line. I thought that would be too much work for me...because the drone...that area is too hot...Hyderabad, you might know...the temperature spikes up to 40-45 degrees (Celsius) sometimes. Not in Hyderabad exactly, but in Warangal. The battery will die quickly and in hot weather or hot temperature when batteries are very hot, we cannot charge them back quickly. We need to let them cool down for five, six hours at least. That's what the drone manufacturer says. But with that type of workload, it's impossible to maintain those things. So, I left the project and came back.

Interviewer: It sounds like it was almost an impossible project to work on.

Prashanth: One single battery would last a maximum of 25-26 minutes. And the wind speed is also like, over 30 kilometers per hour. Drone batteries will also drain much quicker and we need to cover a distance as well and we cannot even charge the battery outside in the field. And it's also hot, so even if there is a power supply option for charging the battery, we cannot charge the hot batteries. So, it's like a drone-killer project. It would reduce the life of the battery to 50-60 charge cycles, and a single battery for my drone costs about twelve thousand rupees.

Interviewer: And do you think the state government knew that, or do you think they just don't care?

Prashanth: I don't think the state government knows all about all these issues. They are just bothered about the completion of their project. If I skip, they'll try to hire someone else.

At times, pilots like Prashanth would get such projects directly from different state governments through government tenders directly, but in the case of the project that he had described, he had been hired by a third-party that had secured the tender for themselves. What made Prashanth's work more problematic was the fact that at times, clients would give him only a few weeks to get his work done, and unlike people working at DAAS companies, he didn't have enough leverage to negotiate timelines with his clients or pick projects that would keep him from risking the well-being of his drones. This often led him to work throughout the week, and often risk the well-being of his equipment just so that he could finish off work that he was contractually obligated to complete. Moreover, his work hours are indicative of an exposure to *time precarity*, which implies that he is losing his capacity to private time for himself, to work upon individual projects of his own, and that he is potentially experiencing a weakening of his ties to the social fabric of the communities he is embedded within (Campos Ugaz 2022).

The second factor that came up in my conversation with Sudhir was that of market competition, which I've covered in greater detail within the next section of this chapter. Repair-work was often needed by drone operators who pushed the limits of what their drone was capable of in order to deliver what a client had requested of them. The need for repair-work could thus be thought of as being positively correlated with a drone pilot's capacity for risk-taking. Moreover, repair-work was revealing of the kind of drones that professionals had access to within different sectors, the extent to which drone operators could spend money on drones (and their repairs), and the degree to which they could perform repair-work themselves before approaching someone who specialized in performing repair-work. Variations within technological access (to drones/parts of a certain quality), the skill to repair (commercially available drones and/or BTO drones), and financial stability required

to remain engaged with flying drones for work or play could thus be said to be encapsulated and traceable within the domain of repair-work.



Figure 18: Repair work in progress at Sudhir's repair store. Credits: Informant's own. Used with prior permission.

Upon looking at Sudhir's followers on his social media pages, it became very clear to me that most of the drone pilots in the city knew him, and that it wasn't just freelancers or recreational pilots who availed his services, but government agencies and mid-size DAAS companies with substantial levels of revenue as well. The same held true for Rajiv in Chennai, and for Yuri, a professional FPV pilot, drone maker and repair specialist who lived in Hyderabad. A high school dropout, Yuri was from Eastern Europe, and was in his late twenties. He had been living in India since the 2000s and used to repair mobile phones for a living before he taught himself how to repair drones using online resources. As Yuri told me, repairing stock commercial drones is a lot easier, but repair jobs can get highly specific when it comes to custom drones, because of how each drone is built differently.

Yuri: So, the thing about the building drones is...at first when I built my first drone, I realized that it is such an amazing fun to create something out of nothing. Like you just order the parts, and you see a bunch of parts on your table and you realize that this is going to fly at crazy amazing speeds and altitude and you realize that you're creating something and you need creativity while building the drone because not even a single drone is built similarly to another. And when it comes out as a single piece, that's what makes me enjoy. And then I improved my skills a lot about building drones and I started challenging myself and building smaller and smaller drones, because the smaller the drone is, the harder it is to build. And the soldering which you have to do that is almost surgical...you need the surgical accuracy to solder that because the solder pads on the board are extremely tiny, maybe less than one millimeter across...and you have to pass all the cables around properly so that they won't disturb each other. And especially when you're troubleshooting your drone after you build it, for example, if you build a drone...but the video which you get in your goggles is not so clear, you start to think – 'What is wrong with my drone?' Then you realize that you didn't roll the wires together, so the ground and video signal should protect each other from the interference from the motors and other stuff. So, when you learn that, you get special kind of pleasure.

Most of Yuri's customers were from the FPV community and would usually know what they wanted from him, but he had also dealt with clients who were less informed about drones and needed repairs or replacements more frequently. Such clients would often be individuals who worked primarily as content creators on different social media platforms. For them, drones were just an instrument that offered them a way of segmenting their social media content and standing out amongst all the competition in a specific content creation niche. Problems would emerge when their demands outstripped what the domestic market could offer, or what an individual repair specialist or drone

maker could provide them with. Or when they, as content creators, could not provide their clients with the kinds of photos and videos that their clients would wish to see. The struggle to remain relevant within the content creator community is very real, and there is a constant need to upskill, which could potentially be a source of precarity and insecurity for anyone who cannot provide their clients with what they seek. Yuri didn't appreciate their lack of respect for drones (and neither did I).

Yuri: I have a guy like that, he's kind of my regular customer because every time he'll do crazy stuff and he'll just bring me a completely wrecked drone and I should reassemble it again for him...find out what is gone and what is still right...and sometimes just make a new drone for him. The new guys are mostly demanding for the best picture quality, the best stability, safety and easy to learn drones. Usually, they want a drone to fly more than 10 minutes, which is very hard to get in FPV and they want small drones, especially below 250 grams, which is also very hard to get.

With Chinese e-commerce platforms like AliExpress and Banggood being banned in India as a part of a larger effort to stem the inflow of Chinese electronics into Indian markets, consumers within the Indian drone ecosystem have been excessively reliant upon local hobby stores (See Chapter 1), 3D printer services, and other black-market salespeople. Manbir, a twenty-year old college student from New Delhi, told me about how the drone components that he'd order from abroad would often get stuck in the hands of Customs Officers at different ports of entry. At times they'd be shipped back to the sender, and on other occasions, their fate would remain unknown. He then told me about how he would acquire drones and other equipment from Chandni Chowk in New Delhi.

Manbir: It's quite a large market...and they do seem to have whatever type of model you want, and they are prepared to repair, or you know, even get spare parts for any kind of model of a drone that you could have issues with. It's the camera market in Chandni Chowk, and there are multiple dealers over there...around five to ten shops...and all of them seem to have all the kinds of equipment that you could need to pilot a drone for different purposes. So, it's quite a large market. And I did ask them how they get all of this into the country...they just told me that they just get it through the border without a lot of documentation. Just plain old corruption.

Such accounts call for a rethinking of informal/grey markets in India, particularly with respect to the burgeoning drone industry. It goes beyond the scope of this chapter to fully address this, but electronics markets of the kind that Manbir described are an indication of networks that facilitate

“globalization from below” in order to cater to urban underclasses (Deka 2017). Moreover, these markets are known to develop and transmit tacit knowledge through informal business transactions, which in turn contributes to the uniqueness and co-creation of technological products that are eventually built using components that are sold there (Deka 2018). Chandni Chowk in New Delhi is a multicultural heritage site with a long, rich history stretching back to the seventeenth century (Rezavi 2015; Dhussa 2023; Goel and Bhavsar 2023); merely referring to it in the context of informal and formal business transactions is reductive, as the boundary between the two is a product of the highly subjective practices of enforcement and subversion (Schindler 2014) and tensions between the two. In Kolkata, Metro Gully in Esplanade could be thought of as a counterpart to the stores in Chandni Chowk that Manbir spoke of.

Indeed, the availability of components makes it harder for certain drones to be repaired. And as a result, local hobby stores are constantly innovating, evolving and expanding their offerings through strategic forms of convergence: repair services and 3D printing services alongside the sales of components and custom drones. Domestic drone manufacturers too, are leaning into such forms of convergence, and are now offering individual components for sale, alongside proprietary drones that hardly any of my interviewees seemed to be interested in. The Indian consumer’s lack of interest in domestically manufactured drones could be attributed to a variety of reasons, but I’ll defer to a quote from my interviewee Kishor, a professional drone pilot from West Bengal who was in mid-twenties:

Kishor: See, right now the drone which I’m flying is a made in India drone...It is quadcopter which carries one KG (kilogram) payload in it. There are huge problems in these drones. First of all, the finishing of the drones are not so good. There are only few small-size drones, like maybe two, three or four, maximum, in the Indian market which have a good finishing. Also what happens is the body gets heated up and sometimes the drones are not stable. And another thing is that often there are a lot of technical faults. Made in India drones are not so user-friendly, I would say. For normal, hobby purpose people...people who are on YouTube or doing content creation...it's not so user-friendly because every time they would have to arm, then disarm (the drone)...and they don't understand calibration on all that. Because with the DJI drone what happens, you go to the software, it shows it's not calibrated. It also shows you

how you calibrate the drone, and it's really simple. Whereas with most of the make in India drones, they don't show you how to calibrate it. You just need to go to YouTube or you need to ask one of your friends, please help me out in calibrating...the ESC (Electronic Speed Controller) or the motors...or whichever part needs to be calibrated.

From Polanyi's (2001) concept of the “double movement”, we know that society can push back against an unfettered commodification of human activity, including, but not limited to, activity within labor markets that are embedded within a web of supposedly protective regulations and institutions that often dampen or constrain market forces. This idea can be extrapolated to state-level economic policies where governments (such as the Indian government, or the United States government) intervene in markets to supposedly protect domestic businesses and maintain economic sovereignty. This is, arguably, the purpose of the Government of India's Atmanirbhar Bharat Abhiyan (Self-Reliant India Mission), which had been announced in 2020. As an economic stimulus package, the mission aims at providing financial schemes and supportive policy interventions in the interests of micro, small and medium enterprises within the country. And while these schemes and interventions are working out in the interests of RPTOs, drone manufacturing companies, and small/medium-size DAAS companies, there are most certainly many other (smaller) stakeholders who are being left out.

Such protectionist stances resonate with many of the concerns highlighted in Choonara (2020), particularly with respect to the role of the state in creating and enforcing labor dynamics as a way of safeguarding domestic imperatives for the reproduction of labor power from competitive, global market forces. This is typically complicated by the fact that the working class and middle class are hyper-segmented by differences in their market positions, the ways in which they have been integrated into authoritarian structures, and how there is a substantial level of variation in how they are compensated for contractual obligations (Howard and King 2018). As Choonara (2020) mentions, this is where Doogan's (2009) concept of subjective insecurity for the individual is relevant, as it could indicate a pervasive sense of vulnerability among workers regarding their economic futures and social status in the face of non-standard forms of employment.

Such insecurities are further problematized by the ways in which drone pilots have had varied experiences in the training programs that RPTOs offer. While Sourav would clearly attest to IGRUA's offerings as the gold standard within the country, many of my interviewees had divisive opinions on them. Kishor kept telling me about how there needed to be a much bigger market for non-RPTO training courses, and how he felt that RPTOs were essentially scamming the drone industry in India. Most RPTOs have a standardized format for RPC courses, but the idea of a "one size fits all" format didn't hold much of an appeal for many of my interviewees, many of whom were experienced drone pilots with varying needs and requirements.

Kishor: They (the RPTOs) have been scamming people, basically. Not scamming people specifically, but scamming the industry because people know why they're going there and what they're getting out of it (Remote Pilot Certificates). But if they're not learning anything, then what's the use? How can they do the job of the drone pilot? Because being a drone pilot, you need to compromise a lot – no one can teach you this. You need to go to different places, you need to learn many things, and you need to be adaptive in learning. And you need to learn many things rapidly. For example, all the things I have learned, I have learned through experience. No one has told me specifically – 'Okay, you *have to* learn this' – everything that I've learned, I've learned on my own, or by asking people what kind of procedure has to be done.

I had another interviewee in Pune liken the RPTOs to corrupt motor vehicle driving schools within the city. We both knew that they (the driving schools) had a long history of working hand-in-glove with the authorities at the State's Motor Vehicles Department, which granted driving licenses for different types of vehicles. The classes at those driving schools were usually a formality and were (in our experience) entirely inadequate for the reality of driving on Indian roads. In a similar vein, RPTOs are authorized by the DGCA to grant RPCs to drone pilots and are thus charged with the responsibility of providing new drone pilots with adequate training, but from what several interviewees told me, their experiences with RPTOs had been entirely inadequate. Even so, the accounts that I heard of people being trained at RPTOs differed greatly, with some of my interviewees speaking in favor of them, and others, against them. Just in the way that some people are likely to find certain driving schools in metropolitan cities to be more thorough with their forms of instruction, Sourav's experience

with IGRUA could be thought of an instance where the experience of being trained at an RPTO could be substantially rewarding.

Given the kind of power that RPTOs possess with respect to legitimizing and even supplementing a drone pilot's commercial activities, any level of distrust in them could deter or sidetrack new entrants into professional drone piloting and discourage existing professionals from seeking further training with them. This could, in turn, impact the pilots' competencies and keep them from being relevant in a field that is characterized by rapid developments in technology and systems of governance. Indeed, if anyone were to visit the comment section on a video for a new DJI drone, there would almost certainly be a few people who'd be jokingly complaining about how they'd just bought a new DJI drone a few days ago, and how they'd be going bankrupt in the process of keeping up with buying its newer models.

Labor within the Indian drone ecosystem is incredibly fragmented where freelancers and DAAS companies are concerned. While some drone pilots might be able to acquire more comprehensive forms of training through private capital, international certifications or exclusive networks of professionals, others might not, and the end result would most certainly be a divide between them and their lesser-trained peers. What matters in the present, are mostly network effects, or demand-side economies of scale that often materialize directly through personal references. Kishor told me about how he had acquired his work through references, which was a dynamic that held true for most of my interviewees who were professional drone pilots: "See...projects...I would say...have mostly come from references. People referred my name and that is how I got projects. Initially that is only the biggest source of projects. Apart from that, see Facebook, social media, LinkedIn and all...that's also good. But mostly projects come from references."

Such network effects are important, as they can lead to the creation of new opportunities for employment, the minimization of precarity, and a reduction in the need for repair-work. What Kishor told me about next, was something that many of my interviewees were doing as professionals as well.

