PHOTOCARTOGRAPHICA

Traversing Photographic and Cartographic Mediation

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Introduction

Towards an Entangled Account of Photography and Cartography as Spatial Mediators

In contemporary digitally networked cultures, new media and image technologies have profoundly altered the way we experience our surroundings. Two technologies of mediation that play a continuing role in quotidian life are photography and cartography. Generally, both photography and cartography cut off and fixate a portion of space and by doing so convey spatial relationships. Having said that, they make up two distinct ways of visualizing space: that is, cartography traditionally employed bird-view perspectives whereas photography was more often concerned with street level views, at least before the camera was tied to a pigeon or brought aboard airplanes. However, in the age of ubiquitous computing both photographic and cartographic images have become programmable, mutable and exist in a permanent state of incompleteness due to their endless malleability (Lister 2013). Thus, both media currently undergo a transformation that leaves room to reconceptualize their reciprocal relationships. As film theorist Anne Friedberg has argued, "new imaging technologies have entailed a radical transformation of the spatial-temporal structure of representation" (2006, 3). Indeed, new image applications increasingly pivot on the visual as navigable database, hence confusing boundaries between formerly distinct media. Different media systems rely to an increasing extent on similar software, and as a result the parameters of media collide, both on a technical and perceptual level (Cohen and Streitberger 2016). One might argue cartography and photography have ceased to exist as two clearly distinguishable media with the landing of digital technology, as is for instance clearly manifested in Google Earth. Nonetheless, the cartographic and photographic as aesthetic and analytic categories continue to bear relevance. This research ties in with the urgency to rethink current and historical intersections of photography and cartography, an issue that has resurfaced with the advent of the digital.

However, in this study I assert that both photography and cartography have always been heterogeneous media phenomena lacking rigid boundaries, even long before the digital turn. Tapping into the old art-historical discussion on medium specificity, it immediately becomes clear that the term medium is ambiguous. In art-critical discourse it was modernist advocate Clement Greenberg who reduced the medium to the physicality of its support (1940). Eschewing this narrow notion of medium, art critic Rosalind Krauss instead proposed a self-differing medium specificity, that can never be collapsed solely into specific conventions or materials (1999a; 1999b). The internal plurality of the artistic or photographic medium is also emphasized by art historian Helen Westgeest, who points out that

photography has always been diverse in its physical manifestations (2008). Yet, I would contend that precisely because of this pluriformity the term medium itself falls short. Therefore, I would argue that the photographic and the cartographic have never belonged to two isolated and autonomous realms, even though the precise attributes of these technologies have ultimately changed with the dawn of the digital. This study, accordingly, considers the continuities and ruptures allowed and prohibited by digitization in order to come to a more nuanced understanding of the contemporary and historical convergence of photography and cartography. To this end, it zooms in on the interesting dynamic or matrix that visual imagery creates. By examining a varied mix of cartographic and photographic phenomena from different time periods, I argue that, rather than reflecting a linear historical progression of paradigms, digitization entails a reconfiguration of constituents in the process of mediation.

The argument will be unpacked in a number of case studies that operate across diverse photographic and cartographic practices. The aim of this study is to work towards a more comprehensive understanding of the logic underpinning both photographic and cartographic mediation. Furthermore, I aim to characterize the complex and overlapping relations between digital photography and digital mapping practices through an expanded definition of cartography and photography as, what geographer Trevor Paglen has described as "seeing machines" (2014a), devices that dynamically act upon the world. I have observed the characterization of such "seeing machines" to have much in common with the experience of reading a newspaper article that philosopher and sociologist Bruno Latour puts forth in his seminal work *We Have Never Been Modern* ([1991], 1993). He asserts that the descriptions that we might encounter in these newspaper articles oftentimes transcend the disciplinary boundaries that have been established at universities. Yet, even though each element within a newspaper story might be studied in another academic department, we are accustomed to navigate these spaces in everyday life without getting confused (Latour 2). Likewise, the case studies that inform my arguments do not neatly fit categories of for instance the aesthetic or the social. For this reason, I propose a mixed theoretical approach to contemporary media-saturated image culture, as traditional theories grounded in disciplinary departments do not provide sufficient analytical tools or might even hinder a nuanced understanding of present-day digital image systems. Whereas commonly the world is thought to consist of entities that have existed prior to the relationships they establish with other entities, in this study I would rather reverse this approach to concentrate on the spaces in-between.

To that end, rather than adhering to modernist teleology or naive notions of progress, this study demands a theoretical approach that embraces non-linearity and non-dualism. By focusing on agency as contingent on human and non-human entanglements this study draws upon new materialist

scholarship and fits in an ongoing academic endeavor invested with rethinking forms of subjectivity grounded in Enlightenment thinking. Vital to this methodological shift is a focus on matter as the materialization of relationships and as a congealing of agency. Revising conventional notions of matter as uniform and passive, this research focuses on the indeterminacies of space as produced through photographic and cartographic mediation. Spearheaded by, amongst others, Rosi Braidotti (1994, 2002), Manuel DeLanda (1997, 2006) and Karen Barad (1998, 2007), new materialist thinking centers on the agency, processual nature and self-organising faculties of matter. New materialists share their discontent of the one-sided focus on the power of language in scholarship, as the lasting heritage of the linguistic turn in philosophy during the 20th century. In compliance with new materialists thinking, in this study I will engage with the entanglement of meaning and matter. Furthermore, by moving beyond persistent dichotomies of subject and object, I intend to start thinking from the act in which these oppositions come about. Notably, the effects of new visual technologies are dependent on non-human entanglements and thus require a methodological approach that moves beyond conventional humanist and anthropocentric models.

