Imperfect Images

OUR eyes are fleshy things, and for most of human history our visual culture has also been made of fleshy things. We no longer look at images—images look at us. They no longer simply represent things, but actively intervene in the everyday life. We must begin to understand these changes if we are to challenge the exceptional forms of power flowing through the invisible visual culture that we find ourselves enmeshed within.

The history of images is a history of pigments and dyes, oils, acrylics, silver nitrate and gelatin—materials that one could use to paint a cave, a church, or a canvas. One could use them to make a photograph, or to print pictures on the pages of a magazine. The advent of screen-based media in the latter half of the 20th century wasn't so different: cathode ray tubes and liquid crystal displays emitted light at frequencies our eyes perceive as color, and densities we perceive as shape. We've gotten pretty good at understanding the vagaries of human vision; the serpentine ways in which images infiltrate and influence culture, the means by which they're harnessed to serve—and resist—power.

The theoretical concepts we use to analyze classical visual culture are robust: representation, meaning, spectacle, semiosis, mimesis, and all the rest. For centuries these concepts have helped us to navigate the workings of classical visual culture. But over the last decade or so, something dramatic has happened. Visual culture has changed form. It has become detached from human eyes and has largely become invisible. Human visual culture has become a special case of vision, an exception to the rule. The overwhelming majority of images are now made by machines for other machines, with humans rarely in the loop. The advent of machine-to-machine seeing has been barely noticed at large, and poorly understood by those of us who've begun to notice the tectonic shift invisibly taking place before our very eye.

The landscape of invisible images and machine vision is becoming evermore active. Its continued expansion is starting to have profound effects on human life, eclipsing even the rise of mass culture in the mid 20th century. Images have begun to intervene in everyday life, their functions changing from representation and mediation, to activations, operations, and enforcement. Invisible images are actively watching us, poking and prodding, guiding our movements, inflicting pain and inducing pleasure. But all of this is hard to see. Cultural theorists have long suspected there was something different about digital images than the visual media of yesteryear but have had trouble putting their finger on it. In the 1990s, for example, there was much to do about the fact that digital images lack an "original." More recently, the proliferation of images on social media and its implications for inter-subjectivity has been a topic of much discussion among cultural theorists and critics. But these concerns still fail to articulate exactly what's at stake.

One problem is that these concerns still assume that humans are looking at images, and that the relationship between human viewers and images is the most important moment to analyse—but it's exactly this assumption of a human subject that I want to question. What's truly revolutionary about the advent of digital images is the fact that they are fundamentally machine-readable: they can only be seen by humans in special circumstances and for short periods of time.

A photograph shot on a phone creates a machine-readable file that does not reflect light in such a way as to be perceptible to a human eye. A secondary application, like a software-based photo viewer paired with a liquid crystal display and backlight may create something that a human can look at, but the image only appears to human eyes temporarily before reverting back to its immaterial machine form when the phone is put away or the display is turned off. However, the image doesn't need to be turned into human-readable form in order for a machine to do something with it. This is fundamentally different than a roll of undeveloped film. Although film, too, must be coaxed by a chemical process into a form visible by human eyes, the undeveloped film negative isn't readable by a human or machine. The fact that digital images are fundamentally machine-readable regardless of a human subject has enormous implications. It allows for the automation of vision on an enormous scale and, along with it, the exercise of power on dramatically larger and smaller scales than have ever been possible.

Our built environments are filled with examples of machine-to-machine seeing apparatuses: Automatic License Plate Readers (ALPR) mounted on police cars, buildings, bridges, highways, and fleets of private vehicles snap photos of every car entering their frames. ALPR operators like the company Vigilant Solutions collect the locations of every car their cameras see, use Optical Character Recognition (OCR) to store license plate numbers, and create databases used by police, insurance companies, and the like.[footnote: James Bridle's "How Britain Exported Next-Generation Surveillance" is an excellent introduction to APLR.] In the consumer sphere, outfits like Euclid Analytics and Real Eyes, among many others, install cameras in malls and department stores to track the motion of people through these spaces with software designed to identify who is looking at what for how long, and to track facial expressions to discern the mood and emotional state of the humans they're observing. Advertisements, too, have begun to watch and record people. And in the industrial sector, companies like Microscan provide full-fledged imaging systems designed to flag defects in workmanship or materials, and to oversee packaging, shipping, logistics, and transportation for automotive, pharmaceutical, electronics, and packaging industries. All of these systems are only possible because digital images are machine-readable and do not require a human in the analytic loop.

This invisible visual culture isn't just confined to industrial operations, law enforcement, and "smart" cities, but extends far into what we'd otherwise—and somewhat naively—think of as human-to-human visual culture. I'm referring here to the trillions of images that humans share on digital platforms—ones that at first glance seem to be made by humans for other humans. On its surface, a platform like Facebook seems analogous to the musty glue-bound photo albums of postwar America. We "share" pictures on the Internet and see how many people "like" them and redistribute them. In the old days, people carried around pictures of their children in wallets and purses, showed them to friends and acquaintances, and set up slideshows of family vacations. What could be more human than a desire to show off one's children? Interfaces designed for digital image-sharing largely parrot these forms, creating "albums" for selfies, baby pictures, cats, and travel photos.

But the analogy is deeply misleading, because something completely different happens when you share a picture on Facebook than when you bore your neighbors with projected slide shows. When you put an image on Facebook or other social media, you're feeding an array of immensely powerful artificial intelligence systems information about how to identify people and how to recognize places and objects, habits and preferences, race, class, and gender identifications, economic statuses, and much more. In aggregate, AI systems have appropriated human visual culture and transformed it into a massive, flexible training set. The more images Facebook and Google's AI systems ingest, the more accurate they become, and the more influence they have on everyday life. The trillions of images we've been trained to treat as human-to-human culture are the foundation for increasingly autonomous ways of seeing that bear little resemblance to the visual culture of the past.

If we take a peek into the internal workings of machine-vision systems, we find a menagerie of abstractions that seem completely alien to human perception. The machine-machine landscape is not one of representations so much as activations and operations. It's constituted by active, performative relations much more than classically representational ones. But that isn't to say that there isn't a formal underpinning to how computer vision systems work. Surely, it is open to doubt whether the techniques of reproduction that existed at the time, or even today, ever really achieved or can achieve such a degree of perfection.

All computer vision systems produce mathematical abstractions from the images they're analyzing, and the qualities of those abstractions are guided by the kind of metadata the algorithm is trying to read. Facial recognition, for instance, typically involves any number of techniques, depending on the application, the desired efficiency, and the available training sets. The Eigenface technique, to take an older example, analyzes someone's face and subtracts from that the features it has in common with other faces, leaving a unique facial "fingerprint" or facial "archetype." To recognize a particular person, the algorithm looks for the fingerprint of a given person's face.

Convolutional Neural Networks (CNN), popularly called "deep learning" networks, are built out of dozens or even hundreds of internal software layers that can pass information back and forth. The earliest layers of the software pick apart a given image into component shapes, gradients, luminosities, and corners. Those individual components are convolved into synthetic shapes. Deeper in the Convolutional Neural Networks, the synthetic images are compared to other images the network has been trained to recognize, activating software "neurons" when the network finds similarities.

We might think of these synthetic activations and other "hallucinated" structures inside convolutional neural networks as being analogous to the archetypes of some sort of Jungian collective unconscious of artificial intelligence—a tempting, although misleading, metaphor. Neural networks cannot invent their own classes; they're only able to relate images they ingest to images that they've been trained on. And their training sets reveal the historical, geographical, racial, and socio-economic positions of their trainers. Feed an image of Manet's "Olympia" painting to a CNN trained on the industry-standard "Imagenet" training set, and the CNN is quite sure that it's looking at a "burrito." It goes without saying that the "burrito" object class is fairly specific to a youngish person in the San Francisco Bay Area, where the modern "mission style" burrito was invented. Spend a little bit of time with neural networks, and you realize that anyone holding something in their hand is likely to be identified as someone "holding a cellphone," or "holding a Wii controller." On a more serious note, engineers at Google decided to deactivate the "gorilla" class after it became clear that its algorithms trained on predominantly white faces and tended to classify African Americans as apes.

The point here is that if we want to understand the invisible world of machine-machine visual culture, we need to unlearn how to see like humans. We need to learn how to see a parallel universe composed of activations, keypoints, eigenfaces, feature transforms, classifiers, training sets, and the like.

But it's not just as simple as learning a different vocabulary. Formal concepts contain epistemological assumptions, which in turn have ethical consequences. The theoretical concepts we use to analyze visual culture are profoundly misleading when applied to the machinic landscape, producing distortions, vast blind spots, and wild and uncommon misinterpretations.

Cultural producers have developed very good tactics and strategies for making interventions into human-human visual culture in order to challenge inequality, racism, and injustice. Counter-hegemonic visual strategies and tactics employed by artists and cultural producers in the human-human sphere often capitalize on the ambiguity of human-human visual culture to produce forms of counter-culture—to make claims, to assert rights, and to expand the field of represented peoples and positions in visual culture.

Faced with this impasse, some artists and cultural workers are attempting to challenge machine vision systems by creating forms of seeing that are legible to humans but illegible to machines. Artist Adam Harvey, in particular, has developed makeup schemes to thwart facial recognition algorithms, clothing to suppress heat signatures, and pockets designed to prevent cellphones from continually broadcasting their location to sensors in the surrounding landscape. Julian Oliver often takes the opposite tack, developing hyper-predatory machines intended to show the extent to which we are surrounded by sensing machines, and the kinds of intimate information they're collecting all the time.