Kishor: See, what I feel is that more people need to be aware about the drone industry because there are jobs available in this industry and people are not aware about it. For example, there are lots of vacancies in drone companies, but people are still looking for jobs. There's a huge gap between these two things. And personally, I want to get some initiatives running where I would be able to provide jobs to many people. As a drone pilot, for example, I get many projects, which I cannot go to and work on because I am already working at capacity. So that's why I want to oversee multiple projects and I want to make sure that people are earning from working on them. For example, I have a co-pilot who has learned from me, and right now he is able to fly on his own and he is doing wedding projects. I love to teach people who are interested in this, not people who are just coming and just asking just for trend's sake. There are many people who come and ask me, would you like to teach me? Then I just ask them, what's your purpose?

In conclusion, the examination of repair-work as a marker of precarity within the drone society highlights numerous imperatives for industry stakeholders, as well as many different challenges that emerge from multiple sources of precarity, some of which I have documented in Table 2 below. Moreover, given the intersectional nature of precarity, repair-work could also be seen as a marker that indicates the forms of precarity that I have outlined in Table 1 from this Chapter as well. Much like how each instance of an insured drone operation is likely to be unique along many parameters, each act of repair-work for a drone is arguably, unique, at least for a brief period. To paraphrase Jackson (2014), and Corwin and Gidwani (2021) – It is during the process of repair that each drone becomes a unique, de-commoditized entity, which, after having been broken in its own unique way, morphs into a symbol of resistance against the logics, infrastructures and forces that produce mass-produced drones. Repair-work, in short, will remain crucial for the existence and sustenance of a sustainable drone society.

TABLE 2

REPAIR-WORK AS A MARKER OF PRECARITY: SKILL DEVELOPMENT, TECHNOLOGICAL ACCESSIBILITY, FINANCIAL INSTABILITY

| SOURCE OF PRECARIETY | DESCRIPTION | EXAMPLES |
|-----------------------------|---|---|
| Skill development | Rapid technological advancements within the drone society necessitate continuous learning and adaptation, and thus place a burden on operators and repair specialists to constantly update themselves to remain competitive and relevant. | Sudhir's involvement in extensive repair work with various kinds of drones demonstrates the level of skill required to remain relevant. Many drone operators often do not possess the knowledge to do extensive repairs and are at the mercy of the few available (and affordable) services options that exist. Yuri's experiences also highlight the precision and creativity needed in both, the act of building custom drones, and repairing them. |
| Technological Accessibility | The scarcity (or absence) of officially authorized repair services for foreign drone manufacturers and the dependency on local technicians or expensive overseas shipping for repairs highlights technological and logistical barriers that exacerbate precarity. This issue also highlights inequitable levels of access to drone technologies, particularly where freelancers and smaller DAAS companies are concerned. | The unavailability of authorized service centers for DJI in India forces operators to either send drones abroad for repairs, to opt for replacements, or rely upon local technicians. This lack of access can affect timely and effective maintenance, increase operating costs for professionals, and potentially even cause them the loss of a client's business. In a worst-case scenario, when the drone forms the bulk of the pilot's business assets, lack of access to effective repair services could even lead to the demise of their commercial activities. |
| Financial Instability | The decisions that are made between repairing versus replacing drones speaks to broader economic and financial vulnerabilities within the drone society. | Drone operators – recreational and professional alike – opt for repairs over replacements due to the high costs associated with the latter. Such financial constraints could be ameliorated if foreign companies like DJI were able to provide comprehensive coverage services such as “DJI Care Refresh” in India. Sudhir's role as a sought-after repair specialist in Pune underscores the economic dependence of professional drone pilots, RPTOs and DAAS companies on affordable repair services. |

SOURCE: Author's own

3.3 Market Competition as a Marker of Precarity: Professional Identity

As I come upon the last marker of precarity within this chapter, I shall focus more upon one sector of work a bit more exclusively: that of professional drone pilots who offer their services within the Indian wedding industry. Drone videography and photography are self-affective practices in world-making (Munck Petersen 2020), considering how human-drone assemblages “fold in” the environments they’re situated within, take advantage of this affective infrastructure to produce wedding media (Tiwary 2016), and produce a perspective (or a product, depending on how you see it) that is unique to the pilot. The ability of the client to discern this uniqueness, however, can vary quite a bit, which is why personal branding becomes an important element of such precarious drone work when viewed within the larger framework of precarious gig work (Vallas and Christin 2018).

I vividly remember the first time I had seen a drone at a wedding. It was January of 2016, at my cousin’s wedding in Mumbai. The *baraat* (groom’s wedding procession) was exiting the premises of a club within the Bandra Kurla Complex as a loud drone flew overhead. I never did get to see the footage it took back then, but I recall seeing a drone operator in a black t-shirt operating the drone from behind the procession. In the years that passed, the practice of using drone footage in weddings became even more common – not just for the wedding itself, but also for the “pre-wedding” shoots. These trends are part of a larger series of trends concerning Bollywood’s fixation with Hindu weddings, the influence of Bollywood on the wedding planner industry in India (which concurrently resulted in an entire genre of shows on different streaming services), and the appeal that “cinematic” footage has within Indian and Indian diasporic communities (Kay and Patel 2019). Kay and Patel (2019) document detailed accounts of the use of drone footage of newlyweds to “make a spectacle” of themselves, not just within South Asia, but across a range of multi-cultural and multi-racial communities, each with a flavor of their own. The drone, as a silent spectator of these nuptial ceremonies and celebrations, affords the newlyweds a chance to express their identity and their socioeconomic status through an array of carefully planned cinematic visuals. As an actor, the drone

becomes a participant as well; a quick search for the keywords “drone” and “wedding” on YouTube would reveal an entire range of tasks that have been relegated to an uncomplaining drone.

Given that professional drone pilots often work for clients in different industries, it would not be uncommon to find that pilots who work in the wedding industry work in the travel and tourism industry as well. Despite some differences, work that is often understood as “destination management” exists within both industries, as does the desire for clients to possess cinematic, shareworthy footage (Vujičić et al. 2022). It would certainly be possible to find specialists who do either one or the other, but many of the pilots that I had either interviewed or found on social media platforms usually worked with both industries given their needs for earning a livelihood.

Market competition for drone-work within the wedding industry can expose operators to a variety of precarities. Analysis of data from my fieldwork drew me to focus on the prominent dimension of “identity precarity”, which several of my interviewees seemed to have been dealing with.

Identity precarity here can be understood as an association between the professional identity as a drone pilot and associated market performance, which can often be volatile due to a number of intrinsic and extrinsic factors. The association between the two can often be influenced by the efforts that a drone pilot must put in towards personal branding to stand out amongst a market that is saturated with similar service providers. “Identity precarity” is arguably a lesser spoken-of form of precarity. Within the purview of market competition in the drone society, it bears relevance at the intersection of discourse concerning self-promotion and enterprise culture (Vallas and Cummins 2015; Vallas and Christin 2018). Identity precarity has been employed in other contexts (that provide some conceptual utility here), although they all seem to link the concept (directly or indirectly) to the experience of being displaced and dispossessed by neoliberal economic forces, and the challenges that come with negotiating precarious identities (McCann 2022; Vargas Salfate and Stern 2024; Crutchley, Nahaboo, and Rao 2024). Wells and Friedland (2023) utilize identity precarity within the broader

framework of an ongoing “recognition crisis” in political communication, with a particular emphasis on understanding destabilization in traditional identities, the rise of populism and the spread of misinformation.

Now before I dive into different vignettes concerning market competition as a marker of identity precarity, I shall briefly touch upon an account that highlights certain other reasons as to why working as a drone pilot in the wedding industry can be challenging. Rishi, a Pune-based photographer in his late twenties, met with me at a café in one of the lanes of Kalyani Nagar, where I had the opportunity to interview him. The two of us had attended the same university for our respective undergraduate degrees, so it was easy for us to build a rapport with each other. While we were both drinking some coffee, he spoke to me about why he avoids taking up work that involves wedding photography and videography with drones.

Rishi: All the wedding photographers and cinematographers I’ve come across...the ones I've worked with or know personally...they do not have a license (RPC). I think it was about three days ago that I was at a wedding...somebody else's wedding...and the guy didn't have a license. But we were in a rural place where there were no permissions required, so it was fine that way. But then when you fly in areas that are a little sensitive, like Pune, or Bombay...Bombay...all of Bombay's in a red zone. It gets very risky when you're flying over there. I have heard stories of people getting caught and put into a police van and then getting interrogated at a police station. So that gets a little tricky. So I to avoid that...try to secure permissions...and that was my primary reason for getting a license.

Rishi then proceeded to tell me about how clients in the wedding industry – most often the families of the two individuals getting married, individual wedding planners, or wedding planning companies – knew very little about the logistical challenges of operating drones in certain environments. What people often claim to know about drones tends to be a lot lesser than what is perceived about how much they know about drones (Aydin 2019). The demands of a client can at times, be unreasonable, which is why professional drone pilots often have to educate their clients about what they can expect, and what can be delivered within a reasonable frame of time.

Rishi: ...This actually applies to my photography business as well. I guarantee quality. That's the only thing that I'll guarantee. Usually what happens in weddings is that a client will ask for

400 photos...500 photos. I do not do that. I do get clients who want those many photos, but they do not really need those many! I mean, what are you going to do with 400 or 500 photos? Use ten or twenty of them maybe? You could like, print out those ten or twenty and put them up in your home or on Instagram and you'd be the happiest person ever. I'll give them fewer photos, but I'll guarantee quality. So that is what I focus on. I feel that clients want to get the most that they can within the lowest possible budget...or within whatever the budget is. In seeking out value for their money, they often forget to prioritize quality over quantity.

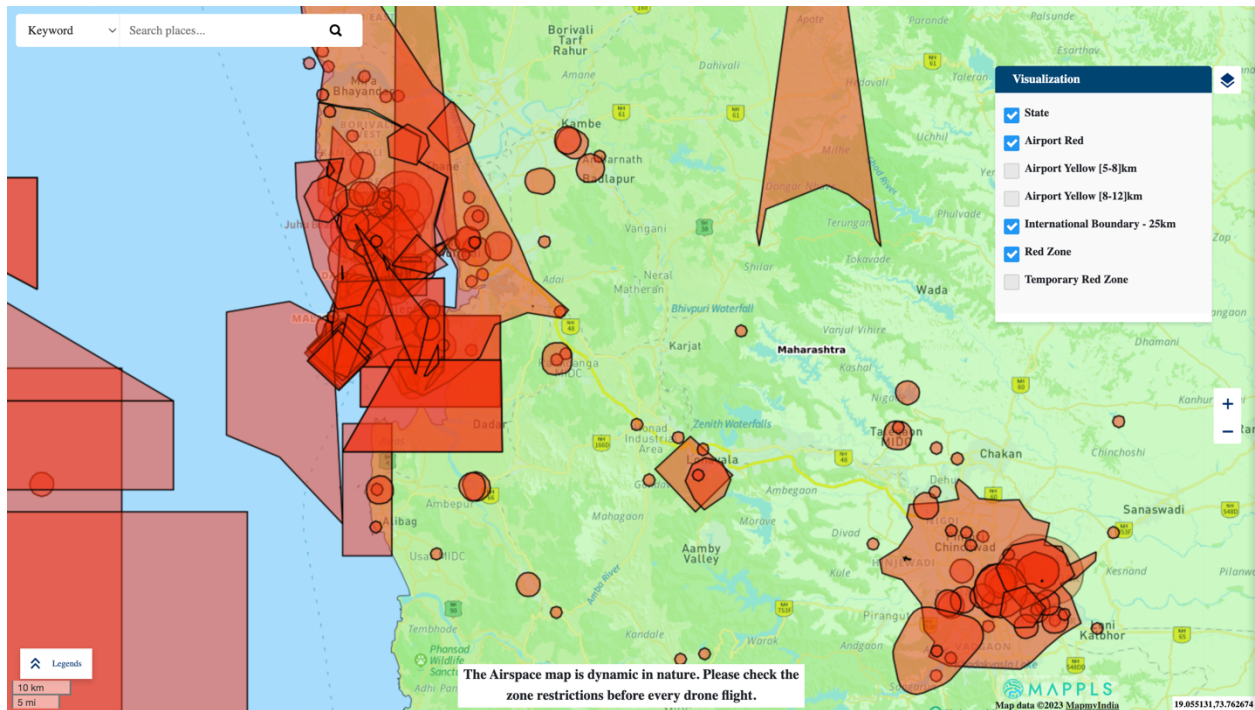


Figure 19: Digital Sky's dynamic airspace map, indicating Red Zones in the cities of Pune and Mumbai. Credits: Author's own screenshot, taken on May 5, 2024.

My interview with Rishi ended on a positive note, though he did ask me if I could leverage my network of interviewees to find opportunities for him. In the interest of safeguarding their anonymity, I had to politely decline his request. I did, however, invite him to a Christmas party at Freebird Productions' premises (See Chapter One) that was happening the following week, but he never came.

I shall now furnish excerpts from two interviews where the pilots had some experience with working in the wedding industry (and some exposure to identity precarity), beginning with Ahon, a

Kolkata-based professional drone pilot in his twenties, who had worked on pre-wedding photoshoot as his first project.

Ahon: Of course, after passing out of high school, I have gone into college and studied Bachelor's in Tourism Administration. And after studying there for three years, I've gotten a job in a travel-based company for nine months. I worked there for nine months and then Covid struck in, had a hard time during those days. During those days, I mean, I got laid off and I had some of the most tragic times of my life. Got another job, worked as a sales representative for a month or so, and then I thought, it's not my cup of tea. Then I thought, let's see, let's explore some more. I was working as a freelance content writer. I was a freelance wedding photographer as well. I did various stuffs all the way. And right now, I'm a bilingual interpreter. I had a passion for clicking aerial photographs, not exactly aerial, but photographs that could be clicked from a height...from a specific height. So previously, since I didn't have a drone, I wasn't able to afford one. Hence, I used to go to the rooftops of the buildings and used to click pictures. I know that's very awkward, but I didn't give up. I thought, maybe someday I'll be able to buy a drone. Now it's been almost a couple of months since I purchased my first drone. And yet I can't forget those memories that I've had clicking and hustling for getting a single click from above from a certain height. I have been a photography enthusiast since 2017. I used to love clicking pictures. I used to explore, I used to love observing things. Again, primarily I was a street photographer. But then I've slowly explored other genres like landscape and travel, daily life, and many others. So, I have always believed on versatility. There's more room to explore new things, and we have endless scopes and possibilities to learn new things. I do go out with some of the photographers and content creators. Go and explore, make content during my spare times during my, let's say weekends or week offs. I'm trying to balance my job as well as my passion. So other than that, I earn a little bit from my drone as well, try to cover some weddings, get a decent amount to at least manage my extra expenses maybe.