New materialism promotes a cultural perspective that upsets dualisms and for this reason is necessarily transdisciplinary. It aligns with posthumanist, non-representational and post-Deleuzian theories, lines of thought that scrutinize the material aspects of abstract entities such as politics and discourse. The emancipation of matter from a passive state of being, is also necessarily a feminist project as it centers on the situatedness of knowledge (Haraway 1988). Recently, within anglo-saxon discourse on space and spatiality the idea of space as socially, culturally and materially produced has taken root (Merrimam, Jones, Olsson, Sheppard, Thrift, Tuan 2012). Nonetheless, conceptions of space as quantifiable, measurable and contained still prevail, notably in the traditional representational understanding of photography, as well as in more traditional fields of geography. Following this line of thought, this research will probe the materiality of space as a lived phenomenon that is mediatized and produced through photography and cartography. By "lived space" I refer to any conceptualization of space that does not reduce it to the static and the inert (Foucault 1980), or as a pre-existing container in which things are to be placed, but rather as co-produced with the proceedings of the world (Thrift 2007; 2009), as a material process (Léfèbvre [1974],1991), as a convergence of movement and vision (Merleau-Ponty [1945], 1962), or the movement of the body (Casey 2001; De Certeau 1984). In these accounts space is not a pre-given and flat surface devoid of temporal dynamics. Instead, these authors posit space as that particular dimension of the world in which we live that is necessarily always co-produced with our mental and temporal experience. This study is occupied with the issue how such a

dynamic conception of space is foregrounded in photography and cartography, or more specifically in the moment where the photographic and the cartographic collide or hybridize. Space, as composed of matter, cannot be deemed a passive background "out there", but embodies an active and dynamic agent that is processual, co-productive and self-organizing (DeLanda 2016; Braidotti 2002; Barad 2007; Hird 2010; Bennett 2010). A critical method that sprouts from forefronting the agency of matter is the practice of *diffractive reading*. Donna Haraway (1992;1997) already suggests to employ the notion of diffract rather than reflect, as the latter implies distance and therefore assumes objectivity. Diffractive reading entails, according to Barad, "reading insights through one another" (2007, 25). As such, diffraction does not equal comparison, as the latter implies two or more pre-existing entities that are then compared to one another. Instead, diffraction should draw our attention to the always-becoming of the make-ups we are used to call "world" (Kaiser and Thiele 2014).

Taking these methodological considerations into account, this research aims to probe the following question: how does the convergence of photographic and cartographic mediation account for space as lived? The main research question will be explored through the following cascading subquestions: how is photography shaped by cartographic concerns, how is cartography shaped by photographic concerns, how has the advent of digital technology altered the dynamics between both media, and how is spatial meaning created and conveyed through photographic and cartographic means? To provide an answer to these questions, this study will not start with an idea of subject and object but rather looks at the processes of transformation in which these concepts come into being. New materialist theories often relate to ethics, responsibility and accountability, aspects that are necessarily involved in a relational theory of matter. In this study I am rather interested in the consequences of the material turn on the way spatial mediation, such as cartography and photography, is conceived. The case studies in this research, that are difficult to pin down to a specific medium, just suggest the various relationalities and entanglements that new materialist theory hints at. Moreover, their claim that everything is always-already interconnected and in process simultaneously provides a solution for the question how cartographic and photographic mediation can account for a dynamic concept of space, and how one could theorize the confluence of both media.

Every partaker, human or non-human, in the mediated process of producing spatial meaning attributes to this process, and each actor has its own indeterminate characteristics. Thus, they reveal themselves as cartographic or photographic media through what Barad calls "agential cuts" (2007, 340), boundary-making practices that create material configurations of the world. This research is invested with identifying these myriad cuttings together-apart that determinate the phenomena of cartography

and photography. Barad argues that these cuts are made in several apparatuses and practices of observation and interpretation. Following these assertions, I argue that the convergence of cartography and photography is necessarily analyzed through agential cuts. Such a convergence is only imaginable if one conceives the world to be a complex and process-oriented entity that is neither pre-existing nor containable. Rather than focusing on causal structures, teleology or determinism, this study aims, following Braidotti (1994) and Hird (2004), to set forth a mapping or cartography of the ways photographic and cartographic mediation collide, without excluding the temporal aspect.

The first chapter explores the reciprocal shaping of cartography and photography across a variety of photographic forms of mediation throughout the relatively short history of photography. Dissecting the 19th century system of metric photography, an apparatus devised by Alphonse Bertillon for use in criminal forensics, and early 20th century aerial reconnaissance this chapter examines the early investments of photography in the cartographic practice of mapping unknown lands and bodies. These examples are put across a recent artwork by filmmaker Eric Baudelaire, titled *Also Known as Jihadi* (2017), a film that traces the journey of a man from Paris to the Middle East to join a terrorist organization through a consecutive series of landscape shots. Through these examples this chapter posits the cartographic as an analytical lens that maps the boundaries between media.

The second chapter explores photographic concerns across cartographic mediation. Google Earth is here one of the most evident examples. A less conspicuous case is the initiative Forensic Architecture, an agency whose primary mission entails to develop evidentiary systems related to specific court cases. Finally, Zachary Formwalt's *An Unknown Quantity* (2015) is a video work comprising numerous photographs that map the interior and exterior of the Amsterdam Beurs van Berlage. As such, it focuses on the limitations or impossibilities of the photographic to visualize capital in the age of high-frequency trading. This chapter contends that the photographic can be deemed as dynamic agent that inflicts a cut.