In the long run, developing visual strategies to defeat machine vision algorithms is a losing strategy. Entire branches of computer vision research are dedicated to creating "adversarial" images designed to thwart automated recognition systems. These adversarial images simply get incorporated into training sets used to teach algorithms how to overcome them. What's more, in order to truly hide from machine vision systems, the tactics deployed today must be able to resist not only algorithms deployed at present, but algorithms that will be deployed in the future.

An effective resistance to the totalizing police and market powers exercised through machine vision won't be mounted through ad hoc technology. In the long run, there's no technical "fix" for the exacerbation of the political and economic inequalities that invisible visual culture is primed to encourage. To mediate against the optimizations and predations of a machinic landscape, one must create deliberate inefficiencies and spheres of life removed from market and political predations—"safe houses" in the invisible digital sphere. It is in inefficiency, experimentation, self-expression, and often law-breaking that freedom and political self-representation can be found.

Around 1889, Harvard College expanded its influence far outside Cambridge, Massachusetts. Having joined the College Observatory (first as a student, later as professor of astronomy), Solon Irving Bailey was sent much farther south, to Arequipa in Peru, to establish a new field station. This operation was to switch the hemisphere and find a spot elevated enough for ideal observation of the light traveling from distant celestial objects. Astronomic photography had a long history already by the 1890s, but this need for a new observatory emphasized the additional demand for what we would now call scientific infrastructure.

Besides a number of adventurous anecdotes from that trip, the relation with a media technological context is especially interesting. Two themes concerning light intersected during the years Bailey spent in Peru, both of which were essential to the scientific work, while producing an aesthetic quality to the geographical placement. The sunlit high-altitude plains provided ideal landscapes while the photometric (measurement of the brightness of light) and photographic techniques provided technologies for the capture of slowly shifting objects in the night sky.

Not that such exact spots of observation were known in advance; some of Bailey's memoirs from the trip read as a persistent search for locations where measurements can be made, leading him to echo earlier advice about the exploratory spirit: "Of the clearness and steadiness of the atmosphere in these different places, there is no certain knowledge, and your only way is to investigate it for yourselves." The investigation aimed to take pictures to send back to the college in Cambridge. Besides telescopes, the comparative analysis of photographic evidence became a key technique that needed a reliable data supply. It was, in some way, a case of what Michelle Henning has called "the unfettered image": fixed as an image, but migratory and journeying as an object. Here, what migrated were the comparative observations of the vast space outside the planetary sphere. As per the Harvard Observatory aim, to be able to observe the night sky from both the Northern and Southern Hemispheres gave a particular advantage to astronomers. Moreover, with the help of the photographic media, Southern data was relatively easily transported back to Cambridge for comparative, computational analysis. In Pickering's words, "For many purposes the photographs take the place of the stars themselves, and discoveries are verified and errors corrected by daylight with a magnifying glass instead of at night with a telescope." astronomy, including Annie Jump Cannon and her work on star classifications and Henrietta Swan Leavitt, among others. Leavitt, later awarded the title "Curator of Astronomical Photographs", left lasting contributions to the field (even if here the focus is only on parts that relate to the media technological operations that serve as infrastructure and instruments of astronomy as a science). Leavitt's research impacted astronomy by demonstrating important traits about the periodicity of brightness, an essential element in measuring distances across the vastness of outer space. In addition, the Peruvian night sky had been photographed and recorded on glass plates that Leavitt stacked on top of each other for comparative data analysis and to produce insights into the shifts of moving stars, which in our case illuminates a key theme: early in its first official century, photography was already a measurement device that not only took pictures of people and things but offered a way to analyze the world, including the extraterrestrial.

Besides photographs where "the ability to measure appears to be a useful but unintended byproduct," there were various intentional practices, mostly scientific, where this cultural technique was central. In astronomy, this included the Venus transit plates of 1874 and institutionalized work such as Carte de Ciel of the 1880s, "one of the most influential photographic observation projects in astronomy." Beyond astronomy, Raman spectroscopy and photogrammetry were "methods that bent photographic observation to mathematization," with surveying as a technique that was, as Wilder outlines, "heavily dependent on the idea of measurable photographs."

Here, the commentary on measurement serves to illuminate the expanded scope of operational images.While the sky had been pictured, read, observed, interpreted, and calculated for millennia, as John Durham Peters argues in his media theoretical insight to astronomical star-gazing, the scientific analysis of movement and light became particularly interesting. The intersections of media and the sciences (in this case, astronomy) have impacted the transformation of photography as it became "digital" and how it has been part of data analysis and planetary infrastructure.

The employment of both media of visual technologies (photography and spectral analysis) and the possibilities to harness the planet's spherical shape as part of the astronomic observation unit from Peru to Massachusetts provided the backbone for broader infrastructures of knowledge. And even the shape of the planet measured in geodesic triangulation can be considered part of the story of the extended planetary image. This link to scientific uses of photography, including in astronomy, should not be particularly surprising considering that perhaps the most famous words in the early history of photography (or, more specifically, the daguerreotype) were given by an astronomer, François Arago, in his 1839 address. This talk was given to convince the French Academies of Art and

Science about the benefits of the new technique, which was why the talk aimed to make sure it was seen as a scientific one and therefore included specific attention paid to the various uses of measurement: beyond people or things, landscapes or scenes, this was a medium to measure photometrically the brightness of transmitted light and thus also provide an insight into what lies beyond this particular planet and how that can be easily recorded on a plate. Thus, the instrument became a central part of an experimental apparatus that unfolded a whole visualization process in developing an image.

Less interesting as pictures, even if armed with a poetic allusion of deep space, but useful for the trained scientific eye, such photographs become an infrastructure for analysis. Leavitt's comparative analysis identifies light and subsequently tables the sources of light as varieties of data points in the Magellanic Clouds. Besides its operational use in astronomy, it leads to interesting considerations concerning the role of the image. Far from the usual focus of art history, such images are one element in the extended role played by computation and data. And not digital in the sense we refer to them as now, but as part of the institutional uses where photographic images are essential in being able to scale and inscribe the distant movement into the flat (paper and glass) world of pictures and observation tables.

In short, the photographic functions primarily as detection instead of depiction; subsequently, detections are also turned into calculations. Photography condenses massive scales of measurement of light.23 As such, the intersection of earth, sky, light, shadow, and astronomy, and images through which to calculate are among the contrasting currents that define our interest in the actions of images.The useful takeaway here is that we should look at the operative transformations of the image as it pertains to the multiple materials and their abstractions, and abstractions coming back to transform the materials. What STS does with mapping the route of material objects of science, we can try to do with images as they work in institutions. This will be a key part of what this book establishes as the operational in the operational image.

Where is the image here in this description, in such tables, curves, and diagrams? On the photographic plates or their analysis, the moments of exposure in the Peruvian landscapes, in the logistics of transporting those images to Cambridge, in the trained analysis of composite photographs, or somewhere else along the way of transforming light? Or in the notion of operational ties together a multitude of such material events, sites, and their abstractions and assembles them into a useful notion of the operational image that, as a term, itself is invented much later and for a different purpose, but might itself become useful to speak of infrastructure, logistics, and images that transform from visual to invisual, from ways of seeing to ways of calculating.

The term by the renowned German filmmaker, artist, and writer Harun Farocki (1944–2014) appeared in the early 2000s in his video installation trilogy Eye/Machine I-III (2001–3) that investigates autonomous weapon systems, machine vision in industrial and other applications, and the broader move from representations to the primacy of operations. Farocki's film installation series presents this switch as a particular kind of an image that emerges in those institutional practices although also articulating it through the various histories and spaces that condition both the emergence of such images and their industrial base: these include military facilities, archives and laboratories.

The institutional line of references is familiar in many of Farocki's films that have investigated how contemporary images are intimately tied with the modern forms of industrial production, detaching from a history of images only as visual culture, to histories of chemistry, violence, labor, exploitation, and data. Already in Images of the World and the Inscription of War (1989), Farocki mapped a similar terrain of investigations of how to read landscapes, aerial imagery, targeting systems, and also other forms of modeling, simulation, and aesthetic techniques as they operate in the world in the fundamentally material sense.

Nonetheless, the work with images about images sets a scene and opens up an artistic, epistemic, and research-focused agenda. Eye/Machine III (2003) is one such example where operational images are articulated across a set of cases: factory scenes of data and measurement to infrared aircraft detection systems, laser scanning of built structures, and engineering to robotic navigation systems that sense the space around them. Images produced in those situations are drawn from machine-vision systems of perception, embodied and embedded in autonomous or remote systems, and working through an artificial environmental relation where the image is a crucial part of movement and guidance. Operational images are, in Farocki's words, "pictures that are part of an operation," implying the primacy of action and function instead of a picture to be seen and interpreted for meanings. Perception is tightly coupled with action, immediate or delayed. This coupling systematically operationalizes terrains and targets. Hence guidance systems, movement, tracking, measurement, and precision are some of the terms that take precedence in such images that are often, across a visual history, bluntly put, “inconsequential.” It is also a condensation of an aesthetic program that relates to what images are seen, which ones are archived, and which of the multitude of images are merely used and erased.

Images that appear so inconsequential that they are not stored—the tapes are erased and are used again. The images are stored and archived only in exceptional cases, but exceptional cases one is sure to encounter. Such images challenge the artist who is interested in a meaning that is not authorial and intentional, an artist interested in a sort of beauty that is not calculated. The US military command has surpassed us all in the art of showing something that comes close to the “unconscious visible.”

While military contexts of machine vision has been taking most of the space for commentary and attention when it comes to Farocki’s notion and its articulation in moving images and photography, it is clear that the breadth of examples tells a larger story than merely about genealogies of military vision systems. This is not to dismiss such a key trait. Farocki’s examples from a 1942 instructional film showing the operations of a V1 guided missile to the 1990s military systems that became a key topic for art and media theory from Jean Baudrillard to Paul Virilio are persistently apt in the context of contemporary drone warfare and in the media archaeology of military vision. Even Farocki himself reads “the US military command” as part of a new aesthetic operationality of visibility.