Ahon found most of his work in the wedding industry through a Facebook group by the name of “Kolkata Wedding Photographers”, which had approximately 75,000 members as of May 5, 2024. At the same time, he relied extensively on personal references. The account of his first experience with working on a pre-wedding photoshoot reveals a certain propensity towards risk-taking that only grew over time. Towards the end of our interview, he told me about how on several occasions, he flown his drone upwards of three times the legal permissible limit to about half a kilometer in the air. It was unclear to me as to whether he had done so for recreational or commercial purposes.

Ahon: My first work was a pre-wedding shoot that I had to cover. It was at Ranchi in Jharkhand. First of all, my experience was superb. Yes, I was quite hesitant. I was extremely nervous. I was panting a lot because of the height, the mountains. And I was like, what if a bird comes? What if a wire tucks in and disintegrates my drone...what would happen? I was panicking unnecessarily. It's my job. I had to gather some courage. I was like, it's an either do

or die situation, let's do this. Whatever happens will happen. Since I did that, I was successful with the shots that they were asking for, and they got what they were looking for. I mean, my clients, obviously, they were really satisfied with my work. I still have good relations with them.

The only reason that Ahon had been working as an interpreter at the time of the interview was because he had lost access to the Instagram account where he built a following of several hundred thousand people. The loss had been demotivating for him, as he spent a great deal of time curating content for it. A social media presence is often where most professional drone pilots would put up portfolios of their work and would typically be their first point of contact with potential clients, well before a website. I have highlighted how this experience relates to the notion of Identity Precarity in Table 3 towards the end of this chapter.

Next, there's Jacob, a Kerala-based interviewee in his late twenties, who informed me about how there had been a trickle-down effect within the wedding industry leading to the proliferation of drones among what he thought of as the middle-class. According to him, drone footage was seen by clients as a “premium element” within wedding media – one that the middle-class was increasingly aspiring to have. What put drone footage within their reach was the fact that many drone pilots charged lower rates for using entry-level drones. For drone pilots, or photographers seeking to diversify their offerings through drones, the barriers to entry within the wedding industry were considerably low. As a report from KPMG India (KPMG Assurance and Consulting Services LLP 2022) reveals, drone imagery services within the domain of “entertainment and media” require low-levels of technical and sectoral know-how and often face a high level of competitive intensity, in comparison to other domains such as survey work, agricultural spraying, industrial monitoring and BVLOS (Beyond Visual Line of Sight) applications – all of which require a high-level of technical and sectoral know-how, but face considerably lower levels of competitive intensity.

Interviewer: So, you mostly use drones for wedding photography...and I understand that you're essentially selling your clients an experience...so what I wanted to know, is a bit more about how it is that you're selling that experience to your clients?

Jacob: Okay. Uh, it's not hard to sell drone services, uh, particularly when you are approaching someone for a wedding because the moment you say "drone", people have an idea of what to expect...like they've seen it used in premium places. And since I'm using a DJI Mini 2, I don't really have to charge a lot. And so, when I bring it up, like, "Do you wanna have a drone at your wedding?...I have a drone. I can fly it for you, and it'll cost this much," then, then they're always down for it. Um, I have never had anyone reject me so far, uh, for using a drone at their wedding or at their event anywhere. And, uh, yeah, it's very easy 'cause having a drone is premium thing because, uh, like even if you're looking like at how things were three to five years ago, having a drone at a wedding was only for the upper class. Right? And, uh, when you would be at a wedding and hear the sound of a drone flying away, all the people look up and think that it's a premium thing. Uh, so when you say that you have a drone, everybody wants it.

For Jacob, working with a drone wasn't his primary source of income, so the aspect of personal branding didn't matter all that much as it did for others like Ahon, who depended upon social media to secure opportunities to work. **Neither one of them believed that they had a firm sense of a professional identity as a drone pilot, and in the view of spotty earnings from drone gigs, it would be reasonable to say that market competition had exposed them both to pronounced degree of identity precarity. Moreover, in the absence of a strong sense of being a drone pilot, both of them were far more likely to engage in acts of deviance.** For example, on his now-defunct Instagram account, Ahon had photos and videos of monuments and locations in Kolkata that he'd quite literally broken the law to obtain. An act of desperation, perhaps, in an attempt to make himself more noticeable amongst a sea of similar service providers. To him, the personal branding of a drone pilot didn't just signal expertise in a particular niche of drone photography and videography, but it also indicated a certain cultural, sociolinguistic, and geographical familiarity with a city or a state that arguably made some drone photographers more approachable than their peers who might have moved there from elsewhere.

Kishor, on the other hand, had mixed feelings about drones being used in the wedding industry. On one hand, he embraced it as a thriving commercial space for professional drone pilots, but on the other hand, he spoke dismissively about how clients in the wedding industry wouldn't know much about his operating costs or his rates for working on different kinds of projects. He considered it a necessary evil for most professional pilots, as it was only a few of his peers who had managed to acquire a level of success outside of DAAS companies in ways that would allow them to be recognized as “experts” in a particular niche of the drone ecosystem. Market competition forced most of them to diversify their offerings, and as Rushil, Prashanth, and several other interviewees had told me, weddings were by far, the easiest kind of project they had worked on.

In conclusion, the intricate ties between professional identity and market competition in the drone industry quite clearly points to a distinct form of precarity that drone pilots are faced with. In order to circumvent identity precarity, drone pilots have to grapple with market volatility (particularly on account of the seasonality of certain kinds of drone-work), regulatory landscapes, and the deeply personal challenge of maintaining and promoting a unique personal brand in a highly competitive environment. The act of confronting identity precarity is not just about negotiating for survival on an economic level but working towards ensuring that professional (and sometimes personal) identities, expertise and aspirations thrive in the face of neoliberal market forces and cultural expectations concerning the work of drone pilots. In Table 3 below, I move away from the way in which I have summarily spoken about different forms of precarity in Tables 1 and 2, and instead provide a slightly more in-depth look at how market competition impacts identity precarity in different ways. Table 3 also serves the purpose of highlighting the intersectional nature of precarity, which I have spoken of earlier.

TABLE 3

MARKET COMPETITION AS A MARKER OF (IDENTITY) PRECARITY

| ASPECT OF MARKET COMPETITION | IMPACT ON IDENTITY PRECARITY | EXAMPLES |
|---|--|--|
| Market Saturation and Client Expectations | With market saturation and client expectation impacting identity precarity, there is an increased pressure for differentiation and a greater need for personal branding. | Professional drone pilots are often forced to stand out in a market which is slowly beginning to achieve saturation within certain niches, such as the use of drones for wedding photography and videography. Finding unique selling points is often challenging and competition often forces them to engage in novel forms of personal branding that might even cause them to break the law to secure distinctive footage/photos. Managing client expectations is another challenge, as they might harbor unrealistic expectations. |
| Regulatory Environment | Differences in legal and operational risks across a country increase the scope for identity precarity. | Different cities have different regulatory and bureaucratic environments that pilots need to be familiar with. The presence of no-fly zones can often problematize their work, as can their relationships with local authorities (or lack there-of). |
| Financial Pressures | Financial instability can lead to certain compromises in the line of work that could affect self-worth, and/or a professional reputation. | Financial pressures lead drone pilots to undercut each other and often charge lower-than-competitive rates in different sectors of the drone ecosystem. This could potentially lead drone pilots to compromise on how their professional identity is perceived by peers, clients, regulators, and themselves. |

SOURCE: Author’s own

Concluding Remarks

At the beginning of this chapter, I alluded to Saskia Sassen’s concept of a “complex predatory formation”, stating that the drone society would be an example of it as well. Much in the way that finance is said to subsume its foundational elements through extractive practices (Aneesh 2017), the labor of drone operators is often overlooked in many respects, undervalued as an economic base, and segregated from drone technology. Little to nothing has been said about the impact of drone capitalism on the precariousness that professional drone pilots are exposed to in civilian jobs, nor has

anything been stated about how the drone society instrumentalizes drone capitalism to serve the needs of certain actors above others. In many respects, the drone society is undergoing a series of risk transformations (Bieber and Moggia 2021) that makes the risks associated with its economic activities seem indistinguishable from the trappings of the gig economy. The decentering of the drone can often lead to the revelation that “drones as a service” are rest upon the delivery of “humans as a service” (Prassl 2018). This begs to think again about how not all actors are created equally, and how the drone society is capitalizing upon the inputs of multiple different industries to create products and services that profit a handful of institutions and individuals. After all, the organizing logic of the drone society is emergent; it has spawned new social bureaucratic, legal, market-based, and algorithmic structures in different countries across the world. Diversity within the drone society’s workforce will matter extensively in the near future, particularly when its market ecosystems begin to mature within different geographies across the world. In fact, the lack of diversity within the drone society can itself be thought of as a marker for sources of precarity such as gender, or race, which is quite possibly why it there are communities dedicated to the representation of women and other racial minorities in the US drone industry. This chapter only covered the ways in which drone insurance, the need for repair-work, and market competition within the drone society act as novel markers for different sources of precarity for civilian drone pilots who rely on their drones for a living. Arguably, there are many more markers that are out there, that I have not been able to witness or access through my fieldwork.

Chapter Three

There is no spoon: The Dual Realities of the Drone Society

1. Introduction

What drone videos or photos show us, and what reality offers in its stead are often two very different things, and the differences between the two can lead to them acting as independent social forces that can shape people's perceptions in a variety of ways. I'll begin explaining this using an example. In *The Matrix* (Wachowski and Wachowski 1999), the audience of the movie is afforded a transcendental vision of reality (i.e., a vision of the "Matrix" itself, and what it allows people inside it to believe to be real), as well as a vision of the "reality" that exists outside of the Matrix (Vasiliou 2005). This is what makes it easier to understand the implications of what the "Spoon Boy" tells the protagonist Neo within the Matrix (as he bends a spoon in front of him using nothing other than his mind): That there is no spoon that Neo should try to bend using his physical strength, for that would be impossible; that he should instead, focus on realizing that there is no spoon, and that upon truly realizing that, he would see that it isn't the spoon that's bending, but only his self. By internalizing the fact that the Matrix, as a system, is a producer of a secondary, simulated reality that is designed to keep him enslaved, Neo is able to recognize its codified, communicative structures and use them in order to resist the Matrix's code and exercise his own agency upon it. His recognition of the Matrix's true nature is depicted more explicitly towards the end of the movie when Neo begins to see the entirety of the Matrix in the form of its constitutive code.

The Matrix is a useful analogy for developing an understanding of systems thinking, particularly through the lens of theoretical frameworks that have been developed by Niklas Luhmann, which I use in this chapter. As much as I wish, I was not the first person to think of a connection between Luhmann and *The Matrix* (though I did independently arrive at it); a paper by van Lier and Hardjono

(2010) used this comparison to certain effect. Why Luhmann? Why Systems Theory? **I employ Luhmann’s theories of social communication to speak of the ways in which mass media uses drone photos, videos, and data (i.e., drone media, broadly construed) to shape how social, cultural, and natural landscapes are understood by people.** I specifically use Luhmann’s approach towards understanding systems such as mass media because of his emphasis on processes of meaning-making, and his argument that reality is only accessible through the medium of social communication systems (Luhmann 2018). All my interviewees spoke of the influence of drone media on their practices as recreational and/or professional pilots, and how it was instrumental in shaping their perceptions of drone culture, built/natural environments, and many dimensions of social life itself. **Understanding how mass media uses drone media, is thus of great importance, and has many implications for how communication is structured and understood within the drone society.**

The study of drone media has often been situated within broader studies of mass media and been rightfully labeled as a disruptive force within the industry’s products and practices (Culver 2014; Tremayne and Clark 2014; Gynnild 2014; Holton, Lawson, and Love 2015). Scholars such as McCosker (2015) provided an early glimpse of the dynamics of this cultural condition, recalling the importance of Haraway’s (1988) notion of the “god trick” in connection with the drone’s subjective gaze. McCosker (2015) also revealed how the domination of a populace could take place through the affective power of drone media, its shifting visualities and the contested relationalities that produce it - some of which I have written of as the sociotechnical negotiations that drone pilots often engage with, in Chapter One.

Most of my interviewees’ spoke of the production and consumption of drone media in connection with a “bird’s eye view” or a “god’s eye view”. In the case of the former, there is a very real desire for avian mimesis to lie at the foundation of drone technology, and what drone media presents them with. And for those who attributed greater significance to the latter, what mattered was

an access to technomorphism (i.e., a state of being designated with machine-like qualities (Lum et al. 2011)), and a firm pathway towards experiencing cyborg-like qualities (Lima and Belk 2024). However, this wasn't a case of one or the other, as the process of engaging with drone media (as a producer or consumer) was often tied to both perspectives. **Drone media *dislocates* producers and consumers alike, leading them towards dissociated experiences where some (or all) aspects of their consciousness and awareness are re-situated within a “new reality”.** As Preece, Rodner, and Whittaker (2024) demonstrated through their study of virtual reality, such dissociated experiences produce messy, multiple embodiment relations that can radically alter an individual's sense of identity, perception and consciousness. Take, for example, how Paramjeet, a New Delhi-based drone pilot in his late thirties, described how the experiences of drone piloting and drone media production had seemingly altered his perception of reality in an interesting way:

Interviewer: You mentioned this ability to be able to picture any particular landscape or setting or a city from a bird's eye view. And I was just wondering as to how often that perspective just subconsciously informs your work, or the time that you spend with people that you're recreationally flying with, or conversations with people that you're just talking to about the drone industry?

Paramjeet: I'll tell you what it subconsciously informs the most...and I've never actually thought about it like this, but since you asked me this question, it really makes sense. So, for me, like I said before, the perspective of any location or environment that I go into now has got a whole new dimension to it. Even from the ground, my mind can visualize what it looks like from up there because I've just flown for so many hundreds of hours. And because I come from a creative background and most of my life has been about creating visuals and creating interesting frames...for me what has fundamentally changed is that any place that I go to, I'm able to see it from the ground level, but in my mind I'm able to see it from up there as well and very instinctively, if it's a location which I know is going to be crazy from up there, I want to have a drone with me because I know that the moment I take it up there, it'll give me exactly what I had in mind. So, I think that's been a very interesting transition that's happened in the way I visualize the environment. And I've now seen that happen in multiple cases...I've shot scenes for some really big movies and just because of having that ability have been able to literally go from, *oh, it was just supposed to be a drone shot* to, *oh, let's make this the opening shot of the film*. And all of that comes from just the ability to understand and feel the landscape from that Z-axis that a lot of people don't have access to. And outside of work, what drone piloting has actually informed the most, is the way I travel. And why I say that is because it's actually bit bizarre how I do this. It's very personal...nothing to do with work. When I travel, I mostly do a lot of road trips. I didn't do this before, but I now view the maps on satellite view and I'm able to create my whole trip's experience...not based on pins that are there in Google maps

but based on visuals that I look at on satellite view. It helps me to know which area is going to be stunning and worth visiting. And I can say I do this almost on an everyday basis when I'm traveling. I can give you examples from yesterday, sorry, the day before yesterday, when I just walked onto a path because I saw it on satellite view, and I knew what it would look like on the ground. The kind of experiences I've had with my travels has completely been changed because of having access to that understanding of *a top view as a ground view* or *a ground view as a top view* or an *angular view* has enhanced my quality of travel fundamentally. I'd actually never connected the drone angle to this...I always thought it was just about the map and how I read the map. But now that you've asked this question, I think it probably a lot to do with because I have that access to a deep understanding of aerial views. So, as I was saying...the day before yesterday...I was with someone and we were trying to get to a spot which had a nice view and we went to this place and it wasn't actually that nice. So, I opened up the map and I found a spot about six minutes away and it had a view that was ten times better than where we had ended up stopping.