The third and final chapter looks in particular at the peculiarities of the digital image and takes the algorithm as its focal point. This chapter zooms in on the reshuffling of constituents within mediatic phenomena as a result of digital technology. It traces the algorithm as a program or protocol of the image that did not newly emerge with digital technology but dates back to the Renaissance and was related to the outset of the humanist episteme. In this period the science of cartography quickly evolved and map projections that shaped the identity of the modern world where produced. The static map images of Renaissance and subsequent cartographers are followed by digital map applications, primarily Google Maps. As navigational platform Google Maps offers the driver the quickest route

possible by algorithmically considering real-time traffic patterns, and therefore provides a poignant example of entangled phenomena of co-constitution. The chapter wraps up with Joan Fontcuberta *Landscapes Without Memory* (2005), an artwork through which he has utilized computer software intended for use in science and military for rendering three-dimensional images of cartographic data. Fontcuberta, however, fed the software a series of reproductions of impressionistic paintings and photographs of his own body, thereby creating a series of post-landscapes that create a no-man's land between the virtual and the real. In this last chapter, the algorithm consolidates the dialectics between motion and inertia. By no means do I aim to permanently resolve the tension between forms of mediation, perceptive modes or the world and the image. Adhering to the theoretical arguments that this study puts forward, I mean to settle on temporary solutions rather than freezing these concepts into a perpetual state of being.

Chapter 1 **The Cartographic**

The Image with/in Navigational Trajectories

On a chilly sunday morning, the last day of May 1908, police officers are called to a Parisian apartment located at an alley in the 15ème arrondissement. Two bodies have been found that morning by the resident family's servant. The victims are identified as painter Adolphe Steinheil and his mother-in-law. Whilst the forensic inspectors search the apartment, one of the officers, Alphonse Bertillon, installs a tripod right above the victims and takes photographs of the bodies at a perpendicular angle. (Dudley 1960)

Seeking a reliable and objective means of crime investigation, Bertillon had devised a method that fused photography with other geometric devices of cross-section and measurement. The resulting schematic photographs hover uncomfortably between photographic pictures of deceased human beings and diagrams of corpses and crimes scenes. Such a moment of suspense between one way of looking and another informs my analysis of the collapse of cartographic and photographic mediation. In this chapter I direct my attention to cartographic concerns that undergird photographic mediation. To accomplish this, I will explore how photography can be approached and theorized through a cartographic lens. When employing this *cartographic reading*, I aim to account for the indeterminacy of both space and the photographic apparatus by permeating its boundaries, extending its scope and impeding on their separate conceptualizations. Simultaneously, this stance provides a fresh perspective onto photographic epistemologies that are still haunted by age-old problems of realism and representation. As photographer and geographer Trevor Paglen asserts, photography always sculpts the world in specific ways (2014), hinting at the relational landscapes that photography is part of. Along these lines, this chapter aims to extend the enduring emphasis on the photograph-as-object, by foregrounding the processuality of mediation. To this end, I explore my case studies in terms of the *navigational trajectories* they afford. This notion enables me to examine the folding together of photographic and cartographic *mediations* on a technical, material, perceptual, discursive and metaphorical level.

1.1 Photography, a New Objective Vision?

Since the early days tailing its invention, photographies - plural as different processes of image-making have always coexisted - have been celebrated for both their mathematical accuracy and their presumed lack of human, and thus error-prone subjectivity. The potential that the newly conceived technology held

for scientific purposes was recognized at an early stage already (Trachtenberg 1980, ix). Pioneers of photographies were entrepreneurial inventors, chemists, astronomers, botanists, engineers or a combination of the listed professions. It may well be due to the lack of exclusive specialization that photographies have been invented, as it was the combination of chemical and optical knowledge, the artistic and scientific desire to fix the image of the camera lucida and an entrepreneurial spirit that eventually tied the knot. In short, its differential application following these experiments indicates that from its outset photography's ontological status had been difficult to pin down (Van Gelder and Westgeest 2011, 1).

When the technology outgrew its infancy and started to mark a territory a few decades after its initial phase of experiments in light sensibility, it became more firmly affiliated with the scientific epitome of "mechanical objectivity" (Daston and Galison 1992, 40). As is pointed out by evidence law theorist Jennifer Mnookin, it was believed that photography's technical procedure made possible a previously unimagined objective vision that held promising applications in the fields of criminology and law (2015, 9). We can here draw an analogy between the magical allure of the photographic process and the revelation of truth: The true account of the events was thought to be inscribed on the victim's retina as the last thing they saw before dying in the way a photographic image is latently registered on a sensitive plate (Lanska 2013). Nonetheless, new insights in late 19th century psychology curtailed reliance on the human memory as a means for reconstructing facts in a court case, and the status of the eyewitness eroded as a result (Lebart 2015, 19). Photography quickly filled up that hiatus as a more detached means of investigation and as such stood at the cradle of modern police technology. In these years recidivism posed considerable challenges to police departments (Kaluszynski 2001, 123). It was French criminologist Alphonse Bertillon who used photography in a sophisticated system he had devised to identify and document recidivist criminals that proved vastly successful throughout subsequent decades from Paris to London and New York.