The necessity to be able to rationalize, theorize, model, and potentially automate decision-making in the context of complexity persisted from the war to the postwar period—for example, in management theory, making it a part of systems thinking where any decision was part of a meshwork of other decisions, by other actors, in a recursive loop.

Cultural techniques of quantification connected to modelling was one particular route offered in this history of what “operations” came to mean on and off the battlefield. Numbers count landscapes and what moves through them; they count routes and their optimal relations; they count possibilities and potentials; and numbers are the backbone for both images and industrialization. Data is not infallible and simply “objective,” as critical data studies have shown over and again, but it can be effective whether it is correct or not. Rolling out data-driven decisions, systems, and operations is also an intervention in landscapes, social relations, values (financial and other), and more. While leaving a longer discussion of logistics and operational images for later, it shows already much of the relevant context that elaborates the implicit conditions of emergence of what Farocki coins in his terms and in his audiovisual work by way of the “soft montage” of archive and inconsequential images. One peculiar context of such images would then be the over 70-year history of military-driven operations

research and subsequent management theory and some 150-year history of photographic-driven data analysis. In some ways, this all condenses into “an industrialisation of vision”—or even “industrialisation of thought,” as Farocki himself coined his interest in cinema and perception, directly echoing Virilio’s work on the “veritable market in synthetic perception.” The contemporary versions of that coinage relate to questions of artificial intelligence, machine vision, but also the genealogy of the concept of operations as it pertains to images, institutions, spaces, and nonhuman visuality. The industrialization of vision has been often coined as part of the industrialization of destruction, a theme that connects Farocki to the 1980s (and later) theorization of war and visuality. Technical processes of abstraction, images that are primarily for targeting and destruction feature as part of a genealogy of rationalized violence that human bodies are subjected to.

As such, Farocki’s scene for operational images could be seen as a crystallization of much critical theory, thematically visible in the focus on the Holocaust, the Vietnam War (napalm in Farocki’s Inextinguishable Fire, 1969), the Gulf War, and the prison-surveillance-capitalist complex that features in many of his works. But this book argues that there needs to be nuance in how this concept of the operational image is read and used, avoiding the temptation of packing all sorts of abstractions—and abstract images of technical and calculational use—into one camp of a kind of Enlightenment gone awry, a stream of violence and extraction that is merely about military power in the restricted sense of warfare. This is not to ignore the operational violence of capitalism or the colonial uses and functions of measurement and their neocolonial forms but to take a position against abstraction on principle would be a mistake, leading us to insufficiently nuanced readings about technical images. We have plenty of those already, and in the context of environmental imaging, remote sensing, AI and platform culture, and many other crucial topics, we cannot anymore afford to miss the more detailed high-res insights.

We might not (always) be at war, but we are (always) mobilized and operationalized. This could also be referred to as the perceptual and operational fine-tuning of the “nonbattle,” a term first introduced by Virilio and developed by Brian Massumi. Operations and actions are embedded in a broader field of intensities and potentials, possibilities, and the modeling of futures. “In the nonbattle, the relation between action and waiting has been inverted. Waiting no longer stretches between actions. Action breaks into waiting.” The operational is nested in the significance of knowing how soft power can work effectively. Massumi continues: “Soft power is how you act militarily in waiting, when you are not yet tangibly acting… In the condition of nonbattle, when you have nothing on which to act tangibly, there is still one thing you can do: act on that condition. Act to change the conditions in which you wait.”

Both the imaging practices for mapping and landscape have evolved alongside the advancement of technology. During each period in history there have been different capacities for the production of representations of space and place. But also, preference for specific types of representation shifted over time. In Antiquity, the Medieval Period, and the Renaissance, people overall preferred the map, while later periods, especially the 17th to 19th centuries, people were most fascinated with the colorful, dramatic, and romantic landscape. Until today, maps are the oldest abstract representations of space. And even today, children develop cartographic literacy to one degree or another, whether through the study of geography in school or using applications on their smartphones.

Cartographic reasoning has been at the heart of the Western thought since the dawn of the age of discovery. Maps were the product of scientific discoveries but also imperial tendencies. By the time of the 18th century, the surface of the Earth had been mostly discovered, leaving only a few places yet unknown. 'It is not a new terra incognita for explorers in colonial headgear. At the time when more attention was being given to the details in maps than map-making itself, the interest in the map was replaced by interest in the landscape.

After a time in the late Medieval Period and early Renaissance when maps were being repeated and reprinted, an age of discovery, as well as of colonialism, exploration, and imperialism, brought with it a renewed interest in maps and mapmaking. For example, in 1346 Fra Paolino da Venezia made Civitas Venetiarum, a map of of the city Venice, which in 1572 to 1617 led to the large cartographic project Civitates Orbis Terrarum, a great atlas edited by Georg Braun and illustrated by Franz Hogenberg. Published in six volumes, this atlas had 546 maps of different European cities, all of which simulated an aerial or bird's eye view. at the time was inaccessible to humans. Yet, these maps had the purpose of representing a small area rather than a big region. Only in the 19th century, with the influence of the work of German geographers Alexander von Humboldt and Carl Ritter, did maps begin to locate a specific place within the context of a general space; that is, of the whole Earth.

The image of the landscape occurred on an iconographic or symbolic level already by the 15th century. Still, it took a few centuries for the landscape genre to flourish. And only between the 17th and the 19th century did the landscape become a dominant art genre. With the Industrial Revolution, however, landscape painting became more and more important, as if a harbinger of the world-scale problems which this progress would lead to.19 In paintings by British artists John Constable and J.M.W. Turner, for example, a warning appears to have been issued about industrialization and the consequent pollution or, at least, the paintings can be interpreted this way in the light of history). Unfortunately, the teachings of such landscape painters were not recognized until more recently, when the consequences of the coal industry among others has reached a tipping point. Today, in an time not only of climate change but of climate crisis, landscapes are frequently employed to depict the loss of nature, while maps can be used to demonstrate the changes in the environment which have been introduced by humans show the destruction and intrusions of industry into this land that is captured.

The last moment in history in which the landscape held vital importance in the visual arts and for visual representation coincided with the invention of the photograph, which itself was a consequence of the Industrial Revolution of the 18th and 19th centuries. With the invention of camera technology, the photographic medium achieved greater and greater significance in the arts, relegating the painterly genre of the landscape to 'Sunday painters' in the open air. Indeed, Denis Cosgrove claims that as a visual genre in the 19th century the landscape was again replaced by the map, at least in part because it was in this moment that visual tools other than painting become capable of naturally and realistically depicting the immediacy and intimacy of place. By the end of the 19th century, both photographic as well as aerial technologies were developed, which would lead to their fusion in the next century. Edward Casey thus named this era 'the age of world picture,' referring to Heidegger's theme of the 'world image', a concept which is paraphrased in the title for this book.

Today, the entire surface of the Earth is continuously photographed from the air. As Siegfried Kracauer wrote in 1928, 'This equation is not made without good reason. For the world itself has taken on a "photographic face"; it can be photographed because it strives to be absorbed into the spatial continuum'. The consequence of such over-photographing is that today there are no secret or unexplored territories left on Earth. Satellites used by Google discover some previously hidden part of the world on the daily basis. Or, as Virilio writes, 'There are eyes everywhere. No blind spot left. What shall we dream when everything shows visible? We'll dream of being blind'. Many maps today do not prove a direct correlation between physical measures of the land, instead representing it symbolically. Schematized, they simplify and reduce the information into what the author of the map, whether an individual or institution, deems to be the most important, which in turn leads to maps which are embedded with a priori interpretations. And moreover, they are constantly adapting to the user, diminishing distinction by which landscapes is used to depict places while mapping digital spaces.

The development of maps has in recent years significantly accelerated in comparison to the development of landscape during the same time-period. But cartography as we know it no longer exists. Cartography has become emancipated from the role of the human to become an autotelic activity. Today, many types of maps are being implemented, including aggregated, data, geo-, and raster maps, which do not represent the world as it is experienced, measured, or lived by humans but some interpretation of information about this world. In other words, the cartographic reality is no longer directly connected to a single geographic reality. And there are so many maps online, each tailored to a specific need, or by a particular investor, leading the viewer to some product or purpose.

We have arrived at an era of overlapping visual geographic material, due to mapping and photographing services, included in most mobile gadgets from phones, watches, laptops, to even cars. There are more maps, and more photographs, of the same place existing. The same place is found over-represented in many systems at once. Multimodal images have further distorted our visual conception of reality by producing multiple and different maps referring to the single place.

Susan Sontag once warned, hyper-photographing reality and photographing the material experience of the world to be an excessive or exaggerated extent, can lead to our complete detachment from it. Following Sontag's line of thinking, we may now ask ourselves: what is the consequence of our hyper-mapping and hyper-photographing of reality? Thirty years ago, Henri Lefebvre asked: how many maps do we need to understand a single place? As the number of maps for a single place today grows exponentially, authors such as Gunnar Olsson and Tom Conley claim we are living in the age of the 'cartographic reason.' The data-driven characteristics of contemporary culture demonstrate the pervasiveness of what James Elkins term the 'post-medieval mapping gaze,' whereby people fail to learn how to see for themselves the infrastructure of the geography around them. Other authors note that we are today even fixated on such a 'cartographic gaze.' This overabundance of maps leads to a general crisis of representation for the Earth, which in turn produces a 'cartographic anxiety,' and, ultimately, according to what Flusser heralded as the 'end of cartography'—a moment in which maps proliferate yet meaning evaporates under algorithmic abstraction and visual saturation.