Paramjeet's account was one of many that showed me that the production of **drone media could simultaneously be understood as the product of a complex system of communication, and a symptom of a socially constructed reality**. In the sections that follow, I delineate the ways in which this “doubling” of reality occurs and provide a perspective on understanding drone media as communication, as seen through the lens of systems theory. This chapter has little to do with the subjective practices of producing drone media in various contexts – a topic worth great scrutiny, but not one that I sought to investigate directly in this dissertation (owing to many kinds of constraints). **What this chapter seeks to do instead, is argue for the co-existence of dual realities within the society - the virtual, and the actual – and provide a comprehensive way of understanding the ontological and epistemological nature of their co-existence**. I shall refine this argument in the following section.

2. A Systems Theory Perspective

Mass media – when understood as an amalgam of television, social media, print media, etc. – is, in the terms of Niklas Luhmann, a black boxed, self-reproducing, observing system that is “capable of distinguishing between self-reference and other reference” (Luhmann 2000). I intentionally include

social media within the portfolio of “mass media” (even though Luhmann doesn’t), as the logics of social media have become almost entirely inextricable from the logics of mass media in the present day (van Dijck and Poell 2013). As a system within a complex, networked society, mass media possesses its own **infra-language or terminology** that serves as its medium of communication. Digressions from the appropriate use of its infra-language are often corrected or chastised in many ways. During the time that I was observing groups of drone pilots on Discord, Facebook, or Reddit, it was fairly common for me to across conversations where edited drone media was often critiqued, and users with “raw media” (i.e., unedited photos or videos) were instructed on how to improve upon what their drones had captured, either by shooting the video all over again, editing it in a certain way, or both. The end goal was almost always some kind of conformity with standards of how the community wished to have drone media be communicated. Deviate, and you would risk being ridiculed, or have no one show interest in what you wished to communicate. From a Luhmannian perspective, it would mean that the individual’s video would have been coded by the system to indicate either compliance or non-compliance with the system’s form of communication. If it indicated compliance, the video would communicate information that can be recognized within a growing, recursive network of drone media and contribute to the form of communication under scrutiny (such as an FPV drone video).

Mass media provides a massive array of different forms of communication intended for different purposes, but those forms are limited and identifiable to those that use them (Luhmann 2000) and engage with them. Compliance with the structure of a particular form of communication could also indicate a clear structural coupling between the system of mass media and another system. For example, within the drone society, an FPV video shot at an exotic location might indicate a structural coupling between the systems of mass media and tourism (with the latter being a self-reproducing, observing system as well (Fariás 2009b)). At the same time, it could indicate a structural coupling

between mass media (a social system of communication) and an individual's cognitive/psychic system, thus bridging the gap between what is communicated on one hand, and what is perceived on the other because of what is denoted (Jakobsen 2011). The concepts of self-referentiality and structural coupling that I have used here will make more sense when I conceptually describe them in the following section.

The portion of my fieldwork that happened online often had me thinking about reality and the representation of reality. As a result of my search histories and the time that I spent in different online drone communities, I would often come across algorithmically recommended advertisements for short courses by professional videographers and photographers who worked with drone media. Most of their ads directed the viewer to adopt “best practices” that would lead them towards viral and commercial success, and/or online recognition by their peers and consumers alike. This might seem reminiscent of what Debord (2021[1967]) had said how the spectacle (here, mass media, or even drone media for that matter) is a unifying force within society that marks the presence of a language of separation and the simultaneous “alienation of the spectator”, and how there is indeed, a unified system of mass media reliant on violent divisions between itself and society. A Debordian analysis might also reveal that in the due course of being agents of the spectacle, drone pilots and individuals within online drone communities who attempt to impose conformist patterns of communication and production on others risk losing their individuality and putting the individuality of other people at risk by enrolling them as fellow agents (45-49). Such social dynamics arguably resonate with what Luhmann describes as the self-reproducing nature of a system, which I shall describe in greater detail shortly.

So how does the system of mass media employ the use of drone media? As an observing system (the system of mass media) produces a transcendental illusion of reality (i.e., what *appears* to be real) that is observed outside of the system as first-order observations (of drone media) by viewers in an external environment. The internal observation of the processes that produce this perceived,

transcendental reality – that is, the observations of the observing system of media itself – produces *second-order* observations that Luhmann (2000) uses as a basis to make a very direct argument: **Mass media produces a reality that is different from its own so that it can distinguish itself from its environment.** What this argument implies is that all knowledge that is produced by mass media through a “doubling” of reality, and is therefore, entirely constructed through its internal machinations of *operational constructivism* (4-7). The process of distinguishing between self-reference and other reference happens within the observing system itself (through its own “infra-language”).

But what does all this mean for the drone society? **The relational nature of the drone society, I argue, reveals from within its networks, a self-reproducing system of mass media that lends itself to the production of this second reality. All that is perceived through drone media is reliant upon a construction of reality itself – a product of the ways in which mass media makes sense of the world that exists outside of it.** This construction of reality, I argue, directly influences the ways in which people interpret the idea of a “technonatural present” – volatile, more-than-human digital entanglements that emerge at the nexus of technology, society and the environment (Searle et al. 2023), which I brought up in Chapter Two of this dissertation. Mass media (and more specifically, its use of drone media), therefore, can also be thought of being a significant contributor towards the contextualization of technonatural histories, as well as the pre-configuration (or affirmation) of technonatural futures.

None of this needs to be as abstract as it might sound, as there is a very real material basis for how the drone society reconstructs social and natural environments as it sees fit. I noticed this in Akhil and Ishan’s description of how data from their drones had been used to aid the demolition of 400 tenements that belonged to impoverished families and individuals. For those who were displaced and rendered homeless, the violent, unsettling moment of displacement in the technonatural present could be said to have been shaped by drone media. Social and environmental realities were reconfigured

through an entanglement with drone media, and the forces of urbanism took hold. The moment of displacement itself could be simultaneously contextualized within a history of architecture for the poor (Debord 2021[1967]) and its intersections with the technologies that led to their displacement.

With the matter of wielding such great power, comes the concern of appropriating great (often, institutional) responsibility. One must question the moral goals of institutions capable of inducing such machinations. Arguably, this is where Latour's work in *An Inquiry into Modes of Existence* (Latour 2013) would be most useful, but it goes beyond the scope of this dissertation to explore questions of power in greater detail. However, it is worth mentioning that the analytical frameworks presented in *An Inquiry into Modes of Existence* (AIME) afford actor-networks with trajectories that they may follow, whilst providing the discerning social scientist with the ability to differentiate between two trajectories. AIME also provides a historical context through certain "fundamental" modes of existence such as reproduction/metamorphosis (Edward 2016), which could be useful for the contextualization of technonatural histories. There is, however, the central issue of determining how power relations are understood within a network, or rather, how Latour fails to provide a clear illustration of how power functions within a network (Choat 2016). I have provided a foundation for exploring this towards the end of the chapter, in a section where efforts are made towards reconciling Latour's ANT and Luhmann's (systems) theory of communication. Questions concerning power are not specifically answered, but I do reveal a compatibility between the two frameworks that might be useful for doing so. For Luhmann, power is a "functional resource" that moves society in a certain direction through the language of social communication (i.e. knowledge) and enables "productive action" (Rempel 1996). To Foucauldian theorists, this might signal a connection between power/knowledge that Foucault makes explicit in his writings, but which Luhmann only speaks of in an implicit manner (80-87). Luhmann instead, focuses on describing power as a mechanism that is responsible for the

reduction of complexity and uncertainty in social systems, as well as the tailoring of expectations and coordination of actions (Luhmann 2018).

The Matrix, as a system, worked towards keeping people enslaved and within the control of its sentient, robotic overlords. There was no true separation between the two realms of the real and the virtual, as the sequels to the movie revealed. Despite being operationally closed off from each other, they remain open to the influence of the other (much like two different Luhmannian systems). Yet the differences between the two are real and productive when unfolded. The power that exists within the Matrix is exerted upon the “real world” through the actions of the antagonist, Agent Smith, and conversely, the movie reveals how many actions or phenomena in the “real world” (such as death) exert agency within the Matrix. The two co-produce each other, much in the same way that the “virtual” nature of communication and the “actual” nature of an actor-network often co-produce each other. I’ve spoken about this in greater detail later in this chapter, in the context of bringing Latour’s and Luhmann’s closer to each other.

My primary argument in this chapter is that within the drone society, mass media produces a constructed version of reality that influences the nature of technonatural ecologies.

This is an argument that complements what Searle et al. (2023) write about, as they stress upon the utility of critically unfolding the processes that repeatedly mediate and remediate the technonatural present. Akhil and Ishan’s work with the Mumbai Municipal Corporation (as described earlier in this section) provides an instance of how this happens, as do the testimonies of many of my other interviewees, but this argument merits a firm theoretical foundation that it could work upon. This is what I seek to establish by first laying out a crucial vocabulary for Luhmann’s systems theory, followed by an examination of how Latour’s and Luhmann’s theories can be reconciled with each other. Finally, I use Luhmann’s work on mass media to reveal how the media constructs dual realities within the

drone society, and I conclude this chapter by providing empirical evidence in the form of first-order observations and second-order observations concerning drone media.

3. The Vocabulary of Luhmannian Systems Theory

3.1 “Self-referentiality”

First and foremost, it is crucial to understand that for Luhmann, social systems are “systems that ‘make sense’ of their environment” (Arnoldi 2001). Society and science are amongst social systems such as these (Luhmann 1984), and the concept of self-referentiality plays a critical role with respect to enabling the way in which a system characterizes itself as different from another system, or its environment (Morgner 2014). Self-referentiality is possibly best understood by means of observation; it serves the purpose of reinforcing the autonomy of a system in a way where its rules are tied to the idea of operational efficiency (400). The creation of such social systems relies upon the codification of communication insofar that communication itself appears unique in its “form”. Codified communication is then reproduced by the system as communication, which is the process by which the system reproduces itself – blockchain ledgers are a great example of this. Through codified communication, a social system can thus discern what belongs to it, and what might be extraneous to it (401). The codification of communication thus makes it possible for a system to possess and exhibit self-referentiality. Finally, social systems possessing self-referentiality are empirical and possess no transcendental status whatsoever (Luhmann 1990). Three levels of self-referentiality can be noted here: self-reference at the level of a system’s constitutive elements, ‘reflexivity’ that signifies ties between internal patterns of communication, and ‘reflection’ which indicates that a system is observing itself and its processes (Schwaninger and Groesser 2012). An example of this concept being used can be seen in Aneesh’s (2009) distinctions between algocratic systems and bureaucratic systems, which

remain structurally open to each other while remaining operationally closed from each other at the same time.

3.2 Autopoietic systems

The theory of autopoiesis builds upon the foundation provided by self-referentiality. Autopoietic systems, to put it plainly, are “closed” entities that cannot obtain their constituent elements from their external environment but generate them within temporal boundaries through a process of selective arrangement instead (Luhmann 1990, 115). Luhmann highlights three major types of autopoietic systems – biological/living, psychic, and social (2). Communication is unique to autopoietic social systems and is labeled as their mode of reproduction (3). Psychic systems on the other hand, utilize cognitive processes to serve the same purpose (Arnoldi 2001). To Luhmann, society is an autopoietic social system that is constituted by the basic structural mechanism of communication and processed within the terms of communication as well (Bechmann and Stehr 2002). Moreover, with communication being equated with its mode of autopoietic reproduction, society can be understood as a recursive system that only alters itself through itself (71). Matters of a causal nature thus take a backseat with respect to the problems of self-referentiality. The only thing that an autopoietic system is incapable of producing through its relations of production is its own destruction, as an autopoietic system can either sustain its autopoietic processes or fail to do so entirely. This marks them as different from humans, who could simply commit suicide by letting a “conscious system interfere with an organic system” (Luhmann 1990, 118).

3.3 Operational/ Autopoietic closure

The aspect of operational/autopoietic closure emerges within a system when it differentiates itself from its environment and achieves a state of being autonomous and “disembedded”. Operational

closure indicates an autopoietic system's boundary-work in action and is not to be confused with the isolation of a system from its environment in any way (Luhmann 1991). To put it simply, it means that a system's operations are self-contained and that they do not inherently depend upon any inputs from an external environment. Using the legal system as an example, Luhmann shows that it reproduces itself whilst maintaining operational closure (1434), and that it can be seen as distinct from other autopoietic social systems such as the economy (1435). Operational closure can thus be understood as complementary to self-referentiality, as the former serves as a mode of executing the latter.

3.4 The notion of complexity within systems

Within Luhmannian systems theory, complexity serves as a threshold that indicates the differences between systems that are autopoietic and systems that are not (Luhmann 1995). It refers to the process of selective arrangement of elements within a system, as a sufficient level of complexity would require the structuring of sub-systems that are far less complex than their immediate, internal environment. Differing levels of complexity between a system and its internal environment make it possible for a form of organized complexity to emerge within the system. This organized complexity can be inferred as a level of complexity within a system that makes "selective relations" possible amongst elements that bear constraints on their "connective capacity" (24-25). With respect to the internal environment of a system, increasing levels of complexity force a pronounced degree of "system differentiation" between its sub-systems, which can be understood as the "forced repetition of system formation within systems", or the emergence of "systematicity" (17-19). With respect to indeterminacy or the absence of adequate information within a system, complexity can be treated as a measure. An inordinate measure of complexity can thus be problematized as a system's inability to understand its external environment and/or itself (27-28). With the added dimension of temporality,

a system's complexity, and its elements by extension, are understood as temporalized and unstable. Thus, with the consistent disintegration of elements and their relations within sub-systems, the process of autopoietic reproduction is burdened by the need to constantly generate new "event-like" system elements (47-50). In short, these elements are understood as the "operations of a system" (49-50).