A few years ago, I encountered one of Bertillon's shiny gelatin silver prints exhibited at a museum space. Displayed as a pristine work of art it was framed individually with an emphasis on its material fragility and the quality of the print. It was at this very moment that it struck me how this photograph, here reduced to a simple picture of a dead body aestheticized in the realm of the museum, had actually been used in police stations, forensic laboratories and courtrooms. I could imagine them passing through the fingers of police investigators, stowed away in cabinets to be recovered again at later stages. They undeniably had been part of a complex material and discursive procedure crucial to the localization of victims, murderers and crime scenes. In an attempt to move beyond the prevailing

institutional framing of photography as autonomous representational medium, and more importantly the focus on the photographic object, I aim to contribute to ongoing scholarly attention to the processuality of photographic and cartographic mediation.

The artifact of inquiry that this analysis departs from is an index card related to the murder of Monsieur Steinheil that carries a photograph of his corpse brightly lit by a magnesium flash-bulb. The print is framed by a grid and the inscriptions "prefecture de police" and "photographie metrique". The print itself depicts the artist, 58 years of age, who was found lying backwards on his duvet, with a piece of cloth in his mouth and a cord around his neck. The photograph reveals parts of his bedroom, a night stand holding some household ornaments, a folding screen and a pair of curtains suggesting a window. Moreover, we see one leg of a tripod and the shoes of the officer in service, the photograph is subtly hinting at its own production process and therefore foregrounding what is at stake.

1.2 The Visual Metric: From Bertillonage to Aerial Reconnaissance

To benefit the search for the culprit of the crime, Bertillon's biometric identification method of recidivist criminals relied on a set of measurements of the interrelationships linking different body parts. A criminal subjected to *Bertillonage* would be forced to undertake a series of anthropometric measurements taken with the use of specially designed gaugers, rulers and other instruments carried out under the strict instructions of Bertillon himself. Eleven different body parts were assessed, selected for their relatively low chance to be affected by processes of aging, and gaining or losing weight. Subsequently, descriptive bone data were drawn from these measurements, collected on index cards and stored in large cabinets. The third and final step of Bertillon's elaborate system comprised a series of front and side-view photographs that introduced the modern mugshot to police work. These efforts to control and contain the (criminal) body (Foucault 1977; Sekula 1986; Gunning 1995) existed parallel to his documents of murder victims. As such, Bertillonage evokes the formal precision of geographical surveys, instead mapping the topography of the body with compelling analytical distance.

The metric photography that Bertillon employed seems to comply with traditional conceptions of cartography as systematized representations of space. Bertillon's photographs of murder victims were taken using an overhead wide-angled camera mounted face down on a tripod leveled exactly two metres above the corpse. In order to see the full body and reduce distortions, the centre of the lens had to coincide with the middle of the corpse. The developed silver gelatin prints were glued on cards specifically designed for this purpose, including precise indications of distance and inclination. Alongside the x- and y-axis, metric photography also includes a z-axis supporting the vertical view down that allows

the investigator to determine quite precisely the measurements of bodies and objects and any distances between them. The desired result was a detailed spatial layout of the position of body, potential weapons and other pieces of evidence. Accordingly, in technical terms the perspectomatric grid, analogue to grid references on charts, allowed the photographs to be read as if they were maps.

I would contend that, perceptually, the perpendicular look down upon the body invites a cartographic gaze that is carefully examining the photographic surface. The territorial logic and the "view from above" conveyed by the crime scene imagery both formally and conceptually coincide with aerial photography. The extension of human vision with aerial photography was professionalized and industrialized on a massive scale during World War I, as a direct consequence of the concealed nature of trench warfare. The fatal wounds on the victims in Bertillon's photographs are echoed in the scars of the landscape inflicted by the "evil eye from the sky" (Amad 2012, 69). As theorist and photographer Allan Sekula observed, the incorporation of instrumental collages of aerial photographs with long ranging artillery has provided fertile ground for a new rationalized warfare (1975, 30). Indeed, it was only with the marriage of the camera and the airplane that the military and strategic purposes of aerial reconnaissance photography were fully realized. During both World Wars the French, Germans and Americans produced a sheer number of aerial photographs as an instrument for advanced military cartographies. Turning the Western Front into the most surveilled area on the planet, these images were used to localize hostilities, scrutinize the enemy's organization of defense and predict their future movements. Thus, in the cartographical application of photography, aerial reconnaissance photographs and Bertillonage served similar purposes as tools in ongoing spatial investigation rather than being merely signs or representations.

1.3 Vertical Perspectives in Machinic Vision

Both Bertillon's crime scene index cards and photographs for aerial reconnaissance are reminiscent of what German filmmaker Harun Farocki has described as "phantom images" (2004, 13), images that are not taken from a conventional human perspective but from a surrogate position. Harocki traces this idea back to 1920s American film recordings that deployed camera shots from unusual perspectives, as opposed to the subjective shot that is taken from the standpoint of a person. The phantom shot echoes what philosopher Thomas Nagel describes as the "view from nowhere" (1986). This perspective, he stresses, is often thought to offer the only valuable insights because it is derived autonomously. The legibility of this view thus in fact lies in its exclusion or "lack of perspective", the nowhere is a disinterested entity and thus independent of and unhindered by human flaws.