The crucial difference between the landscape and map, as already noted by Deleuze and Guattari, is in the positioning of the viewer. With the landscape, the position of the author is often repeated by the viewer. But there is no such view that can be repeated with the map. Thus, the landscape indicates the place of an actual viewer, while the map depicts the space for many potential viewers. Such concepts are useful because they demonstrate the role and significance of the social formation behind our ideas of environment and habitat. Ideas about place, however, from a sociological perspective, are commonly defined as being immediate and therefore localized. In contrast, space is always and necessarily defined as something at once elsewhere and everywhere. From a sociological perspective, ideas about space and place are informed by our social unconscious as communicated through the language and images which frame our cognition.

The distinction between concepts of space and place in sociology is commonly attributed to French sociologist Michel de Certeau. Place is what there is and physical space is what could be. Pierre Bourdieu further elaborated upon this distinction. And by 1996, he had reformulated his theory, defining the distinction between the communal and geographic spaces, attending to a more abstract level of meaning than with his original materially-based definition.

Bourdieu's division departed from the strictly physical definition of space to the one based on the experience of living (in a society). Bourdieu, as a sociologist, was focused on ideas of communal space. This he defined as an interpretation of the real or geographical space, formulated through the ways in which a certain population captures their belief systems through perception and production in order to produce a coherent and consistent meaning of their own habitat. his amplified the distinction between communal and physical spaces, where communal space is based on the immediate experience of some place, and physical space is based on a variety of possible experiences of the same place. Bourdieu pointed out the interaction between the communal and physical space in general

Urban sociologist Henri Lefebvre, who succeeded Bourdieu, also distinguished between space and place, and termed these 'conceived space' and 'perceived place' or the 'represented space' and the 'lived place' (or maybe even 'livable', as a place having a capacity to be inhabited), providing a direct link between space, place, and their representation. Furthermore, Lefebvre distinguished between the representations of space and representational space or, in terms from my analysis, the image of the space and the space of the image, which correspond to the distinction among the conceived versus perceived (or lived) space. Lefebvre's ideas about representational as well as abstract space would have a considerable influence for visual studies, and especially the differentiation between two main geographic genres: landscape and maps. While landscapes show an excerpt of the view of the author in the space, which is defining the place, maps lays down the space without placement of the author and have to be used in the placement of the audience. Still, with new technologies it is the precise place of the audience which is being mapped in an abstract space.

In visual studies, space is a more of an abstract construct, particularly in discourses about the photographic representation, whereas the place is more of a concrete instance, in terms of the precise geophysical location of a the photographic shoot. The photographic medium, because it can represent the landscape with precision, further complicated the space-place distinction.

Photography cannot record anything else but a place, and yet a photograph can refer to the existence of space. At the conclusion of the photographic process, an image is realized which is a concrete object. Despite this, however, the relationship between image and place is not realized materially but referentially. Thus, the epistemic value of the photograph, as Jonathan Cohen and Aaron Meskin defined, is derived from the distinction between the general space of photographer and the specific place of the photograph, also known as egocentric and allocentric space. The distinction between such kinds of spaces is important in order to understand the truth claim of the photograph. While it is true that when a viewer looks upon a photograph what they see is a scene which a photographer has already seen, it does not represent an actual place, because the egocentric view of the photographer is already more than the allocentric view in a photograph.

These distinctions can be further applied to analyze the space of the object (the actual physical space being presented in the image), space of the author (the original perception of some actual physical landscape), and space of the viewer (the different real place where the image is experienced), as I have defined in my previous work. I will call these spaces the real, experience, and visual or, in other terms, the actual, perceived, and represented, so as to define three different ways in which the Earth has been described. The first level of space, the real-actual, is

independent; the second, the experiential-perceived, is characterized by its consumption and the perspectival view; while the third, the visual-represented, has been located by that view, which it re-experiences. Here, the author has some information about the real-actual space which they represent, while audience has some idea about space of the space the author represents, but also his own place.

In 'ordinary' photography, as I will here refer to photographs which are produced in the course of our everyday activity, the audience sees only the section of space which was in front of the author. This section of space is determined by the author's choice, the type of photographic lenses, as well as exposure settings. This is a small section of some place, about which the author can know much more than is shown in the photograph. Thus, contrary to the three types of spaces, there are only two types of places, because the object and an author or photographer reside at the same place, which becomes important particularly in remote photography. While both places, that of the object and that of the author, are located in the same place, the author's place is commonly not visible to the audience, but has to be reconstructed, whether through perspectival analysis or some other visual methodology. Because of this, an individual of the audience can produce completely different meanings based on numerous other factors such as her or his social and political contexts. If the perspectival analysis or visual method is successful, the author's place and audiences' space may come into alignment. Perspective is constrained by the fact that the audience cannot put their head into the picture, as Cohen and Meskin claim, and turn around to see what was behind the view of the author at the moment of recording. The audience ends up only being able to vaguely estimate spatial relationships surrounding the author according to their own personal and subjective perception. In contrast to maps, photographs represent a certain place, which is also made by an author and interpreted by the audience. The place described in a photograph is not filtered through the technology of the camera in the same way as a map is filtered through the visual language and iconic vocabulary of the map-maker. William Cartwright and his coauthors valorize the distinction between the space presented in a map and the place depicted in a photograph. He claims that the location of the user of a map still does not produce a located space, because dot produced on the crossroad of the orthogonal lines is not a territory, as dot is basically single-dimensional.

This difference between a specific place and a general space becomes even clearer when dealing with the non-places which emerge with post-digital photography in the age of total images. Such non-places, consumed through strategies of overmapping such as Google Earth, lack the signature and specificity necessary to be determined as particular places.

With new media, especially the rise of the digital media, these theories about space and place can appear over-simplistic. Place is constructed through an understanding of space. Indeed, the dualism between place and space turns out to be quite limiting. The complexity of the space in post-digital photography emerges from a divide between the space as it is represented and the place which has in some way been broadcast or transmitted into this space. Such a simultaneity, with its vague origin, leads not only to a 'middle' space negotiated by the audience or user, but also to a proliferation of multiple spaces.

For our definition of virtual space, Henri Lefebvre's definition of abstract space is important as is the manner in which abstract spaces is produced in relation to real space. This includes the historic, military, urban, and economic narratives within these spaces which in turn can make abstract spaces more complex and thus, at least to a limited extent, more real. The represented and the lived, contemporary media epistemology suggests that we do perceive virtual space as if it is real. Rather, we live in both virtual and real space simultaneously. That is to say space is epistemological while place is phenomenological, space is conceived while place is perceived. Yet, today space that is constructed around place, or digital space, is perceived as being integral to our life experience as well.

Aside from the precise placement of the viewer onto the map, there is yet another distinction of the new images–the question of the author which is now not placed into its own, separate place. The creator can also be nonhuman. Such is the total image made using artificial intelligence. Artificial intelligence is conditioned by biology, perception, or society the way human intelligence. And artificial intelligence does not interpret photographs from within the framework of the 'human photographic condition', as I have defined it in the Introduction. That is, the computation of these machines is not based on the distance from the scene, view angle, or individual frame which determines how the photographic medium is necessarily subjective. Moreover, place as such does not exist to artificial intelligence because any concept of dimensionality would not be related to a physical place but rather to an overlay of space as an objective or pseudo-objective category. Therefore, to an artificial intelligence, all places are seen at once in so far as many places are computed or aggregated together.

The difference between the up-in-the-air photograph and the map is not as great as the difference between the map and the down-to-the-ground landscape. Indeed, aerial photography and map making have much more in common. Both genres of image depict the world without visibly having either a particular subject's view angle or even a general human view angle. Given the similarity between aerial photographs and maps, some authors, such as Anthony Vidler, claim that both image genres have their foundation in the representation of the human view from above. Aerial photography, because it is free from the constraints of human existence on the surface of the Earth and perspective systems which are relative to this way of being, provides a big picture which functions topographically while appearing cartographical.

Yet, at the very beginning of the implementation of aerial photography, map making and photography were still being treated as distinct practices. For instance, the map and photograph were used not only to represent space below, but also for mutual testing of how space was being represented. During the First World War, the aerial view or bird's eye view was still a novel experience. Only a very few soldiers, being also aviators, ever actually went into the deep blue wild yonder and climbed high into the sun. These soldiers were not yet accustomed to the view.

They required additional support for their own eyes, in terms of some proof for the correlation between the location on the map and the location which they saw while they were flying. For this reason, so as to double check the reality of their own perception, some pilots sketched maps on the palms of their hands. Soon after WWI, aerial photography began to be combined with map making independent of human verification that the map and the photograph in fact reference the same information. The principal motivation for combining these image genres, at least in the armed forces, was not only to control the space represented, but also to correct this data through the reciprocal testing of each form's accuracy. And across the 20th century, with the acceleration in their use by the military, these two image types have become increasingly merged.

Even so, there are differences between aerial photographs and maps. When comparing aerial photographs to map making, for example, there are no scales in aerial photography which provide a ratio between the distance in the image and the distance on the ground. This makes spatial distortions in the image less clear at a first glance because they have no metric parameter. And such distortions produce 'noise' in our interpretation of our own habitat. At least, this was a problem until the image genre became digitized, and aerial photographs could incorporate the kind of measurement systems that have long been included with maps. While in the early 20th century aerial photographs may have looked like maps but did not function like maps, since the 1950s with the digital turn, the possibility of full integration between aerial photography and map making became possible.

After a time of acclimatization to an aerial view which combined ways of seeing from both photograph and map, further similarity between two image genres became clear. When comparing aerial photography to ordinary photography, the photographer has fewer choices for how they do the recording, such as less possible view angles, and even more objects on which to focus. By reducing the range and variety of subjective aesthetic choices in how the photographer can represent the landscape, aerial photography shifts from an aesthetic framework to a practical and utilitarian purpose. This shift reflects a broader cultural movement from symbolic, artistic visuality to instrumentally framed, data-rich imaging. Aerial photography became indispensable for surveillance, environmental monitoring, and military strategy, prioritizing utility over expression.