3.5 Interpenetration

To begin with, it is important to note that Luhmann examines human beings and their ties to social systems through the concept of interpenetration, where the term "human being" is used to designate both, psychic and biological systems (210-211). This manner of assembly squarely fits human beings within the idea that the environment of the social is constituted of human beings themselves. The term "interpenetration" designates a very particular set of relationships between autopoietic systems only. Here, the systems in question bear a reciprocal equation, making their complexity "available" to the other (213-214), whilst exhibiting the nature of system-environment relationships in the process. By becoming environments for each other through a process of "binding", they are internally and externally affected and influenced by the structural arrangements of the other. Interpenetration makes it possible for the boundaries of one system to be contained within the operational sphere of another; Luhmann provides an example of the way in which the consciousness of psychic systems could host the boundaries of social systems, and conversely, how the communicative realm of a social system could encompass the boundaries of a psychic system (217-218). This is not a case of "unity", but one of "difference" instead, as complexity between the two systems is never completely transferable to the other. The incomplete transferability of complexity ensures that varying forms of sociocultural evolution are made possible. Luhmann also goes on to explain the binding between human beings as a kind of "interpersonal penetration" (237-238), but it

goes beyond the scope of this response to delve into its specifics. To tie these ideas together, Luhmann states the following:

“All socialization occurs as social interpenetration; all social interpenetration, as communication. Communication succeeds and is experienced as successful when three selections (information/utterance/understanding) form a unity to which further communication can connect. Participation in this occurrence--whether as a source of information, as an utterer, or as someone who understands the utterance in relation to information—is the basis of all socialization.” (243-244)

3.6 Structural coupling(s)

The idea of structural coupling is arguably responsible for the renunciation of any kind of all-encompassing model of causal relations; it displaces any kind of input/output framework and situates the theoretical framework of autopoietic systems in its place (Luhmann 1991). At the most basic level, a coupling indicates a “temporary interlocking of independent units” (Luhmann 1995, 222-223). An exception, perhaps, arises in the case of the integrity of an autopoietic system, which is made possible through the steady structural coupling that it bears with its own medium, lest it might break down (220-221). A structural coupling between an autopoietic system and its external environment on the other hand, permits mutual influence without any direct interference in the operational aspects of each respective system. Most crucially, the “twin concepts of (operational) closure and structural coupling exclude the idea of information ‘entering’ the system from the outside” (Luhmann 1991, 1432).

What a structural coupling is, in essence, is the idea of difference manifested. As Luhmann says, it is a “form with two sides: an internal side that admits irritation and an external side to which the system remains indifferent” (1433). A structural coupling merely directs communication as forms of “irritation” from one operationally closed system to another, which in turn is internally translated and validated by the logic of self-referentiality, and the “criteria proposed by non-self-referential epistemologies” (Bausch 2006, 70). One of the most comprehensible examples that Luhmann provides is that of a constitution serving as a structural coupling between a legal and political system.

Both, the legal system, and the political system are autopoietic systems; the determinations and decisions communicated by the legal system are acted upon by manner of reference within the political system, and conversely, the determinations and decisions communicated by the political system can be interpreted by referring to statutes and the distinction of what may or may not be constitutional.

3.7 Structural Couplings and the Integrity of Knowledge

For Luhmann, knowledge possesses varying shades of integrity within a system and outside of it. Knowledge, for him, is contingent on the internal operations and distinctions of the system, as opposed to any kind of absolutist representation of an external reality. If we are speaking about a certain kind of knowledge, such as scientific knowledge, or legal knowledge, then it must be validated by both, self-referentiality, and the “criteria proposed by non-self-referential epistemologies” (Bausch 2006, 70) that would typically stem from other systems that are structurally coupled to the system of science or the legal system, as seen in the example above.

The focus on the notion of knowledge might seem like a bit of a distraction, for Luhmann clearly states that the theory of self-referential systems is in no way exclusively concerned or grounded in traditional epistemology. But as I highlighted earlier, understanding knowledge within Luhmannian systems theory is crucial if there is to be an explicit conversation on the relationality that exists between power and knowledge. What his theory of self-referential systems seeks to do, is furnish an explanation of the “operations” or discrete events that go on in within a system, and the “expectational structures” that envelop them (Luhmann 1995, 292-293). An understanding of these operations, by extension, would assist with the process of distinguishing knowledge from the autopoietic processes of acquiring knowledge: attaining, retaining, testing and extending (Bausch 2001). Knowledge, by contrast, can be understood as a “non-hierarchical quality that emerges out of a recursive covering inside the system” (Luhmann 1995, 483-484).

This distinction between “knowledge” and the “processes of acquiring knowledge” might sound rather simplistic at first, but the primary purpose of this distinction is to show that the locus of knowledge production lies within social systems, as opposed to psychic systems. Moreover, when knowledge (the product of communication) and the object of knowledge (i.e., reality itself) are treated as two separately evolving entities, an observer might be faced with a question that Luhmann (1995, 484-485) articulates very succinctly: “How can one guarantee that observation maintains contact with reality when it claims to be knowledge, even scientific knowledge?” This is a question that I was indirectly hinting at in the introduction of this chapter. To Luhmann, the “real” is what “knowledge indicates is real” (480), and “observations are operations” carried out within a system (Luhmann 1991, 1437). **Thus, it is essential to recognize that self-referentiality is a “thematic asymmetry that we impose upon our reality” (Bausch 2006), and not simply “a complete duplication of whatever functions as the self at any time” (70).** This implies that what we know is not reliant upon the observation of reality or the mechanisms of consciousness, but upon the autopoiesis of knowledge, which is distinct from the act of observation (Luhmann 1990, 8).

What must be understood here is that what a system (such as that of mass media) observes aside from itself, is its external environment. It does so by distinguishing between itself and the external environment, using modes of distinction (theories, methods) that are known to it, as explained earlier. By this logic, one could conclude that the environment is not communicating any information to the system in any way (Lee 2000) aside from the irritation delivered through the modes of interpenetration or structural coupling. The final and most important theoretical consideration concerning the integrity and credibility of knowledge is best expressed in Luhmann’s (1995) own words:

“It is much easier for a theory that interprets its objects as self-referential systems to present its own self-reference. This is to be expected when the theory recognizes itself in the field of its objects as one among many others. Theoretically guided research (including that guided by a theory of self-referential systems) can be nothing other than a self-referential social system,

what's more, one among many, a subsystem of a subsystem of a subsystem of society, thus, one of very limited societal scope ... The theory of science will be able to make use, above all, of the general insight that its self-reference is sensitive to chance and conditions itself in order to create structured complexity, with the result that the system can combine a high degree of indifference regarding its environment with specific sensitivities. Self-reference and other-reference are uniquely combined here, in harmony with the theoretical concept we espouse.” (487-488)

The matter of the integrity of knowledge should therefore be reframed and understood in the context of how the integrity of social systems is maintained. The context that I provide here serves as an explanation of *how* structural couplings maintain the integrity of a social system, and by association, the integrity of the knowledge or reality that it produces. It might be useful to articulate that the popular tensions that exist between Habermasian theory and Luhmannian theory (concerning their respective views on communication) were not vital for this process of contextualization and go beyond the scope of this study.

One example of how structural couplings maintain the integrity of a social system (and the knowledge it produces) can be seen in the structural coupling that occurs through legal contracts (Harste 2016). Another example is the structural coupling that occurs between the political system and the media (Almlund 2011). Luhmannian systems theory is by no means inadequate or incapable of guiding empirical inquiries (Besio and Pronzini 2008) and could quite possibly encapsulate existing sociological analyses on the integrity of different forms of knowledge. Many other fields – communication, public health, education, public administration, organizational theory – to name a few, have utilized systems theory (Baraldi 1993; Harrington 1999; Koskinen 2009; Rodger 2012; Boccia Artieri and Gemini 2019; Steiner-Khamsi 2021), highlighting Luhmann's contributions and epistemological questions in the process.

Perhaps, it might be correct to attest to the assertion that “complicated conceptual relationships of this kind may intimidate sociologists” (Luhmann 1995, 487-488). In the next brief

section of this chapter, I describe the compatibility between Luhmann's theory of communication and Latour's ANT – a compatibility that addresses certain shortcomings of my use of ANT so far.

4. Bringing Latour and Luhmann closer together

Reconciliation between different theoretical frameworks is a process that has often led to the development of robust theoretical and empirical perspectives that have helped us understand society in a nuanced manner. The “Critical Theory of Technology” can be thought of as one example where earlier literature from STS is being reconciled with the Frankfurt School (Feenberg 2017). However, even such widely-accepted and well-known outcomes of reconciliation have been known to possess limitations – a fact that I foreground to highlight the limitations within this particular chapter. Even so, limitations can often be an asset to the evolution of theoretical frameworks overall, and it is my hope that the framework of the drone society – despite its existing limitations – will continue to evolve. My inspiration for reconciliation here comes from Nick Couldry (2008), who was possibly amongst the first to articulate that the act of attempting to “network” the system of media with actor-network theory would be a productive one that would provide a more nuanced understanding of the effects that media would have upon the social world.

I use the words “closer together” in the title of this section because there are certain distinctions in the ways by which Latour and Luhmann explain ontological realities, and in how both of them provide descriptions for the how “reality is a relational effect” (Law and Urry 2004). Actor-networks are simply “actual” assemblages of heterogeneous elements that lack the need for the stability that Luhmannian social systems require in order to come together. There are however, minor, yet complementary differences between the two. Firstly, ANT is said to be vested in the “actual”, as opposed to Luhmannian social systems, which are essentially “expectational structures” (Luhmann 1995, 292-293) that possess the ability to generate actual assemblages. Secondly, actor-networks and

assemblages are relational frameworks where “which signifiers only acquire meaning through relations with other signifiers” (Müller 2015), while Luhmann’s systems of communication rest upon the premise that “meaning is unowned” (Dunn Cavelty and Jaeger 2015) as neither the authoring system, nor a receiver in an external environment have any kind of ownership over communicated information. Arguably, this could be said to complement the kind of decentralized use of agency that ANT relies upon. Thirdly, those who attempt to bring Luhmann into the realm of relational sociology have clearly acknowledged that “Luhmann is not interested in actors, the meanings they ascribe to their actions and the historical consequences following from them” (Guy 2018a; 2018b). ANT’s actors are “radically indeterminate” (Callon 2007), while Luhmann’s systems are not – the two of them are completely different units of analyses, so their differences must be respected. This complementary difference permits for a reconciliation of the two that I shall now highlight.

Fariás (2009a; 2010; 2014) was probably the first scholar who effectively brought Luhmann and Latour closer together through a novel principle that they developed and subsequently dubbed “full symmetry”. This was arguably more effective in its simultaneous use of Latour and Luhmann than a comparative approach that provided a reconciliation between the two through conceptual convergences and divergences (Pignuoli Ocampo 2024), or the use of a *third* theoretical framework as a foundation for the two (Noe and Alroe 2006). Noe and Alroe’s (2006) use of Peirce’s general semiotics, while simplistic and elegant, was somewhat reductive in my humble opinion. On the other hand, Fariás’ principle of full symmetry complements the principle of generalized symmetry in ANT (Callon 2007), or simply, symmetry between non-human and human actors (See Chapter One). Without implying theoretical synthesis between the two theoretical frameworks, the principle of full symmetry invokes a co-productive “symmetrical account of actual assemblages and virtual processes” that accounts for frictions between the two, as well as an “insurmountable gap” (Fariás 2014). As a way of explaining the need for the principle of full symmetry through an example, Fariás discusses

how sightseeing buses create a distinct and complex touristic experience through the integration of both human and non-human elements, and how neither ANT nor Luhmann's theory of communication would be sufficient with respect to explaining its complexity. Farías' principle of full symmetry provides a thorough explanation of social phenomena by accounting for the co-production of ANT's actualism and Luhmann's virtual processes of sense-making, while also addressing many of the critiques of ANT. Farías uses the term "virtual attractor" as a less ambiguous designation for Luhmann's term "unity" (which has been described earlier in this chapter), and uses them to provide an elegant way towards comprehending the co-constitution of these virtual attractors alongside actual assemblages through two different, yet complementary kinds of data. In this sense, it would be feasible to say that the relational nature of the media can be thought of as a series of human and non-human actors in a network, as well as a black-boxed entity.

5. Mass Media and the Doubling of Reality

It would be remiss of me to not speak briefly of Jean Baudrillard (Baudrillard 1994; 2005), considering the title of this chapter (and the influence that Baudrillard had on the Wachowskis), aside from the fact that I brought up Guy Debord earlier in relation to how I had been thinking about reality and the representation of reality in the due course of analyzing my data.

First, there must be an argument: **Drone media creates its own reality.** There is empirical evidence for this, as shown in Table 1 further along in this chapter. However, I do not accept this second reality as a hyperreal substitute for reality itself – a distinction between reality and the representation of reality is crucial to my understanding of the data that I had acquired, and my analysis of it. Moreover, a certain theoretical and empirical compatibility between Luhmann and Latour has already been established in the previous section.

Secondly, a follow-up statement: **Drone media, at times, can present elements of what could be thought of as elements of a hyperreal representation.** However, these elements are often constructed and intentionally included, and I found no evidence to support the idea that there is a third order of simulation taking place where the representation of reality becomes the only reality there is. This, to me, seemed far-fetched and unnecessarily abstract – though I recognize that Baudrillard’s theories have led to the production of exceptional scholarship concerning drones, albeit in the totalizing, institutional context of the military. I do, however, wish to mention that while I enjoy reading Baudrillard’s work nonetheless, I found little utility for it in my analyses.

Thirdly, some context for what led me to think about Debord, Baudrillard and Luhmann: I’m taken back to my memory of one of the most profound incidents to have influenced my interest in drones from a social scientific viewpoint. It was at the peak of the COVID-19 pandemic that an article by Danish Siddiqui (2021) attracted a great deal of attention on social media on account of the photos it presented. The article had been written about mass cremations in New Delhi and presented a series of photos – two of which had been taken by a drone. The images challenged the government’s stance at the time – its denial of the impact that the virus had upon the people of India, the statistics it presented, and the efficacy of the measures it had been taking to protect people from the virus. Siddiqui’s photos galvanized the population of India and the Indian diaspora in a moment of collective trauma. In thinking about what the images presented, it was hard to not pay attention to what the mass media had been used to portray up until then (as a “first order” observation), and how it detracted from what Siddiqui’s photos presented. Public discourse was full of individual and collective reflections concerning the ways in which the pandemic was being reported about by the government, and why it had been the way it had been (these were “second order” observations). Reality, as presented by the mass media, had thus been “doubled”. Siddiqui’s photos, as drone media, had presented a reality of their own.