The scientific actualization of this philosophical "view from nowhere" would be the zenithal gaze (Söderstrom 1996; Pickles 2004). The zenith is an imaginary point that is positioned directly above a particular point in space, establishing a z-axis downwards. With the zenithal gaze, the viewer is brought into abstract relationships to the territory viewed. The vertical perspective has become the quintessential cartographic gaze, presenting an overview of spatial relations for a precise referential rendition. As art theorist Claire Reddleman points out, the cartographic view downwards "synthesises in one image a viewing position imaginatively located directly above all parts of the mapped area simultaneously" (2017, 57). Therefore, she suggests, this view is also affiliated with knowledge projection onto an area not yet encountered empirically. The cartographic image then generates the legibility of the territory when all reference points can be viewed vertically and simultaneously, resulting in a space that appears ordered and rational. Geographer Christian Jacob asserts that the idea of a detached view from above is a "timeless fantasy" that was only substantiated by cartography and later the technological practices of aerial photography that introduced the possibility of remote viewing (2005, 1).

Yet, the zenithal gaze is deemed authoritative because it remains conceptually incompatible with the human lived body. Against this background, airborne imagery equipped the military with new mechanical eyes. With the invention of photography, and slightly later the introduction of film reels for moving images, a new age of machine vision had already started. Regarding the lens of the camera, Soviet pioneering filmmaker Dziga Vertov put forward, "I am kino-eye, I am a mechanical eye. I, a machine, show you the world as only I can see it." ([1923], 1985, 17). This statement implies that the machinic eye is autonomous and separate from, even superior to, the human eye. Accordingly, in airborne photography the metaphorical "view from nowhere" and a set of free-floating machinic eyes coincide. As historian Raymond Craib writes, "the eye was detached from the viewer, surveying the landscape from above, so was it presumed that the map itself was disembodied, free of human bias and prejudice" (2000).

It follows from the above that the view downwards is connected to a surveilling presence - associated with domination and control - or a disembodied position of a God-figure. The problem at stake here is articulated in media theorist John Johnston's article "Machinic Vision" (1999), where he confronts the metaphysical distinction between man and machine in philosopher Paul Virilio's *The Vision Machine* (1994). The birth of prosthetic visual devices marked, according to Virilio, a sudden break with the order of natural perception that would pose a great threat to man. Johnston points out how the "unified natural body" proves to be the greatest obstacle in Virilio's theory, as by the same means it deems all technology alien and intrusive (32). To offer an alternative, Johnston appeals to the Deleuzian

notion of machine, that interrupts the dichotomized relationship between mechanic and organic. As Deleuze and Guattari argued, such a distinction cannot be made, assemblages encompass both elements (1980). Similarly, Jonathan Crary underlines that these assemblages are a "site at which discursive formation intersects with material practices" (1990, 31). Furthermore, as Donna Haraway posits, "the eyes made available in modern technological sciences shatter any idea of passive vision; these prosthetic devices show us that all eyes, including our own organic ones, are active perceptual systems, building in translations and specific ways of seeing, that is ways of life" (1988, 582-3). What Haraway points at is that remote viewing is far from disembodied. The apparatus is not merely a passive instrument but transforms "reality" into a picture (Marburger 2014, 119). As such, the apparatus has all kinds of social, political and aesthetic but also spatial and temporal parameters that must be taken into account.

Obstructing the myth of the detached aerial view, film theorist Paula Amad suggests that we regard the "view from above" in a "fluid, relational context" (67), as the aerial view cuts across the faculties of the eye and the body (86). Furthermore, the military aerial view has always been connected to other new spatial perspectives such as the laboratory microscope or the inverted aerial view up into the skies through the telescope. These "micro-macro perspectives", Amad asserts, stress why we cannot deem the aerial view as a separate and autonomous perspective. The abstracted outlook on a territory, cannot be disconnected from all the risks inherent in early aviation where "the public triumphs [...] were always shadowed by disaster" (73). Additionally, the military utility of aerial photographs was heavily reliant upon print enlargers and magnifying glasses to recover details that were lost in the tremendous reduction of the visual field, which further upsets the micro-macro dichotomy and cuts through techno-material faculties. This leads to the conclusion that the vertical view down is anything but objective and detached but is rather situated dialectically between abstracted and embodied knowledges.

The phantom perspective of automated warfare has given rise to a new image category. Farocki was one of the first to recognize a new visual regime inaugurated by image-making machines. In the third part of his filmic *Eye/Machine* series, Farocki deals with these images that are themselves part of operations and dubs them as "operative images". In the strict conception of Farocki, operative images are "made neither to entertain nor to inform" (2004, 17). As such, operative images do no represent reality but intervene within actions and processes. Operationality offers opportunities to rethink photographic images in new performative ways (Austin 1962). Rather than reproducing a pre-given reality, the image is entangled within different operations. The above suggests that it is when framed

explicitly as operative image that the photograph most visibly reveals its cartographic features: the image itself supports and assists in navigational procedures.