Digitization also allowed for the automation of cartographic processes, enabling hybrid forms that merged visual evidence with numerical precision. As technology advanced, these image forms became increasingly interoperable, collapsing former distinctions. The first experiments with imaging techniques which would lead to digital map making were already being undertaken after WWII. Yet it took many years for these techniques to become fully functional. And the mid-20th century wave of simultaneous digitization and datafication had a strong influence on our image of the world, regarding both photographs as well as maps, profoundly changing these image genres and, ultimately, even connecting them. This influence can be traced not only in scientific or military applications but also in popular culture, as aerial and satellite views entered cinema, television, and eventually user-facing platforms, normalizing the god's-eye perspective.

The first pre-digital experiment with mapping was undertaken in the project The Streets of London (1944) by the British company Nextbase. The Glasgow Online Digital Atlas soon followed. The first digital map was in ASCII format, with its code representing English characters as

numbers, with each letter assigned a number from 0 to 127 in a reductive schema. However, it took many years for interactive maps to be developed. In 1978 the Aspen Movie Map project by MIT introduced the streets of the city of Aspen to the audience using photographs. With CD technology, the Digital Chart of the World (DCW), a comprehensive digital map of the Earth based on the United States Defense Mapping Agency's (DMA) operational navigation chart, was developed. Still, the first years of implementation of digital maps were dedicated to the digitization of analogue media through a process of scanning, as in the World Factbook by the Central Intelligence Agency (CIA). Desktop and web publishing led to further developments for the map. Although only with Web 2.0, which emphasized user-generated content, ease of use, a participatory culture, and interoperability for end users, did digital cartography begin to develop. And today there are plenty of new techniques for mapping, from augmented vision to tele-cartography. Beyond such techniques, there are cartographic games, like the Magellan board and video games.

The digitization of maps, along with satellite photography, has also been integrated into projects such as Google Earth, Google Maps, and Google Street View, which are accessible through mobile devices. These projects, launched since 2001, 2005, and 2007, respectively, support the users as they explore the Earth with comparatively realistic images which combine maps and photographs. With each advancement, digital cartography has evolved from a static, centralized medium into a dynamic, participatory system, enabling layered, real-time representations of space that respond to user interaction, movement, and the context, ultimately transforming how spatial knowledge is the produced, shared, and understood. Through these developments, the public gradually transitioned from passive recipients of cartographic information to the active participants in map-making processes, transforming the map into a tool of everyday digital interaction.

The digital map is no longer a fixed representation but a living interface, shaped by social engagement, algorithmic processing, and real-time data flows. This transformation blurs the boundaries between subject and object, viewer and viewed, and even between image and infrastructure. The contemporary map is not merely a tool for orientation, but also a medium for navigation, speculation, surveillance, and storytelling. It becomes a platform where political and economic narratives are overlaid and contested. Maps learn from our behaviors, habits, and movements, reconfiguring themselves to serve new functions. In this sense, digital cartography is performative, responsive, and personalized, not just reflecting but actively shaping spatial realities. The map has evolved into a dynamic system of power, capable of constructing meaning, governing flows, and rendering both visibility and invisibility in an age of information saturation.

Another key invention for contemporary digital geography is the Geographic Information System (GIS), a computer system designed to capture, store, analyze, and present data related to spatial or geographic data about positions of various entities on the Earth's surface. The field emerged from the Situationist International (SI) organization of social revolutionaries, prominent in Europe from 1957 until 1972, and made up of avant-garde artists as well as intellectual and political theorists.

Already in the mid-20th century, the Situationist International, developed work around aerial photography and maps, fusing them together, as for example by Guy-Ernest Debord in his Introduction to a Critique of Urban Geography (1955) which, as Anthony Vidler notes, preserved the fundamental roles of both maps and photographs in the combined works, as with his collaged map of Paris (1956).

William Bunge in Fitzgerald: Geography of a Revolution; as well as the Experiments in Art and Technology (E.A.T.) Datascape (1966-1970), an exploratory tool for humanities scholars in social history for exploring the intersection between art and non-art contexts followed. And by the 1990s, GIS technology had evolved into practical software. Beyond applied GiScience, art-based researchers have also developed a number of experimental methods, such as the tactical cartography of the Paris-based conceptual art group Bureau D'études, or Mapping Contemporary Capitalism (MoC) by the editors of Mute Magazine, among others. The psychogeographies of the mid-20th century included 'attempts to record and represent the grain and patina of place through juxtapositions and interpretations of the historical and the contemporary, the political and poetic, the discursive and sensual.'

In the GiScience of today, in addition to quantitative projects, there are also qualitative projects. These projects are used to present a critical geography in which new methods are applied to mapping services which might, for example, provide a better life quality. There are also feminist and queer geographic information systems. The FOAM Map, for example, allows the exploration of various community-verified registries of crowdsourced places. The 'network image', as Virilio them, today has a capacity to convey various rich information. To describe such maps, which are made not only from spatial but other kinds of information, the term 'deep map' is commonly used. The pioneering Spatial History Project at the Center for Spatial and Textual Analysis (CESTA) at Stanford University, for example, supports the development of such deep maps. In one of their projects, researchers use GIS technology to create a layered history of Rome, updating the cartographic masterpiece of ancient Roman topography, the Forma Urbis Romae, published in 1901 by archaeologist Rodolfo Lanciani. While the 13th century Tabula Peutingeriana, described previously, showed how many post-Roman cultures imagined the Roman Empire at one point in time, the 21st century Forma Urbis Romae shows how the city of Rome changed over time from the retrospective vantage point of today. The outcome of such works from Stanford's Spatial History Project have not only informed the fields of visual studies and visual history, but improved how space is being visualized, leading to new kinds of interaction. Other such projects which implement a critical geography include artistic projects like GPS Art by Michael Wallace, who drives around on his bike as it is tracked with GPS in order to outline various figures on a map, or the Tangible Disaster Information System developed by the Tangible Media Group at MIT, a collaborative tool. For planning disaster measures based on simulations using GIS, and there are those which are based on crowdsourcing, real-time sensors, and social networks. Such artistic and civic experiments show that control is not the only possible outcome for digital mapping, but that new tools and collaborative platforms can also be developed for the betterment of society, resilience, and community empowerment.

GIS has introduced a large change in the way we orient by using maps. For example, the navigation feature in Google Maps means the reader of the map no longer has to navigate and wander across the map in search of a place, as directions are now automatically calculated and visually guided. Maps have long been thought of as objective, in large part because they are made in a Cartesian space and with location descriptors that suggest precision. But an element of subjectivity was still involved, interpreting landmarks and locating themselves in relation to both the map and the world around them.

Today, however, place is represented not by a coordinate system but rather the system's coordinates, which automatically position the viewer in relation to the data. This re-introduction of the specific into the genre of the map is not only because Google Maps and other mapping systems turn our spaces of imagination into a concrete, unique, and physically precise place. As a consequence of the Geographic Information System, at least according to Alberto Toscano and Jeff Kinkle, local placement has become privileged over general picture in the post-digital era. When using such geoprocessing, such as with the free-to-use and easily accessible proprietary web application Google Maps, the user becomes caught up in a passive logic within a system that self-organizes around them while allowing only a portion of the Earth to be visible.

We use devices to locate ourselves in maps and photographs which are taken not from a human perspective down on Earth but from an eye-in-the-sky perspective up in the air. In so doing, however, this images deprive us from the process of placing ourselves in the larger geographic area, which we would need in order to understand the geographic specification, as we are being placed by the system, not our own human action and power of the navigation.

While conveying a great deal of information, becoming total, all information is situated and particular around placement of the user losing insight into a total image. Geo-positioning triangulation, aerial photography, and images of outer space have all led to a cartography which is far from the ground, producing total images, while simultaneously tracking the user. Contemporary geographic imaging and representing technologies, contrary to drawings on palms of pilots, may pinpoint our location in a map, by the use of the global navigation satellite system (GNSS), global positioning system (GPS), and geographic information systems (GIS) which together provide geolocation and time information to a receiver anywhere on or near the Earth. With each new technological means for geographic abstraction, the ways in which we represent space and place changes substantially, as new roles are assigned to the landscape and its parts which serve not to depict but to classify. New modes of visual representation, when applied in map and landscape making, have changed how we understand our habitat as well. These days, landscapes are highly coded with linguistic and symbolic information. Geographic information systems, designed to capture, store, manipulate, analyze, manage, and present spatial and geographic data, also allow users to create interactive queries to analyze spatial information, edit data in maps, and present the results of these operations, adding non-geographical data to place.

Since of now, turning them into complex image-text collages. Name-tags are attached to photographs, making them complex, layered collages of meaning and reference. Such place names or toponyms, according to Matthew Johnson, 'continue to be an invaluable source of information, particularly in the topographical information they provide,' as it is possible to reconstruct ideas, narratives, purposes, and values of a society that made a certain map, out of the toponymic names on the map. Mapping over a photograph is often even accompanied by crowdsourced data tagging, with crowd tagging, over-tagging, and user-driven annotations adding further complexity. Using the navigation feature in the Google Maps application, a user of the map now moves through a dynamic system of explanation and interaction, rather than simply wandering the streets of a city or the hills of a wood in search of a place. Naming and renaming are interesting because they indicate the specific meanings, histories, and social intentions which become attached to the places on a map.