Siddiqui's photos indicated how mass media can curate a very specific version of reality (i.e., a doubled reality), and how the suppression of information can distort how reality might be represented. Clearly, the doubling of reality is a process and a phenomenon that is deeply embedded with the use of power. Topics, not opinions, as Luhmann (2000, 68) says, indicate the agency of systems as they engage in corrective actions. Think about how, in *The Matrix*, the reflexive processing of the system's own state of information can be observed in several ways, of which the most noticeable and obvious is how the matrix uses its Agents to handle any irregularities that emerge within its functioning in real time. Or how in *The Matrix Reloaded* (Wachowski and Wachowski 2003), the matrix presents the audience with the character of the "Architect" who attempts to steer Neo's actions in favor of topics that would benefit the system's existence (namely, the end of the human city of Zion and the cyclical "rebirth" of the matrix). In a similar way, Luhmann (2000) writes about how a system can connect "one operation to another in self-constructed temporal horizons, referring again and again to its own state of information, in order to be capable of discerning novelties, surprises and therefore, information values" (14).

In *The Reality of Mass Media*, Luhmann (2000) refers to the work of Heinz von Foerster, one of the most widely known theorists on cybernetics from the 20th century, for a brief description of how a system is capable of reflexively processing its own state of information. Luhmann's assertion that autopoietic systems are not exclusively biological built upon a rich history of cybernetics theory, which lay the foundation for much of the social communications theory that he developed (Brier 1996; Scott 2004). It would be sufficient to say that while systems theory and cybernetics share many similarities (such as a focus on self-organization, information processing, feedback, autopoiesis, etc.), the two bodies of work broadly focus on different aspects of systems and their applications. Luhmann's ties to cybernetics are deep and influenced by several cybernetics scholars, and this is made quite apparent by his writing in *The Reality of Mass Media*. Luhmann goes on describe mass media in the vocabulary of

his systems theory of communication, applying the principles of cybernetics in an unconventional way (Paetau 2013) to argue how it possesses the status of an autopoietic system; much like other social systems such as the economy, the legal system, the political system, etc.

I mention the ties to cybernetics because of how the key indicators of the “doubling of reality” were inspired by cybernetics theory. Here I speak of first order and second order observations, which I have briefly described earlier in this chapter. Perhaps the simplest way of understanding second-order observations would be to first differentiate between the act of second-order observing (or the act of “observing an observer who uses language”) and the process of deconstruction (Luhmann 1993). Derrida’s explanation of deconstruction relies upon unpacking internal contradictions and instabilities that are more amenable to the study of texts or concepts, where an observer could be anybody, nobody, or everybody, for that matter, as meaning depends upon the contingent identity (or identities) of the observer(s). For Luhmann, the observing system differentiates between itself and other systems, and/or itself and its own environment. The way in which a system differentiates is recursively used to reflect upon its own functioning; that is, the same distinction that a system makes between itself and its environment “re-enters” the system, thus allowing it to reflect upon its operational nature. This is paradoxical, for what is re-entering the system is at once, the “same”, and not yet “the same”, leading the observing system to possess what Luhmann has called a productive, yet paradoxical, “unity of distinction” (Luhmann 1995b). This is where the importance of a system’s *oscillator* and *memory* functions come into play:

“To cope with these consequences of a re-entry of the internal external difference in itself, the system needs and constructs time. It needs a memory function to discriminate forgetting and remembering. Its past is given as a highly selected present and, in this sense, as reality. And it needs an oscillator function to be able to switch from marked to unmarked states in all kinds of distinctions, in particular to switch from hetero-reference to self-reference and vice versa. The system will not have an unselected past, nor will it be able to follow a linear prospect into the future. Its future will never become present; it cannot be marked by true statements. The relevant distinction, therefore, will not be true/false but something like flip/flop” (Luhmann 1995c,174).

In short, Luhmann operationalizes discontinuity between the system and the environment as a useful way of distinguishing between a deconstructionist approach and the act of second-order observing. In the case of the former, the act of deconstruction becomes tantamount to viewing the dissolution of a system’s history, while in the case of the latter, a multitude of possibilities and potentialities for the future remain. If observing systems such as the mass media were being subjected to deconstruction, their complexity would simply diminish, and their history would be made to consume itself (Luhmann 1993, 780). Acknowledging them as self-observing enables access to the structured complexity of the system being observed. Moreover, doing so also allows them to acquire additional complexity.

So clearly, while it would suffice to say that first-order observations are simply observations that are presented to an external observer by a system such as Mass Media, second-order observations merit more than just a simple definition. In Table 1 below, I have provided an inexhaustive list of first order and corresponding second order observations concerning drone media. These observations were abstracted from all 29 interview transcripts, and digital ethnography that I performed over the entirety of this project, where I maintained notes on several hundred drone videos and journalistic articles pertaining to drone use in India. Each of the “categories” that I have provided in the table below could very well have an entire chapter written on them, replete with a range of ethnographic vignettes.

TABLE 1

**FIRST-ORDER OBSERVATIONS AND SECOND-ORDER OBSERVATIONS
CONCERNING DRONE MEDIA**

| CATEGORY | FIRST-ORDER OBSERVATIONS | SECOND-ORDER OBSERVATIONS |
|--------------------|---|--|
| Natural landscapes | Drones can capture the beauty of nature using a bird’s eye-view that are accessible to anyone with the ability to buy a commercial drone. | Mass Media often constructs a highly choreographed and edited vision of nature, where its value arguably lies situated in being pristine, a medium for escapism, and an idyllic, idealized realm |

| | | |
|--|--|---|
| Urban spaces | Drones offer a new way to understand, appreciate and portray urban infrastructure and architecture. They also provide document events in real-time and capture the dynamics of urban populations in novel ways. | that is ripe for exploration. Certain videos or photos might provide a viewer with a subjective experience concerning the “choice” to either view themselves as “being in” nature or having dominion over it. The accessibility of nature too, is intentionally framed that way for a multitude of reasons – some of which might reflect the agendas of the travel/tourism industry. While the media provides views of urban spaces that are often more vibrant and dynamic, they also provide a hyper-realistic and often censorious view of urban life which can dictate how the public’s perception of urban development and life in a city are shaped, often from the vantage point of a certain socioeconomic class. |
| Recreational drone use | Commercially available drones, like those sold by DJI, offer advanced features that are aimed at all kinds of drone pilots, and are portrayed as being easy to use. | The media showcases these drones as being accessible and often emphasizes on their role in democratizing the practices of aerial photography and videography. It also oversimplifies the kind of skills and knowledge that go into operating drones and promotes a superficial engagement with these complex technologies. |
| Professional drone use (Real estate, weddings) | The production of media in the real estate and wedding industries can often indicate a prioritization of spectacle over substance. Drones allow professionals to capture high-quality footage that is often used in creative/artistic shots. | Drone media blurs the lines between reality and entertainment (in the case of weddings), or reality and spectacle (in the case of real estate) – leading to constructed perceptions of real-world significance. This is because cinematic content can promote (what might be perceived as) unrealistic standards and superficiality within the production of content. The norms of producing such content are often discursively reproduced by drone pilots, who hold each other to certain standards of production. |
| FPV drone piloting | FPV drones provide a truly immersive “bird’s eye view” and allow pilots to fly in ways that other “regular” drones simply aren’t capable of. Building and customizing | The media risks glorifying risk-taking in the pursuit of precision that is often required of FPV drone pilots. At the same time, it risks promoting an elitist |

| | | |
|---------------------------------------|---|---|
| Community Engagement/Welfare projects | <p>FPV drones involving navigating technical challenges and innovative forms of problem-solving.</p> <p>Drones can be fruitfully put to use in the context of technical education, opportunities for entrepreneurship and social welfare projects by a government or a public agency.</p> | <p>subculture where a gendered meritocracy is often prioritized.</p> <p>When informed by a government in this respect, the media habitually indulges in the fetishization of drones and their framing as “technological marvels” that are meant for social good. In depicting drones like this, the media risks glossing over a multitude of issues (e.g.: accessibility in the case of the Government of India’s NaMo <i>Drone Didi</i> scheme, or any nation’s use of military drones). In cases such as that of the <i>Swamitva Yojana</i>, the media unilaterally frames the public’s perceptions, and presents little to no space for an alternative understanding of the project, such as the view that it might very well be a state-led surveillance project.</p> |
| Economic or Market Factors | <p>In countries where certain foreign drone manufacturers are banned (such as DJI in India), local compliance can be challenging for vendors/buyers, and the import of drones (or drone components) can be complex or even illegal.</p> | <p>The media’s narratives concerning these economic barriers is often tied to geopolitical tensions and protectionist policies and say little to nothing about the impact that these complex patterns of exclusion have upon local innovation and consumer choice. Nor do they reveal anything about how these exclusions make building/buying certain drones an expensive process, and how the maintenance of drones becomes equally challenging in itself.</p> |

SOURCE: Author’s own.

6. Coda

It was around six in the evening, a few days before Christmas in December of 2023, and I was sitting opposite Shomu at Third Wave Coffee near Salunke Vihar in Pune. Shomu was a filmmaker in his mid-thirties, and a co-founder at Freebird Productions, where my other interviewee Ritwik worked as well. We spoke of the ties between artists and academics, of new forms of knowledge, and of how the café we were in was promoting indigenous coffee plantations through the sales of their products.

My conversations with Shomu have always been very stimulating; as a filmmaker and a storyteller he knew how to weave narratives together where few people would be able to connect the dots. In speaking of the people that I had interviewed for this dissertation, I told Shomu about how Rushil invited me to play an alpha version of the video game *Star Citizen* on his desktop for about an hour, and how I spent nearly three or four hours with him *after* our interview had been concluded. While I thoroughly enjoyed Rushil's company, his souped-up gaming desktop, and the motorbike ride we took to go eat *pav bhaji* afterwards, I also spoke about how unexpected all of that had been for me, and how it allowed me to learn more about him. Shomu and I began to (anecdotally) speak of a crisis of loneliness amongst younger men, and technologically mediated coping mechanisms that they would often resort to. Of how one of our close friends had had resorted to using gaming as coping mechanism during a bad breakup, or how many others we knew would use Reddit or Discord to seek out a community.

As we swiveled back onto the topic of drones and representations of reality, we spoke of the utility of the knowledge and the insights that I was trying to produce. What Shomu said next really stuck with me. “Kafka *tob sab ne padha hai bro* (Everyone has read Kafka, bro), what really matters is this - what can you do with that knowledge? How will it help people?” Kafka here was being used as a reference to the abstract work of certain academics and the cryptic tomes that they would produce. Shomu valued tangibility and wished for me to communicate something utilitarian to him. If there was a response that I could give him now, particular with respect to this chapter, it would simply be that my analysis sheds some light upon the relational characteristics that exist between social structure (in a Durkheimian sense), and the forms of knowledge that are present within the drone society. However, as Table 1 in this chapter indicates, I have barely scratched the surface here. As social/communicative systems evolve, so would the psychic system of the individual. And through its descriptions of reality, mass media displaces many other realities (which might have been convincingly

argued for) with a “doubled” reality of its own (Luhmann 2000, 85), thus influencing public discourse and the perception of the individual. This is not to say that the mass media has a monopoly over the representation of reality, but that it affects the conditions under which individuals and social systems are structurally coupled with each other (115-116). For some people, there is no spoon, but for many others, the spoon is the only reality that conveys meaning.

Perhaps this is where it is best to depart from systems theory and return to an understanding of the drone society through the broader lens of ANT. As I thought upon the mediated nature of reality, my memory takes me back to my thoughts about non-human actors and the way in which the Røde microphone I had been using for my fieldwork simply broke and stopped working. As a crucial participant in the network, it had been responsible for the production and analysis of my data, aside from being an entity that enabled and shaped communication. I had to borrow a smaller microphone from Shomu instead, who had a fair amount of spare gear at hand at Freebird Productions’ office. “Just one piece of advice bro - don’t change your gear during your project unless it breaks down”, he said to me as he handed me the mic. “Stick with the system that’s working for you. *Ye apna husool hai* (This is our/my rule).”

Concluding Remarks

“The principal end and design of writing or publishing, should be to convey down some useful knowledge to the rest of mankind, since it is what we are indebted, to communicate our talents, in return for those helps we have received from others.”

- Henry Beighton (1741)

At the outset, there is one crucial remark that I would like to make that concerns the ties between military drones and civilian drones within the drone society. Many scholars have their own takes on what connect the two, but what my findings tell me is that **drones are vehicles of precarity**, and that its nature as a vehicle of precarity can be observed in both militaristic and civilian contexts. Drone technology is unquestionably an inseparable part of myriad precarious futures (Stephens, Sellberg, and Donaghy 2020), not just the economic ones I have spoken of. I shall elaborate upon this with an example.

During the time that I been writing this dissertation, the ongoing genocide of Palestinian people has simultaneously been taking place. My use of the platform Snapchat allowed me to observe ephemeral, publicly posted photos/videos from Gaza on Snapchat’s “Snap map”. Three themes were common among the small sample of photos and videos that I observed: Media featuring pleas for help and assistance, snippets from the lives of displaced Palestinians and their camps, and citizen journalism. Among the latter two themes, I occasionally witnessed images of small Israeli quadcopters that had been taken from the ground (by Palestinian people). Days later, I came across articles from multiple global news outlets stating that the Israeli military had been luring Palestinians out of hiding using drones that used audio systems to play sounds of crying infants. While certain news sources debated upon the veracity of these claims, a recent report by the Euro-Mediterranean Human Rights Monitor (2024) stated the following:

Israel’s army has increased its use of electronic-controlled quadcopters—which were previously restricted to use for intelligence purposes—for killing and injuring Palestinians. The Israeli army has escalated its premeditated murders, extrajudicial executions, and judicial

killings against Palestinian civilians through direct targeting with snipers and drones in various regions of the Gaza Strip, in addition to aerial and artillery bombardment of residential areas, Euro-Med Monitor said...According to the rights organisation, Israeli sniping operations, killings, and executions primarily target unarmed civilians in shelter centres, hospitals, streets, and populated residential areas; these civilians pose no threat or danger to anyone, as they are not participants in any hostilities...Based on investigations conducted by Euro-Med Monitor, the Israeli army is using small killer drones fitted with machine guns and missiles from the Matrice 600 and LANIUS categories, which are highly mobile and versatile, i.e. ideal for short-term operations. Their systems can automatically search buildings and create maps to identify possible targets; carry lethal or non-lethal payloads; and carry out a variety of missions for military personnel and special forces...These drones have killed dozens of civilians, confirmed Euro-Med Monitor, by firing automatic machine guns mounted beneath the aircraft at random gatherings or by shooting directly at people. (Euro-Med Human Rights Monitor 2024)

The report and the media that I had come across on Snapchat compelled me to think about all the ways in which drones make peoples' lives vulnerable and precarious to state power and the military-industrial complex. If I were to shift my attention to the Swamitva Yojana (see Chapters 1 and 3), I would quite certainly find it feasible to hypothesize about the project as the biggest state-funded rural surveillance program that the world has ever seen. This might seem like a misleading oversimplification of the program given its numerous objectives, but the potential for the misuse of the program's data cannot simply be dismissed. Take, for example, how as of July 2024, there are no sociological critiques of the data offered by the "Gram Manchitra", a spatial planning application, which is in the process of being enhanced with drone maps and other spatial data acquired through the Swamitva scheme. In my view, the scheme could easily be situated within discourse concerning data privacy and the "anxieties of recognition" (Singh 2021), much in the way that the Indian Government's infamous Aadhaar project had been.