1.4 A Cartographic Lens: From Representation to Navigation

Throughout their history, maps have frequently been relied on as objective transmitters of knowledge. Consequently, a common interpretation of cartography presents the map as an objective and static representation of spatial relationships, which took over after the Renaissance and became firmly rooted in Western narratives of progress thereafter. Therefore, in traditional discourse, cartography is put forward as an abstract model of a material world. (Dodge, Kitchin and Perkins 2011; Crampton 2009; Pickles 1995). At the end of the 19ᵗʰ century, photography was inserted in this positivist mode of one-copy - one model. The representational status of photography, that was rooted in its mechanical objectivity, made it suitable as evidentiary tool (Mnookin 2015, 9). Sekula asserts how, starting from Henry Fox Talbot's experiments in calotype in the 1830s, photography had always-already been imbued with an evidentiary quality (1986, 6). However, as he emphasizes, the evidentiary power of photography does not merely lie in its indexical bond to reality that builds a correspondence with a physical territory. Rather, he insists, it is the "presentational circumstances" that infuse the photograph with a certain meaning, thus recapitulating photography as a social practice (1975; 1981). Bertillon's photographs, as I found them hanging in the museum, perpetuate a natural state of being, whereas the process of taking these photographs requires a calculated, enduring and laborious act. As criminologist Simon Cole puts forward, "Bertillon made it possible to visualize criminality in a ploddingly bureaucratic yet devastatingly effective way" (2001, 58-59). Bertillonage as a forensic investigatory method was effective, not because it articulates true reflections of victims and criminals alike, but precisely because it demanded a conjunctive reading of image and related data. We could argue that it is not only within presentational circumstances - i.e. at police stations and in courtrooms as opposed to the museum space - that Bertillon's perspectometric photographs gain meaning, but rather in the entire material-discursive constellation of reading and cross-referencing different index cards in the process of forensic research.

To explore this idea, I turn to an important distinction made by Valérie November, Eduardo Camacho-Hübner and Bruno Latour between a navigational and mimetic understanding of maps. They noticed that "digital technologies have reconfigured the mapping experience into [...] a navigational platform" (2010, 583), that is typified by a database/interface configuration. As such, the digital map marks a departure from the classical representational trait of cartography as a direct and fixed model of a reality out there. Whereas digital mapping applications as dynamic cartographies foreground the

procedural dimensions of maps, the analogue map seems an autonomous object. The authors argue instead that maps as techno-scientific processes are inherently navigational enterprises rather than mimetic ones. The distinction between, what they refer to as BC (before computer) and AC (after computer), lies in the detectability of these navigational processes, that have "re-materialized the whole chain of production" (584). Nevertheless, maps in the BC era are similarly substantiated through navigational processes. Therefore, so they argue, all maps consolidate cascading steps of data acquisition, storage, management and calculation. Additionally, I would posit that all maps serve some sort of navigational purpose. If maps are not used to literally navigate from one place to another, they can operate on other levels of localization. Navigation, so I would say, always implies and supports a sense of self-presence in relation to one's spatial-material surroundings. Moreover, I propose navigation as the idiosyncratic cartographic device that acts on various levels, both technical and perceptual.

Departing from this concept, I aim to scrutinize expressions of photographic or cartographic mediation in terms of the *navigational trajectories* underpinning the processes of production, distribution and reception. This idea of *navigational trajectories* is broadly alluding to media scholar Nanna Verhoeff's navigational scheme of vision that she explores through the notions panoramic and navigational complex (2012, 138). With regard to the mobile gaze, Verhoeff asserts that a space cannot be fully experienced without movement, it invites a "navigational mode of viewing" (49). Along similar lines, I aim to theoretically expand the cartographic device of navigation to emphasize how both cartography and photography have always been part of a networked, material configuration.

Bertillonage assumes the body to be completely knowable and locatable, as an objective fact that is externally localized. However, such a status of the image as map of a body's topographical features is not self-evident. Tracing the navigational trajectories reveals how the correspondence between the gelatin prints of victims and the event of the murders is not pre-given but materializes in the complex forensic procedure that subsequently draws the boundaries between victims and murderers. Latour asserts that images lose their scientific persuasiveness when they are withdrawn from the sequence of images preceding and following (1986; 1987; 2010). Similarly, both maps and photographs as technoscientific artifacts are inscriptions that are not simply one of two endpoints, i.e. reality and model. It is crucial to the impact of Bertillonage and aerial reconnaissance alike to realize that the clues the forensic inspector or the army officer is looking for are not informed by the photograph as a model that reflects the situation on site, a relationship what November, Camacho-Hübner and Latour would call "resemblance". Instead, the activity of navigating a space is always based on the detection of a number of cues relevant to the operation. Therefore, any link between the image, and the

assemblage of related data and images are established in navigational trajectories that as such inform the subsequent act.

As human rights theorist Eric Stover points out, forensic investigation requires a photographic document, however the fuller picture is only revealed in close association with schematic drawings that yield scale and measurements (2015, 170). It is within this chain of reference that the photograph becomes operational, which therefore necessarily exceeds the boundaries of its frame in order to become meaningful. In order to better grasp the significance of photographs as diagrams, I here turn to image theorist Aud Sissel Hoel's examination of photography's scientific potential to reveal. She draws on the collaborative work of astronomer Joseph Winlock and mathematician Charles Peirce in the 1860s to argue that photography's scientific capacities do not reside in its indexical origin and mechanical objectivity. Around 1869 Winlock and Peirce carry out experiments to establish photography as legitimate tool for observation and research. In order to do so, Winlock draws a distinction between photography's pictorial and metric functions, in which the latter "is 'accurate' in the sense of displaying the object's features in a systematic manner - that is, as from a fixed or unchanging point of view - ensuring the comparability of the features relative to each other" (2016, 63).