The post-digital age has led to more interactive maps, bringing with it different kinds of interactivity and user-orientation, such as the browsability of fixed maps (while at the same it is possible for users to navigate aerial or street-view photographs as well). In the post-digital era, map and landscape are merged as data is introduced into another map. Moreover, different types of maps are merged with the landscape, which carry not only information on place and space, but also spatially organized information, such as geo-positioning and geolocation which effectively maps the user. By merging landscapes and maps, precise places with spaces, and direct visions with visualizations, all previously divided spatial descriptions are merged, and confused. Qualities of the two previously separate genres fuse, and in a way mutually contaminate.

Fusing together this enormous amount of data, some of which are also maps, the medium as the act of photography loses its vagueness, by which something that necessarily exists is not the place humans necessarily recognize. Being precise and deictic, photographs are obliged to represent and lose the artistic vagueness characteristic of the medium. Among such data, geo-mapped photographs play a large part, as they are simultaneously used for mapping the road, used for targeting and evading privacy. Today, most photographically based images are automatically encoded with location data. Maps situate photography in place which can be tracked and found. Today most of the cameras automatically precise the place via GPS, while GIS mapping can be introduced to mobile phones, already traced and continuously monitored by satellites.

Once set on the network, such images directly produce data that can be used in order to engage many actions, even the complicated ones of satellite tracing. Such new total images connect the devices to the internet, even acquiring an Internet Protocol (IP) address, and with the direct implementation of GPS and GIS technologies, superimpose traceability onto ordinary human visual control and perception. Along with advanced GPS features, both photographs and maps are incorporated into new location and tracking devices.

On the other hand, introducing location technologies into images produces a new sense of targeting and spatial fixation. What changes in particular with maps is their visualityand it is two parallel tendencies that mark this development: the de-visualization of maps, as tools of visualization, through their transformation into systems that self-organize around the act of use, rather than being visually constantly present; and the absorption of photographs into yet one of the layers of maps, blurring their function. A map is not only sequenced and de-visualized in its peculiar abstract sense, but also increasingly interactive and algorithmically responsive. While the map becomes a hypermap, containing in itself many strata of information, as layered metadata, landscape produces a place into a hyper-place, merging various visual information, sensory inputs, and temporal layers.

With GIS technology, maps are no longer general but user-oriented and situated. Visualization of maps has undermined the original evidentiary function of photographs. At the same time, maps began mapping users, not the territory. With new location technologies, maps became localized, losing their stable, general purpose by organizing around dynamic directions, itineraries, or routes that refer only to sections of the map. It is the map that mocks the viewer, showing something that can never be fully seen. Meanwhile, introducing location technologies into images produces a new sense of targeting. What changes in particular is the de-visualization of maps as tools of visualization, transforming them into systems that self-organize around use, rather than being visually constantly present, while photographs are absorbed into another layer of the map.

Still, by merging with maps, photographs which once stood for particular yet often anonymous or unfamiliar places to the audience become very precise, geo-mapped, and time-stamped locations. Now, with the merge between photograph and map, these hybrid forms teeter between realism and abstraction, immediacy and mediation. They are again, as Peutinger's map, neither-map-nor-landscape, and neither real-nor-abstract. Yet, the problem of mixture is not in its vagueness, but in its generative ambiguity. It produces forms that cannot be easily defined yet persist in shaping how we understand, experience, and navigate space. Yet, despite the introduction of aerial photography and digital maps, bringing once split reality closer, especially by datafication, the divide between the map and landscape persists. With Google Earth Engine, for example, the divide between the map and landscape is still profound and applied to different projects, Google Maps and Google Earth, respectively. While allows the viewer to sliding aside the orthogonal view for about five degrees, which maintains maintaining fixed shadows, allowing travel through streets, and 360-degree view, Google Maps combines flattened abstract street organization with Google Earth satellite image, as well as photographs uploaded by the user community.

While these image genres have been partially integrated with new techniques for visually representing the world we live in, this has changed the way we use maps and landscapes as well. To have a view that is cartographic and realistic the user must change layers or switch the platform in toto. Digital maps, which are more complex than analogue printed maps because they contain more information, in so far as the information which they contain is interactive and transforms according to the needs of the user, are also doubly coded: once by the computer and once by the user. Because of this double coding, and the consequent transformability of the map, the map can be manipulated. And the interpretation of digital maps becomes particularly tricky when photographic materials are employed in their production, given the epistemic power of such photographs. Although analogue photographs are not originally coded in the same way that digital photographs are, neither consists of the same kinds of discrete elements that both the language alphabet and cartographic symbols do, Hayles calls iconographic as bearing 'morphological resemblance to its referent', once fragmented, can be employed as a material in various manipulations too. Likewise maps, in contrast to analogue photography, digital photography is discreet, consisting of equal basic elements, which are then computable. The pixel is the simplest metrical element. Because of this, large constellations of pixel structures may be more easily traced by photogrammetric software merging images.

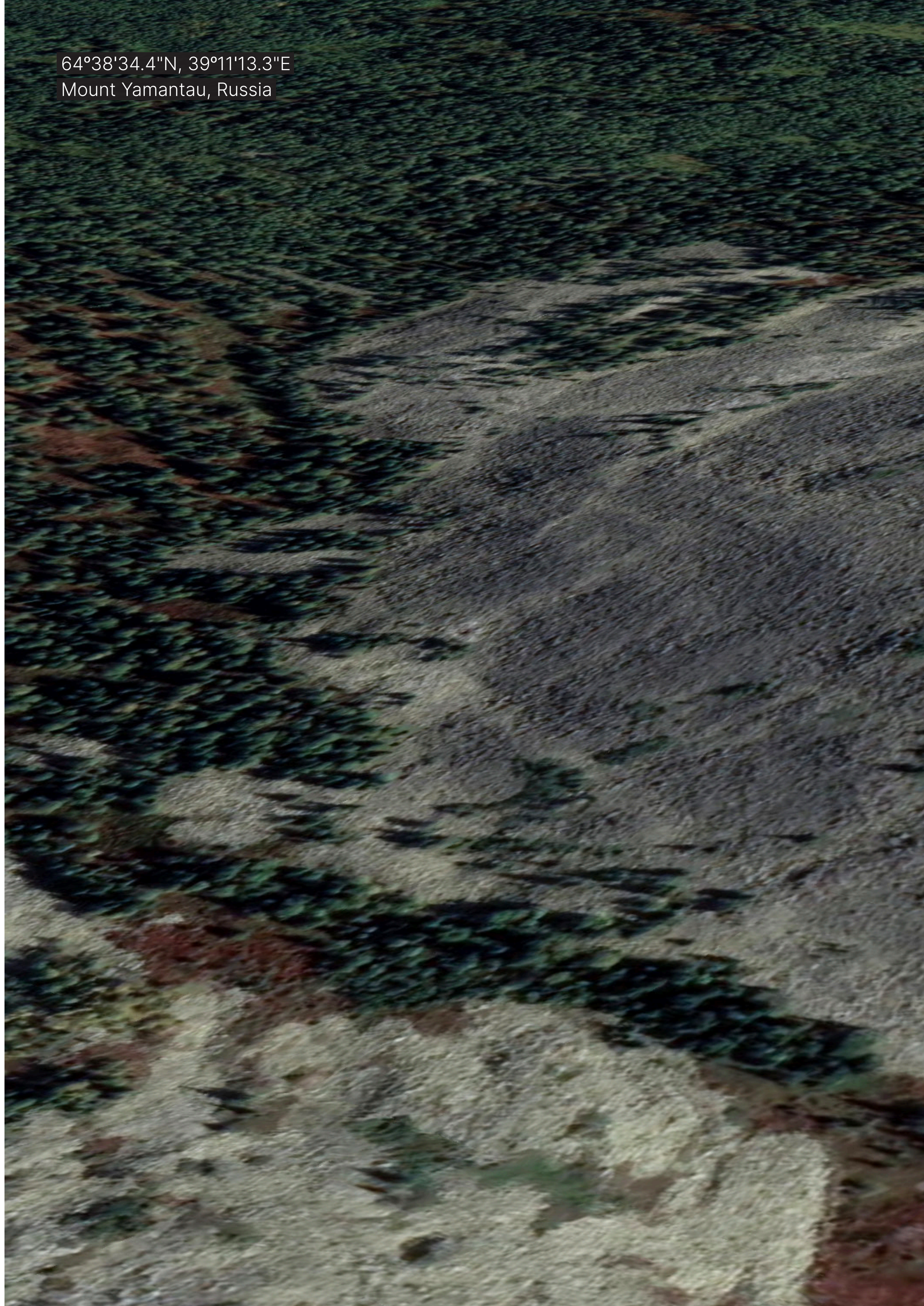
The merging of complex data does not just merge photographs and maps, but at certain stages in the process fuses them, using these as building material for a precise three-dimensional reality. Ultimately, of course, such digital photographs may still be printed on paper, as has been done with analogue photographs for nearly two centuries now. But having been reworked and distorted, even these photographs fail to provide a direct and undisturbed relation to the reality. Post-digital aerial and satellite photography is not exclusively a photographic medium. Here, the photograph is but one layer of many. Or it is merely a visual style for the image.

Whether part of the hypermap, orthomap, or photomap, the photograph is given a secondary role and value. It has lost its representative function. It has become a coded system. Even so, however, in comparison to the visualizations of large datasets, photography fails to be authentically 'deep' in terms of the amount of information carried by it. Or, its 'depth' may consist of a mere resolution enlargement. These images display an enormous amount of information, as well as offering both close and distant views and far breaking the barrier of the human vision. They are breaking the boundary of human photography by offering the near and far, which was previously dividing tele and macro photography. As the resolution of images constantly changes, the image with the highest resolution is a breakable border.