There is certainly a history to this form of cartographic control; let us not forget that the Great Trigonometrical Survey of India (GTSI) had numerous consequences for the people of the Indian subcontinent during the times of colonial rule. With its emphasis on a fetishistic level of precision, the GTSI acted as a tool for the imperialistic control of the English East India Company (Lorenzo and Vieracker 2014). What agency, in that case, would a program like the Swamitva scheme present the

State with in the face of democratic backsliding in the world’s biggest democracy? If the data from the GTSI could embody sociocultural values (Sarkar 2012) through the use of technologies and techniques that would be considered primitive today, the ethical dimensions, inclusivity, technical vulnerabilities and the political economy of the Swamitva scheme deserve far more scrutiny. Merely stating that it is “unlocking rural potential” (Mehta, Santhanam, and Kaushik 2023) is a reductionist statement that would arguably only serve certain neoliberal interests. In the face of the lack of transparency and complexity presented by large scale national projects such as Swamitva, there is a need to reminded of how the roots of the modern land survey seemed to have prioritized the principles of accountability, transparency and public good above all. Here I quote a short passage from the dedicatory epistle of William Leybourn’s book, *The Compleat Surveyor*, addressed to Sir Edmund Wingate, known for his extensive work in mathematics:

This treatise being finished, and ready to see the light, I could not bethink my selfe of a fitter Patron then your self to protect it. Your knowledge in, and affection to the Sciences Mathematical, as also the civil respect you usually vouchsafe such as affect those studies, arm me with this confidence. I foresee that this my presumption in exposing this Work to publike view, may meet with some detractors, but Your approbation thereof, will both convince them of their Errour, and plentifully satisfie me for the pains I have taken therein. Howbeit, what reception soever it may obtain with the Vulgar, my intention (I doubt not) will give me support and encouragement, my aime therein being nothing else but the publike good, and this my Dedication an evidence to let You know how much I am. (Leybourn 1657)

In refocusing upon the nature of the drone as a vehicle of precarity, it must also be said that **the drone is capable of extending precarity onto all who use it or fall within its gaze**. The drone-worker, the DAAS company, and the recreational drone pilot are all exposed to different (and often overlapping) forms of precarity as this dissertation has depicted. At the same time, when viewed through the lens of “drones for good” projects – that is, humanitarian projects, environmental protection or wildlife conservation projects (Levush 2015) – it can be said that **drones can potentially minimize certain forms of precariousness as well**. There are, however, some sources of precarity that I have not yet had the opportunity to examine in detail for this dissertation, such as those imposed

through the convergence of drone technology and artificial intelligence (Wilcox 2017b; Del Casino Jr. et al. 2020; Csernatonni and Lavallée 2020; Srivastava 2023), though it would be worth mentioning that this project with more concerned with such convergences in civilian contexts.

Moving forward, I firmly believe that the field of drone studies must invest more deeply in its examination of the precarity that drones impose upon our lives, regardless of the “use case” that they are being situated within. I shall now pivot towards providing a more structured series of remarks for the conclusion of this dissertation, beginning with brief responses to all its research questions, a section on the nature of its inquiries, an overview of its limitations, and finally, comments on the implications of this study for future work in academia, industry and public policy. For the drone society, the employers of drone technology, the burgeoning field of drone studies, and future directions for this study of mine, I quote an even older text on the art of surveying in the interest of guiding all the work that lies ahead: “Quia facilius est addere quam de novo facere. That is for to saye / It is lighter to adde / refourme / or correcte / thanne for to make newe and perfyte.” (Fitzherbert 1523).

1. A brief series of conclusions

In this section, I shall provide brief responses to each of the research questions that I produced in the introduction. To begin with, there is the matter of providing a response to my first research question – What is the drone society? I’ve come to conclude that it much more than a metaphor as I’d originally posited. The concept of the drone society is multi-faceted; as a dynamic and emergent network, it represents multiple concurrent interactions between humans, drones, algorithms, sociopolitical structures of governance and other human and non-human actors. The drone society is consistently constructed through these interactions, as ANT suggests, with drones acting as extensions of human agency within technonatural environments. Against the backdrop of “drone capitalism”,

the drone society exposes civilian drone operators to new forms of precarity and unstable working conditions that are not very different from those present in the gig economy. Furthermore, human-drone interactions influence broader societal norms, notions of deviance, regulations, laws, policies and even tangible forms of culture.

My second research question concerned the process of “becoming” a recreational or professional drone pilot within a civilian context. The analysis of all the data I came to possess taught me that the process often involves a blend of formal and/or informal elements of learning, ample amounts of practical experience, and consistent community engagement. There is no linear pathway towards becoming a recreational or professional drone pilot, just as there isn’t any real template for becoming either or both. Sociotechnical negotiations, however, are a key component within this process, as aspiring drone pilots are required to balance legal requirements with community norms, ethical considerations, the use of economic resources at their disposal, and the acquisition of technical mastery. Pilots often have opportunities to participate in formal and informal networks where they get to share their know-how, seek advice from their peers, and even collaborate on different kinds of projects. Some of these networks could be local or regional groups, or massive national/global forums, but they all seem to serve a similar function: that of providing drone pilots with the support they’d need to sustain their aerial pursuits as well as contribute to the collective advancement of their hobby’s/profession’s practices.

The third research question for this dissertation concerned the nature of work within the drone society, which I found to be characterized by technological innovation, regulatory conformance (which often varies a lot across different regions) and economic uncertainty. Many civilian drone pilots simply don’t have access to a steady income, and with the understanding that the drone society can function as a complex predatory formation, it is often the case that their expertise and tacit knowledge is undervalued by their clients and/or employers. The actions of the drone and the work of the pilot

are not just functional in the context of getting a unit of work done, but symbolic of larger societal trends – the emergence of human-drone agency, algorithmic mediation, the creation of new bureaucratic infrastructures, and the formation of novel collectives and collective endeavors. The drone society challenges traditional notions of work, leisure, and community, signifying a shift towards a technonatural future where these digital ecologies reshape human experiences, natural environments, processes of labor and social structures (Searle et al. 2023).

The fourth research question mostly concerned the emergence of novel forms of precarity. In addition to economic precarity, regulatory precarity and technological forms of precarity (which I traced using the need for drone insurance and the need for repair-work as markers of precarity), I used market competition to eke out “identity precarity” as a novel form of precarity that concerns drone-work. In short, Identity precarity can be understood as an association between the professional identity as a drone pilot and market performance, which can often be volatile due to several intrinsic and extrinsic factors. Identity precarity often pushes professional drone pilots to continually differentiate their services within sectors of the drone industry that are often saturated with competing service providers. This involves having to continually manage the expectations of clients and invest significantly in personal branding efforts, often to the extent that it could lead drone pilots to compromise on their professional integrity and engage in acts of deviance.

This dissertation’s fifth research question pivoted onto how systems of mass media process and instrumentalize drone media. Using Niklas Luhmann’s Systems Theory of Communication, I concluded that drone media is often used to create compelling and immersive content that can heighten an audience’s emotional engagement and create a sense of immediacy and presence, particularly within the contexts of news reporting, sports, tourism, entertainment and many other industries. Drone media serves specific narratives and agendas, and often outdoes traditional photography and videography by offering angles that can blur the lines between the nature of reality

and the consumption of a spectacle. Through the careful selection, editing and curation of events and/or locations, drone media presents audiences with hyperreal representations of reality, which in turn shapes their perceptions and arguably reinforces various power structures and governmental/commercial interests. The second-order observer analyzes how each stakeholder's respective values, priorities, and biases play a role in shaping first-order observations. They might also explore the distinctions each stakeholder makes, such as "security vs. privacy" or "innovation vs. intrusion" and the ways in which these distinctions influence rhetoric and decisions concerning public policy.

Lastly, with respect to the sixth and final research question, it can be said that drone media bears a significant influence on perceptions of both built and natural environments. The "aerial view" of the drone can either amplify or obscure certain aspects of built environments, and consequently change how these spaces are understood, used and valued. It can often affect the dynamics of urban planning and development and minimize certain socially relevant considerations, thus reflecting the designs of broader socioeconomic or cultural agendas. The same thing can often happen in the case of natural environments as well, leading to superficial engagements with natural environments (or ideas/expectations of natural environments, more specifically). Indeed, if the realities of the needs of ecological conservation and environmental degradation were to be overlooked in the face of such superficial engagements, there could be very serious consequences.

Where then, is the field of drone studies left with knowledge concerning the emergent nature of drone culture? To put it briefly, it can be said that emergent civilian drone culture reshapes social norms, the nature of labor and cultural production against a backdrop of technological innovation, precarity, and evolving regulatory frameworks. At the same time, civilian drone culture possesses the potential to foster a sense of community among drone pilots who navigate complex sociotechnical

landscapes, but it also constructs dual realities that influence public perception and reinforce existing power structures.

2. On the nature of this dissertation's inquiries

The framework of the drone society emphasizes on a complex, multidimensional analysis of “flat” relational networks. Moreover, it might be somewhat obvious to you, the reader, by now, but my focus on the inherent precarity that marks the existence of civilian drone workers highlights this study as an inquiry concerning social inequality. My approach to the examination of social inequality is propelled by two driving factors that emerge from the field of STS; cultural exchange between academia and industry on one hand, and epistemic modernization that occurs at the intersection of state and industrial power on the other. I shall speak of these in greater detail to highlight the nature of this dissertation's inquiry, and the many ties between the disciplines of Sociology and STS on one hand, and the field of drone studies on the other.

To begin with, I shall provide some historical context. There have been clear, noticeable differences in how social inequalities have been focused upon within STS when comparing the wealth of literature produced by the field before and after globalization bore an impact on it towards the end of the 20th century. Take for example, the fact that it wasn't until the second edition of the “Handbook of STS” was published that gender began to receive substantial attention from the field (Hess et al. 2017). Most of this attention was directed towards analyses of how gender lent itself to various political and epistemological endeavors (Harding 1986; Haraway 1988), and it was only in the third edition of the handbook of STS that gender truly and definitively began to intersect with the study of social inequalities. Pre-1990s STS literature rarely overlapped with class or race in the context of social inequalities; a major reason might have been the underrepresentation of BIPOC scholars within the “STSverse” (Hess et al. 2017, 321-322).

Globalization played a major role in altering these dynamics, as scholars from the global south began to participate in these conversations and present alternative, postcolonial viewpoints on matters that were centered around the discussion of enduring social inequalities. This is where a greater degree of assimilation between the axes of race, class, gender, and greater representation for the global south occurred, and differences before and after the impact of globalization became noticeable. Naturally, the demarcations between these two periods are not firmly articulated or set in stone in any way, given that globalization is a process that simply cannot be attributed to one or two historical events. The shift from examining race, class, and gender as components of discursive formations in STS to situating them at the locus of critiques of state/industrial/transnational assemblages of power was a progressive one. It involved changes and innovations in methodological approaches, the emergence of perspectives from the global south, and the destabilization of hegemonic controls that had been instated by the domains of academia, centralized governance, and national/transnational businesses.

To get an idea of what the entanglements between social inequalities and STS were like before globalization, it would be prudent to think about Winner's (1980) examination of how technological artefacts are imbued with a certain "politics" of their own. In one of the two cases provided by Winner in his paper, Robert Moses' historical "low bridges" on Long Island, New York are portrayed as "technological arrangements" that are akin to a "form of social order" (123-124). As spatial markers of inequality, these bridges were characterized by Moses' perspectives on race and class, his political leanings, and affiliations. The "low bridges" were infamous on account of how they denied marginalized and underprivileged sections of population any kind of access to Moses' parkways, and were a symbol of segregation, elitism, and authoritarianism. Indeed, as Winner puts it, "Many of his monumental structures of concrete and steel embody a systematic social inequality, a way of engineering relationships among people that, after a time, becomes just another part of the landscape" (124). Winner's example of Moses' low bridges, however, is a deceptively simplistic one, considering

that the technology of a bridge is not at all complex like that of a black-boxed computer algorithm (Woolgar and Cooper 1999). For Winner, complex theorizing was never really at the heart of the low bridges case study. This was also reflected in the way that he fleetingly spoke of non-white populations and low-income groups. Winner's paper concerned itself with a departure from the minutiae of the low bridges, and the actual reality of how much traffic moved on them. By focusing on Moses' intentions instead, Winner highlighted his attention towards questions of morality and the impact of Moses' political choices. Such applications of technological determinism were not grounded in the lived realities of marginalized and unprivileged populations, and rarely ever built upon the lived experiences of individuals from those communities.

The paper by Winner was significant on account of how it provided a basis for the deeper examination of technological determinism, and its eventual development as a "theory of society" (MacKenzie and Wajcman 1999). Influenced by Ulrich Beck's (1992) theory of "reflexive modernization", Latour's ANT, Kuhnian STS and post-Kuhnian theories of ecofeminism and feminist technoscience, MacKenzie and Wajcman's (1999, 6) work on technological determinism presented certain characteristics of recursiveness that resonated with the production, reproduction, and maintenance of social inequalities. By positing "technology as a precondition of new technology" (12) and discussing the "social shaping of technology" (28) as a prominent social force, MacKenzie and Wajcman paved the way for a thicker sociomaterial assessment of race, gender, and socioeconomic status within a globalized world (Hutchby 2001; Shilling 2004; Sassen 2008; Arthur 2009; Hicks 2010; Orlikowski 2010; Couldry and Hepp 2018).

In the mid-2000s another prominent modality and approach towards the study of social inequalities emerged through the "New Political Sociology of Science", or NPSS (Frickel and Moore 2006), which essentially "drew explicit attention to the role of science in concentrating power and reproducing inequality within existing institutions", and "highlighted the political relations between

science and other major social institutions” (Hess et al. 2017, 325). NPSS developed a range of approaches for studying social inequalities. These approaches included rigorous inquiries into the consequences of commercializing scientific activity, dissections of the associations between scientific projects and activism, and examinations of the relationships between science and governance with a particular emphasis on the effects of neoliberal policies (Moore et al. 2011). An assessment of the ties between science and religion (O’Brien and Noy 2015; Noy and O’Brien 2018; O’Brien and Noy 2020) also had a clear impact on the understanding of various kinds of social inequalities. By positing such relationships as significant drivers for changes within science (Catto et al. 2019), civil society, and institutions of business and governance, scholars within the tradition of NPSS elicited a nuanced understanding of many kinds of social inequalities. Examples of this would include a deeper comprehension of the inconsistencies within socioeconomic development (Zinda and Zhang 2018; Kozlowski 2021), the politics of group formation (Edgell et al. 2020), identity politics (Wedow et al. 2017; Schnabel 2018), and systemic racial inequality (Ecklund, Mehta, and Bolger 2019; Baker et al. 2020) to name a few. In short, NPSS drew upon the assessments furnished by political sociology, the study of social movements, religions, and organizations to break down the hegemonies of the “market” and the “nation-state” (Moore et al. 2011). Its inclusion of civil society is arguably its most important dimension, as it introduces (and continues to introduce) contesting politics and perspectives that are a by-product of the impact of neoliberal policies and lived experiences from across an entire spectrum of social inequalities.