This understanding of the photograph as diagram implies several things according to Sissel Hoel. For instance, it insists the importance of the sequential positioning of photographs as inscriptions, that is executed by standardization and repetition. Furthermore, she suggests, the photograph as diagram presents the following twofold alternative to indexicality as precondition for photographic realism. First, its evidentiary strength does not reside in its mechanical objectivity that relied primarily on the non-intervention of the photographic apparatus. On the contrary, every observational instrument ordains its own infrastructural logic for revealing and exposing particular aspects of a phenomenon. Second, photographs can yield information effectively when handled in a systematic manner. This diagrammatic understanding of photography obstructs the notion of mechanical objectivity mentioned earlier - that was based on non-intervention. Observational instruments intervene in the observed phenomenon. The diagrammatic notion of photography underpinning Winlock and Peirce's work thus fits contemporary new materialist focus on the co-constitution of observer and observed object.

1.5 Navigational Visuality: From Bird-view to Street View

In his seminal work *The Practice of Everyday Life*, philosopher Michel de Certeau asserts that the depiction of the space of the city had traditionally been a bird-view perspective, whereas the citizens experience the city from below. Foregrounding the navigational turn, De Certeau discerns the "map" as

a static, formalized account of spatial relationships from the "tour" as spatial movement. City walkers have the most fundamental way to experience urban life as when they walk their bodies follow the shapes of the urban text: they write space without being able to read it (1984, 153). He calls these operations of bodily movement through space "spatial practice" (159). The space of the urban walker is not a predetermined space but produced through the act of walking. Opposed to the abstracted space encountered in the vertical gaze, this space is practiced and lived. The shift from bird's eye view to the urban dweller's street level perspective from below is epitomized by the online cartographic application Google Street View. Street View was inaugurated in 2007, some time after its older siblings Google Maps and Google Earth, and in a way functions as a bridge that connects both platforms. Street View enacts the integration of cartographic and photographic perceptive modes and has set its ambition to ever smoother translations of the one mode into the other. It is accessed through Google Maps which offers the perpendicular view down associated with cartography as laid out earlier. A layer of blue lines in the Google Maps interface indicate the possible locations one can enter the Street View mode. Drop the pegman on any blue line or spot on the map and one "lands" on the street.

The spherical view offered at "street level" invites the viewer / user to wander across the image as virtual space, that is composed of a series of single images, stitched together and laid out across a spatial terrain. The resulting navigable panorama image conceals a conglomerate of data, software and the input and response feedback of the viewer / user. It extends the scope of the photographic image by creating a borderless total mass image of the world. While Maps and Street View are often classified as cartographic and photographic modes, the latter is already cartographic within Google Street View. Rendering Google Street View images is inherently processual. It pertains the accumulation of static photographs as raw material, whereas the resulting image is far from static. Google Street View's virtual doubling of space is constructed in a number of cascading steps that are set in motion by an army of moving vehicles. Each car is prepared with a special camera on its roof equipped with a rosette carrying fifteen lenses that can capture up to fifteen images simultaneously. As such, the rosette allows a spherical view to be taken instantaneously. While the driver follows the assigned routes the cameras automatically take photographs every 10 to 12 metres from an average height of 3,5 metres, freezing the situation on the street at random moments.

The aggregated photographs are sent back to Google's headquarters, stitched together and mapped to their corresponding locations on the digital map thereafter. The seamed image quilt is then layered with pan and zoom functionalities allowing one to rotate along the same axis of the rosette camera that was installed on the moving vehicle. As such, Google Street View's mode of operation

involves an affective feedback loop between the data visualizations and the virtual wanderer that each time creates a different map image (Verhoeff 2008; Lammes 2017). The sequential arrangement of each spherical image offers a seemingly borderless image that extends as far as the user is willing to continue wandering, provided there is an internet connection. Nonetheless, as the mapped routes are restitched together in post-production processes, this complex embroidering of images has created an image that is both synchronous and diachronous at the same time. Image overlaps reveal the stitching of individual photographs and encompass an uncanny temporality.

The camera-equipped car records a paradoxical unfolding sequence of presents. Even though Street View is assumed to be a borderless, complete image, this promise is obstructed when the directional arrows skip streets, leaving parts of the city disconnected and thus forging gaps in the map. Certain areas, especially ones that house commercial businesses are prone to more frequent updating. Residential areas, on the other hand, are considered to be more stable and visited by camera-equipped cars less frequently. Sometimes seasonal changes are revealed even though they are set in a coherent street context. Any sense of fluidity becomes then ruptured by such discontinuities. Furthermore, when the user pans through the stitched panoramas other road users seem to appear and disappear from the frame at unanticipated moments. Later additions to the network of panorama images expose a temporal hiatus between one part of a neighbourhood and another. These discrepancies in time are however only apparent when the user pans through the images.

As programmer and photographer Clement Valla observed, the Google image platform is "essentially a database disguised as photographic representation" (2012). Like any empirical artifact it hides its genealogy. The relational database encompasses a total, mass image of the world that will constellate according to previous searches and operations and therefore consolidates different temporalities in one navigational trajectory. The relational database disengages with the linear sequence of film in favor of a single time that ties everything together. According to Paul Virilio, time has surpassed space as main constituent of perception, in which before and after coexist (2000). This extended present is structured eternally in the relational database of Google Street View. Whereas the routes are preprogrammed, the user can construct their own trajectories through the image. As such its principal motivation and operation is movement where space and time collide.

The affects of mobility have received increasing scholarly attention since the 1990s, spurring a spatio-visual or navigational turn, also referred to as the spatial turn in media studies or the visual turn in geography (Thielman 2010). As human geographer Tim Cresswell states, mobilities lie at the microgeographies of everyday life (2011, 551), and therefore also inform and mediate photographic and

cartographic practices. The interrelational aspects of space as a form of coexisting heterogeneity has been explored by geographer Doreen Massey. She proclaims one can never travel across space as a dead flat surface. She rather perceives space as "a cut through the myriad stories in which we are all living at any one moment. Space and time become intimately connected." Space, she reminds us, is always being made and remains unfinished, as a "sphere of a dynamic simultaneity" that evolves into "loose ends and ongoing stories" (2005, 107).