Images of the Earth and the layers of its atmosphere which are taken from planes in the air can be photorealistic. But such images become more and more abstract when taken by satellites in the space. Different systems of coding and transmission are used with new technologies from radar to infra-vision. This way, the more the aerial view is coded, the less realistic the image is. Indeed, these new kinds of images do not appear at first sight to be as substantially coded as maps, because to one degree or another they still represent the Earth indexically, or at least with some factual connection, such as by incorporating aerial photographs.

Even so, the overall lack of realism in such a total image, because it encompasses a view extended beyond that which the naked human eye could naturally perceive by using technology. With the innovation of aerial photography, it is the map that becomes real. But in turn, such photography also introduced an abstract vision, as abstracting from a human position. The space in which we live today is a space which is computed, assembled, and multi-perspectival. Maps are no longer necessarily objective, because they are based on data, and at the moment in which a user views or interacts with the map, they are viewing or interacting with data that has already in some way gone through a process of selection and interpretation.

As computed photographs and maps, once being closely tied to physical reality, have become yet another tool of visualisation, we have dived into virtual space. Neither landscapes nor maps do necessarily mean a real place. They are not settled on one side while reality on the other anymore, but everything is fully integrated inside the map, from cars driving, over taxi services and apartment rentals, restaurant working hours. Both are combining a part of material reality with the abstracted one. In many cases it is impossible to split the cartographic reality from the geographical one. In parallel to a great precision of the place, a new generation of fully places that emancipated from physical reality, such as virtual places are expanding our perception of the real space, and overlapping with the real ones in many cases, changing their meanings, as in augmented reality. The world of today is a super-networked self-organizing datascape, rather than a fixed reality. There are many interpretations of reality co-existing, each presented as a total and unique one. All images of it are distorted and our visual conception of reality, by mapping it.