In another vein of thought, the relationship between technology/science and social practices (Cowan 1983), provides yet another intersectional, STS-centric approach to social inequalities. Cowan’s work foregrounded industrialization, modernization and the middle-class in an age where technological advancement was meant to make lives easier (3). Their development of the “work process” as an analytic concept (11) spurred several interventions in the application of feminist STS

theory and its use of technological artefacts, the study of performativity, and theory focused on product design (Engelen-Eigles 1991; Wagman and Parks 2021). Consequently, these interventions resulted in conversations on power and power relations (Light 1995), the division of labor within domestic settings (Bardzell et al. 2011; Silvis 2019), and practices characterized by the rural-urban divide (Brinkman 2017) to name a few. The focus on “studying up” further strengthened the notion that technology/science and society are co-constructed (Wajcman 2002), whilst also highlighting the latent potential that artefacts possessed to manipulate and shape the fabric of the social itself. However, the practice of “studying up” was not without its share of politics, problems, and limitations (Barabas et al. 2020). In a globalized world, these problems became even more pronounced, but there was hope for potentially addressing them through the recruitment of a diverse range of theoretical perspective from the global south.

Depending on how technoscientific practices and concerns pertaining to sociomateriality have been approached, the need to study social inequalities through a multi-sited and “comparative, global, and transnational methodology” (Hess et al. 2017, 329) has become one of paramount importance. Taking this need into account, STSers have made forays into the asymmetries presented by differing geographies and publics, particularly those from the global south. This has resulted in a decentering of the worries and interests of transnational corporations, and a deeper, more vested interest in populations that have been historically situated at the margins of both, research, and society. Here, I am referring to the subjects of queer, feminist, and postcolonial STS, which I spoke of in the Introductory section of this dissertation. The “superpositionality” of the researcher, i.e., the “multiple, hierarchical, situation-dependent status positions of the ethnographer in relation to his or her interlocutors in a field site” (Williams 2018) has all kinds of impacts on multi-sited research, and especially when it concerns the study of power differentials and the utilization of a reflexive methodology (218-219).

While it goes beyond the scope of this response to explore these impacts in greater detail, there are two drivers of change in contemporary STS research that must be noted in relation to the study of social inequalities and this dissertation's approach to drone studies.

The first driver is the hybridity that now characterizes the ecosystem within which knowledge transfers and cultural exchanges between academia and industry take place. This facet of hybridity has enabled the growth of the public academic, scholar-activism (Hess 2015), the steady transformation of social inequalities (Hess et al. 2017) and is the result of an “asymmetric convergence” (333) between academia and industry. The fluidity of the exchanges made within this ecosystem are particularly noticeable in research that concerns the innovations being made in science and technology (Amrute 2020; Vallas and Schor 2020), and the inequalities that are either exacerbated or produced on account of them (Conner 2019; Mohamed, Png, and Isaac 2020).

The second driver has been conceived of as “epistemic modernization” and emerges through a focus on “state and industrial power” in a way that methods and inquiries are sensitized to the overwhelming needs of historically vulnerable and exploited publics (Hess et al. 2017, 333). To quote Hess:

The epistemic modernization of the scientific field and its relations to other social fields creates openings for social movements that have mounted challenges to political and economic elites. STS research on social movements and mobilized publics has resulted in a range of new concepts and insights of use to STS scholars interested in inequality (Hess et al. 2017, 334).

Some examples of the study of social inequalities and vulnerable publics through the lens of the epistemic modernization can be seen in the work of Kowal (2013), Campbell and Stark (2015), and Navon and Eyal (2016), though they do not explicitly focus on social movements. A more thorough review of the intersection between STS and social movement literature can be found in Breyman et al. (2017).

In summary, STS' approach to the study of social inequalities is certainly acquiring intersectional characteristics that are disrupting the boundaries maintained by industrial, transnational

and state-led assemblages of power. Reflexive methodologies and intellectual traditions within STS continue to evolve alongside technological innovations and novel practices in the sciences, and knowledge-work can be seen assimilating the complexities and contributions put forth by social movements, colonial histories, and the relationships that science and technology have with race, gender, religion, sexuality, ethnicity, and socioeconomic status, amongst others. It is primarily the nature of these relationships that have inspired the inquiries of my dissertation, and it is my hope that they are more deeply situated within the field of drone studies in the years ahead.

3. The limitations of this study

This dissertation has proven to be an exercise in the use of the sociological imagination (Mills 2000[1959]), as well as an exercise in the application of abductive analysis. An attempt to create new theoretical frameworks as a postmodernist project, not grand theory as a modernist study, and an attempt to work on the nature of empirical puzzles using “surprising findings”. I believe I’ve succeeded in the sense that I now know how much work lies ahead of me in the context of turning this dissertation into a palatable book that would appeal to a broader audience than that of academics alone. And as a first step towards that book project, I believe that there are several broad limitations of this dissertation that must be acknowledged.

To begin with, I was limited by the number of interviews that I have taken for this project, as well as the demographics that I have interviewed. When combined with the fact that I exclusively interviewed people who lived in India, the process of building the concept of a drone society is challenged extensively. And while I tried to supplement my data with ethnographic insights from online communities that were more global, I believe that this project would’ve benefited extensively from me having interviewed people from other geographies. I cannot claim to capture all the essential aspects of civilian drone culture on a global scale, though I have certainly presented a strong case for

a few of its characteristics. It is certainly possible that a comprehensive survey instrument and quantitative analysis might capture certain aspects of drone culture that have been missed within this dissertation.

Secondly, as this study has indicated, drone policies are changing rapidly in different parts of the world. At the time that I'm writing this conclusion in July 2024, the United States is moving closer to banning the sale of Chinese drones in its consumer markets through the "Countering CCP Drones Act" (Russell 2024), as the associated bill has already been reported to the House of Representatives (Stefanik 2024). Moreover, the FAA's "Remote ID" rule has now come into effect (Federal Aviation Administration 2024), bringing a new layer of bureaucratic governance into the professional and recreational use of civilian drone use in the United States. These are changes that have occurred in the past year alone.

Thirdly, as I have mostly interviewed drone pilots who are either hobbyists, professionals who work as freelancers or employees of DAAS companies, and a few who are community leaders/managers, there is the issue of limited access to stakeholders. I did not have access to representatives of the DGCA or the Government of India, nor did I have any access to individuals working for the FAA or the Interagency Committee for Aviation Policy (ICAP) in the United States. The perspectives of these stakeholders, additional minorities within the drone society, and additional members of the public might have provided additional information for consideration.

Finally, as my writing concerning the Swamitva scheme and other policy issues concerning the ban of Chinese drones in India and the United States would highlight, there is a lot more to be said about the nature of privacy and surveillance in the drone society and the impact of xenophobia, particularly when viewed from the vantage points that policy and governance have to offer. Moreover, much of what I have given due consideration to this dissertation as a work within the field of drone studies is informed by the disciplines of Sociology and STS. There is a lot more interdisciplinary

and/or transdisciplinary work that needs to be done. Theorizing for an entire sub-discipline or a new area of study is a monumental task, and what came to my mind most often was the article written by Kieran Healy (2017) regarding how nuance is a “bad virtue of good sociological theory”. I thoroughly support Healy’s ideas of “nuance traps”; my project carries with it the intention of assisting the productive growth of social theory, despite the odds presented by unproductive, disciplinary “blocking”. In studies such as this one (and much in line with the abductive approach), theory and empiricism serve to provoke each other in a cyclical and inter-dependent manner.

4. Implications for work that lies ahead (within academia, industry and public policy)

Arguably, the interdisciplinary nature of drone studies is such that any developments would ideally concern the academy, industry and public policy at the same time. Many more inquiries are needed to investigate the nature of precarious drone-work, and the effects of policy and/or technological innovation on precarious drone-work.

Drone media too, deserves more scrutiny for what it offers at face-value, and the politics of its representation must not go unnoticed. Think about how, during the COVID-19 pandemic, hundreds, if not thousands, of dystopian videos of empty cities in lockdown emerged on social media platforms and other websites like YouTube and Vimeo each day. Most of these videos had been shot and edited by civilian drone operators, who seemed to possess a disembodied form of mobility across the built and natural environments of urban landscapes. Often backed by melancholic background music, these videos actively reminded people of how they weren’t getting to see their cities or neighborhoods for weeks at end. It became obvious from the comments on these videos that people were reacting to them in many ways. Some drew hope from them as they prayed for normalcy, while others despaired, or simply marveled at how beautiful these cities looked in the absence of human activity. The “pandemic drone” (Hildebrand and Sodero 2021) created a visual archive of a very

specific collective experience, and in doing so, it brought the genre of drone videos into the mainstream that wove social, natural and semiotic elements together. Such forms of cultural production are possibly indicative of a fundamental transformation within the nature of modernity itself.

I'll elaborate upon this a bit by referring to the work of Ulrich Beck, whose work has deeply influenced me over my time as a graduate student. The "first modernity", in the words of Ulrich Beck (1992) marked a period when societies centered around nation-states, and social connections were mainly territorial. The institutions and principles of the first modernity, such as nation-states, Fordist corporations, and welfare states, depended on well-defined distinctions between categories of individuals, objects, and activities (Beck and Lau 2005). However, due to factors like globalization, individualization, and global risks, the first modernity was superseded by "second modernity" (or what Beck had originally called "reflexive modernity"). In the second modernity, the aforementioned distinct boundaries become fuzzy, and the "either/or" approach is replaced by the pluralist logic of the "both/and" principle. This change posed challenges for decision-making within the social institutions of the first modernity. As categorical borders grew less defined, there was a need to establish new methods of drawing boundaries, but conventional scientific resources were no longer adequate for making clear-cut decisions. The concept of reflexive modernization posited that the process of modernization itself disturbs the institutional structures within the first modernity by casting doubt on its rationality. Habermas (2005), much like Beck and Lau (2005), suggested acknowledging an internal discontinuity between first and second modernity, in which a certain continuity of the first modernity's principles is known and acknowledged, but the emergence of reflexive modernization altered the operational nature of social institutions.

So, what does this mean for the relationship between the concept of the drone society, and our understanding of modernity in the contemporary moment? What else will the activity of network-

tracing lead scholars and policy-makers to? Contemporary biopolitical and necropolitical ontologies fall short in their abilities to describe the experience of “non-human sensing” (Agostinho, Maurer, and Veel 2020), and any associated forms of cultural production that blur the lines between people, nature and technology (Wilcox 2017a). Here I refer to the need of better understanding the agential presence of an “algorithmic modernization” here, which encapsulates the increasing role of algorithms, artificial intelligence, and other digital technologies in shaping the way societies operate, make decisions, and solve problems. The term could also be used to refer to the presence of black-boxed algorithmic risks (Cotter and Reisdorf 2020, Ulbricht and Yeung 2022, Kappeler et al. 2023), which I believe to have directly and indirectly described through the lens of second-order observations of drone media in Chapter Three of this dissertation. Clearly, cultural consumption and production within the Drone Society are inextricably linked with the concerns made known by algorithmic modernization and the production of knowledge about the environment, but a lot of work remains to be done beyond the domains that this dissertation has investigated.

Additionally, drone studies is a field where there is clearly a lot of potential for methodological innovation that involves the direct use of drones themselves. Hildebrand’s use of drones for “autotechnography” (Hildebrand 2020b) is merely the tip of the iceberg, and more “technical” drone studies rooted in the sciences have arguably been more creative in their use of drones for research than their social scientific counterparts.

My dissertation also highlights the need to expand upon the ethical dimensions of civilian drone use, the digital divide in access to commercial drone technology, and many other dimensions of the sociocultural impacts of drone technology. Future research might benefit from focusing on additional aspects of gender, race, caste and class that I have not addressed (or fully addressed). There is also a need for industries to address the working conditions of drone workers and conceptualize what job security and professional development within this space should look like. Finally, public

policies need to be mindful about accidentally amplifying existing social disparities; programs such as *Drone Didi* merit additional scrutiny in terms of their efficacy.

5. Some Final Thoughts

When I began this project, I imagined that I would have the time to have to acquire a Part 107 certification within the United States, as well as a DGCA RPC in India. Neither of the two happened, and I believe that the two experiences would have added yet another layer of nuance to my insights on “becoming” and “being” a drone pilot, or “producing as” a drone pilot, or “consuming as” one. Two things might happen as I move forward with additional projects that build upon this one (including the impending book project that would be based off this dissertation): Firstly, even though I do fly drones and consider myself a drone pilot, I’ll possibly have more access to drone communities as more of an “insider” in India and the US if I get myself an RPC and a Part 107 certificate respectively. The implications of that level of ethnographic access remain to be seen. Secondly, being a certified pilot in both geographies (and perhaps even others) might change the nature of my work on drones from being just a meta-activist project by adding the dimension of it being an experiment in participation.

On that note, I must address my positionality and privilege in relation to this project a bit more extensively. My identity as a cis-het, middle-class, upper caste, able-bodied bilingual North Indian male with a Hindu name unquestionably made many of my participants more accessible to me, as did the fact that I had grown up all over India. My education too, proved to be an asset, given that many of my interviewees viewed my institutional affiliation very favorably. I believe that my age (as that of a 32-33 year old during the time of my fieldwork) was also crucial – I was neither too young to not be taken seriously as a researcher by many of my interviewees, nor was I too old to be thought of as being “out of touch” with drone culture. Age, gender, caste, socioeconomic class and religion were

all important factors where my access to data in India was concerned. These dimensions of my identity also brought me to think of my findings from the use of digital ethnography in ways that drew comparisons between my ethnic/cultural background, and those of the people I observed in various online communities across the world.

Finally, on a closing note, I just wish to acknowledge that professional drone-work isn't easy at all, and that it rests upon a convergence of many kinds of technical and non-technical skills and bodies of knowledge. It befits all drone studies scholars to recognize this and pay more attention to the myriad forms of precarity that professional drone pilots are consistently exposed to. This dissertation is for drone-workers across the world, and for the indomitable spirit that they collectively bring to the labor force, in the hope that public policy and infrastructure can evolve and support them better someday.

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