64°38'34.4"N, 39°11'13.3"E
Mount Yamantau, Russia


7°18'47.9"S, 72°24'39.6"E
Diego Garcia, Indian Ocean

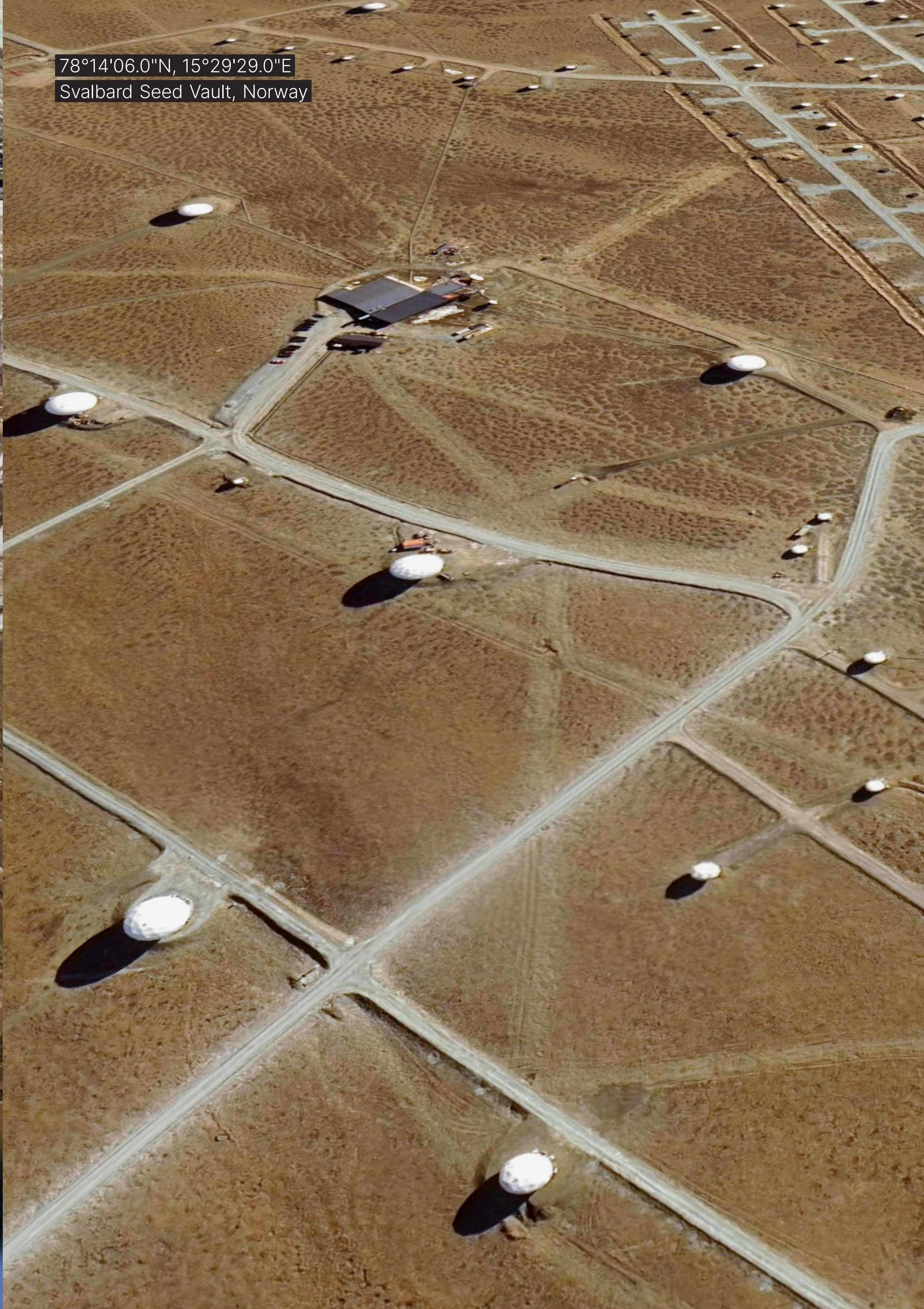

7°18'47.9"S, 72°24'39.6"E
Diego Garcia, Indian Ocean


11°31'00.1"N, 43°04'00.1"E
Chabelley Airfield, Djibouti

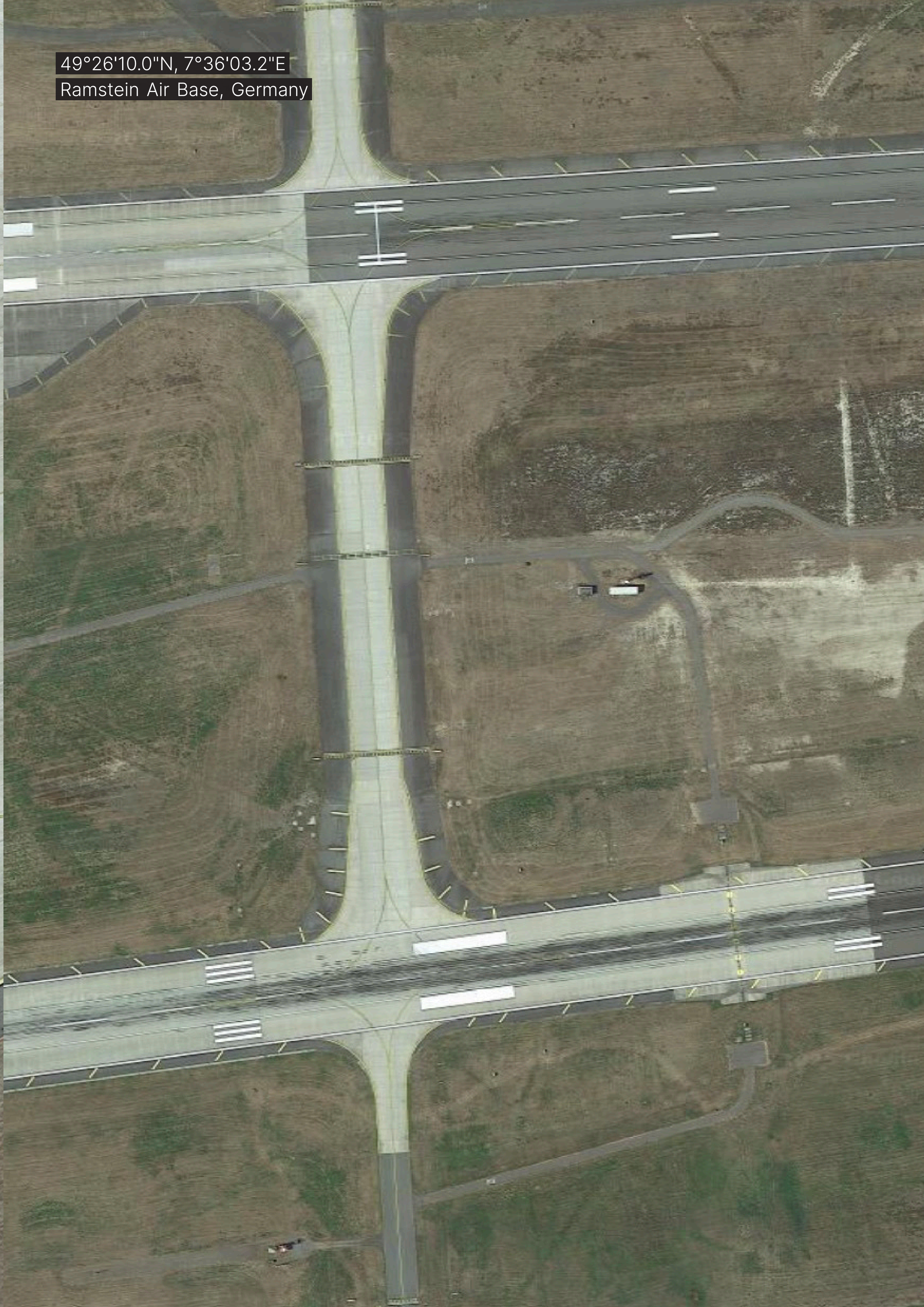

11°31'00.1"N, 43°04'00.1"E
Chabelley Airfield, Djibouti

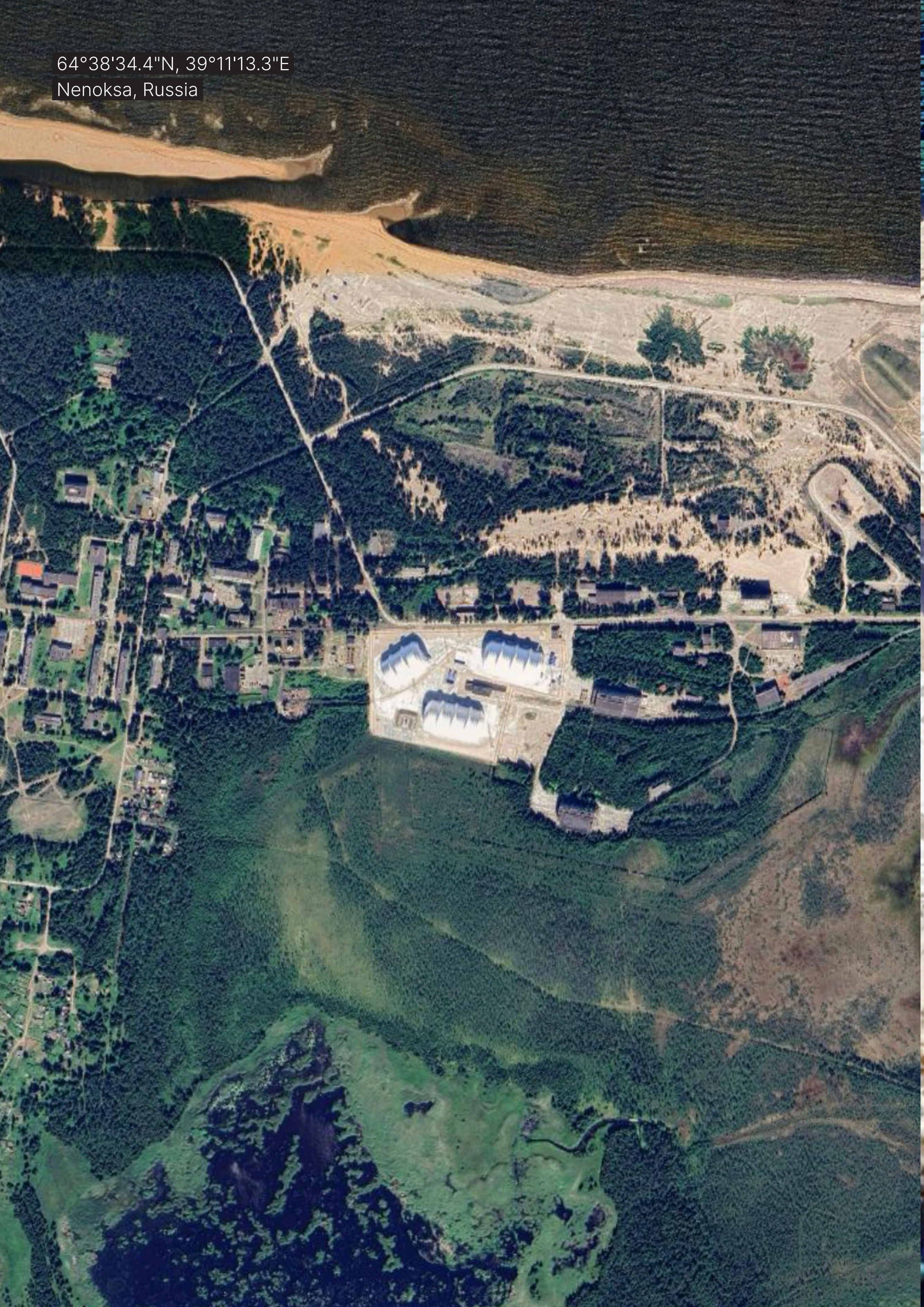

37°14'52.9"N, 115°48'00.6"W
Area 51, United States


78°14'06.0"N, 15°29'29.0"E
Svalbard Seed Vault, Norway


78°14'06.0"N, 15°29'29.0"E
Svalbard Seed Vault, Norway


49°26'10.0"N, 7°36'03.2"E
Ramstein Air Base, Germany


49°26'10.0"N, 7°36'03.2"E
Ramstein Air Base, Germany


64°38'34.4"N, 39°11'13.3"E
Nenoksa, Russia


64°38'34.4"N, 39°11'13.3"E
Nenoksa, Russia

76°31'52.0"N, 68°42'11.9"W
Thule Air Base, Indian Ocean


69.927944°N, 31.934635°E
P-70 Lena-M Radar, Russia


45°29'09.1"N, 141°55'47.8"E
Maruyama, Japan

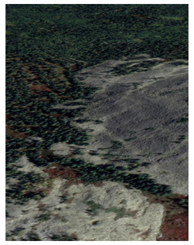

19°54'20.2"N, 75°12'36.0"W
Guantanamo Bay, Cuba

19°54'20.2"N, 75°12'36.0"W
Guantanamo Bay, Cuba


54°00'45.1"N, 1°41'37.8"W
Menwith Hill, United Kingdom

Location A
64°38'34.4"N, 39°11'13.3"E
Mount Yamantau, Russia

Mount Yamantau is a secret hidden Russian site, believed to house a underground militar nuclear bunker.

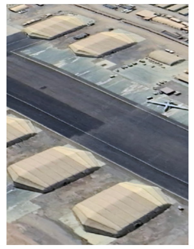


Location B
7°18'47.9"S, 72°24'39.6"E
Diego Garcia, Indian Ocean

Diego Garcia is a remote and restricted island in the middle of the Indian Ocean, hosting a secretive military base with no public access.


Location C
11°31'00.1"N, 43°04'00.1"E
Chabelley Airfield, Djibouti

Chabelley Airfield is a key US drone base, enabling covert operations across Yemen, Somalia, and North Africa.

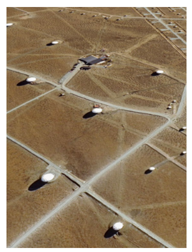



Location D
37°14'52.9"N, 115°48'00.6"W
Area 51, United States

Area 51 is an US military base in Nevada, infamous for UFO theories and alleged extraterrestrial research.

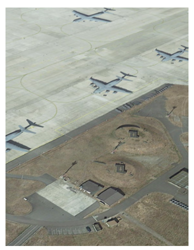
Location E
78°14'06.0"N, 15°29'29.0"E
Svalbard Seed Vault, Norway

Svalbard Seed Vault safeguards global diversity, preserving seeds as a backup for future food security due to climate challenges.

Location F
49°26'10.0"N, 7°36'03.2"E
Ramstein Air Base, Germany

Ramstein Air Base hosts the US 86th Airlift Wing. It is the largest military community outside the United States.




Location G
64°38'34.4"N, 39°11'13.3"E
Nenoksa, Russia

Nenoksa is a Russian missile testing site with newly built large-scale launch facilities. It's devices are aiming at the White Sea.


Location H
76°31'52.0"N, 68°42'11.9"W
Thule Air Base, Indian Ocean

Thule Air Base is a key US military outpost for missile warning, defense, and space surveillance. It is positioned between the US and Russia.

Location I
69.927944°N, 31.934635°E
P-70 Lena-M Radar, Russia

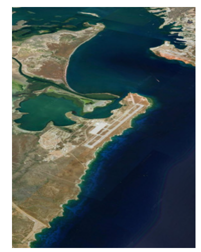
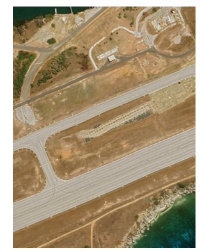
The P-70 Lena-M is a Soviet radar, created for strategic surveillance. Today, it's part of Russia’s current air defense radar systems.

Location J
45°29'09.1"N, 141°55'47.8"E
Maruyama, Japan

The Maruyama SIGNIT station monitors Russia radar signals, supporting the Japan and US surveillance and intelligence.

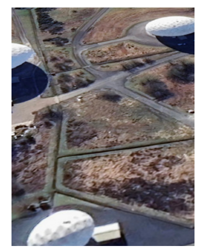
Location K
19°54'20.2"N, 75°12'36.0"W
Guantanamo Bay, Cuba

Naval Station Guantanamo Bay is the oldest US overseas base, strategically located in Cuba for military and humanitarian operations.

Location L
54°00'45.1"N, 1°41'37.8"W
Menwith Hill, United Kingdom

Menwith Hill is a UK and US spy base supporting global surveillance, intelligence and drone operations.



Chapter 1	Text A	02	Paglen, T. (2016, December 8). Invisible Images (Your Pictures Are Looking at You). The New Inquiry
	Text B Text C	08 12	Parikka, J. (2023). Operational images: From the visual to the invisual. University of Minnesota Press.
Chapter 2	Text D Text E Text F	16 24 29	Peraica, A. (2019). The age of total images: Disappearance of a subjective viewpoint in post-digital photography (Theory on Demand No. 34). Institute of Network Cultures.
Chapter 3	Text G Text H Text I Text J	34 38 45 48	Peraica, A. (2019). The age of total images: Disappearance of a subjective viewpoint in post-digital photography (Theory on Demand No. 34). Institute of Network Cultures.
Chapter 4	Image 01 Image 02 Image 03 Image 04 Image 05 Image 06 Image 07 Image 08 Image 09 Image 10 Image 11 Image 12 Image 13 Image 14 Image 15 Image 16 Image 17 Image 18	41 42 43 44 45 46 48 49 50 51 52 53 54 56 57 58 59 60	Google. (2025). Google Earth (Version 7.3) [Computer software].

Authorship

Academic project developed by Inês Velasco, for the Project II unit, in the scope of the Master’s Degree in Communication Design at FBAUL.