However, the act of walking as the archetypal and elementary form of city life experience, as put forward in the work of De Certeau, has been surpassed by other forms of mobility. Following these developments in mobility De Certeau installs a dichotomy between the human that writes the urban text with strokes of pleasant chaos and the automobile that reduces the people inside the carriage to prisoners that are caught in "a bubble of panoptic and classifying power" (1984, 111). In contrast to this, geographer Nigel Thrift asserts driving to be both embodied and sensuous (2004, 45). Whereas De Certeau has a rather negative outlook on technology, Thrift embraces the new connections that technologies afford. His metaphor of driving in the city then becomes a productive update of De Certeau's ideas on the urban walker. The practice of driving is akin to wandering, however it incorporates a new informationally boosted hybrid body. It is precisely this man-machine-world assemblage that characterizes Google Street View as mediating technology.

Nigel Thrift's car and its driver are related to the Street View car, but serves as a broader metaphor for embracing technology, or literally being embraced by technology. The navigational trajectories that Google Street View affords intersect the human-technology assemblage. The driver and car merge metaphysically (temporarily) to become a person-thing (2004, 47), an entangled thing for the duration of the car ride or the tour through Street View. Google Street View is then not merely a simulation or representation of the reality we encounter in our cities but becomes a mode of reality on its own terms that is neither completely separate from nor exactly mirrors a reality outside. Google Street View technology encompasses a visual topography that is rendered through movement on different levels. The motion of the car, the algorithmic stitching of the images and the user's panoramic walk within the image all pertain different mobilities that inform the navigational trajectory that traverse the Street View image.

1.6 The Explorative Gaze in *AKA Jihadi*

Such a photographic roadmap can also be found in Eric Baudelaire's film *Also Known as Jihadi* (2017), a 102 minute film that portrays the protagonist's possible journey from France to Syria and back again

in a widescreen moving shot. The cinematic movement takes the viewer on a road trip from a Parisian suburb, to Turkey's border regions with Syria, and via Spain back to a Parisian court. Paul Virilio observed an analogy between the car's windscreen and film: The "voyeur-voyager in the car" bears resemblance to the "moviegoer". As such, both windscreen and moviescreen are similar framing devices. (Virilio 2006, 106). This equation of watching a film and the act of moving through a landscape is echoed in *AKA Jihadi*. The core of the film comprises two types of material, that together form a tissue of visual and discursive fabric. The elongated visual takes are alternated with screenshots of legal statements and police documents, read out in a voice-over. In this format the film follows the traces of Abdel Aziz Mekki, a young man detained in Paris for allegedly travelling to Syria to join the Al-Nusra Front. Yet, rather than focusing the lens on the the main character, the camera is turned 180 degrees away from the protagonist towards the landscapes he has traversed throughout his life. The film is indebted to Masao Adachi, the progenitor of Japanese landscape cinema, who asserts that landscape is strongly related to hegemonic political power. This *Fukeiron*, or landscape theory, is a highly abstract yet thoroughly materialist idea, as it pinpoints the material foundations (in physical landscapes) of discursive effects (Rei 2016). In line with Adachi's Fukeiron, *Also Known as Jihadi* attempts to create a portrait by means of landscape, subtly obstructing the cultural dichotomy between portrait and landscape modes of photography. While immersed in the process of watching, the film reveals the contours of its entangled terrains. Parallel to the physical urban and rural landscape is the judicial landscape that adds another stratum to the image both formal and content wise. On a different layer, the premise of the film resists a separation between subject and objective landscape, as I will explore below.

Fundamental to *AKA Jihadi* is the idea that the protagonist's biographies are not informed solely by their actions but what they have seen, thereby freeing the cinematic disembodied eye in order for it to reconnect to the body. Yet the significance of the landscape is more complex, as media art theorist Erika Balsom puts it, it "is the only world we have, and we are not in it alone" (2018). In *AKA Jihadi*, landscape views become a mode of thinking and conceptualizing. It relocates the significance of indeterminacy in times fixated on hastily drawn conclusions, and polarized media debates. It proposes the "ethical power of opacity and unknowing" (Balsom 2018) against the hyper sensationalized representations in the mass media. *AKA Jihadi* instead highlights the austerity of the judicial proceedings by simply reading them out. The landscape shots invite the viewer to scrutinize the image for any signs that might indicate or motivate why Mekki embarked on the journey he followed. Although we know that such a sign would be impossible to find, we are prompted to explore the image for traces like a forensic inspector.

AKA Jihadi's ultimate slowness and boredom that is provoked by the film's minimalist architecture, allows the mind to wander. In *The Philosophy of the Landscape* Dutch philosopher Ton Lemaire has argued that the embodied event of walking is analogical to the act of thinking and theorizing. This phenomenological approach to the experience of space does not take merely an interest in the geographical space traversed but expands towards the individual and mental perception of space. Here theory (as activity of the brain) and praxis (as activity of the body) are consolidated ([1970], 2007, 15). The benefits of walking on the mind have been acknowledged by a great number of philosophers tracing back to Immanuel Kant and Georg Hegel, as a way to grasp the subjective self (Solnit 2001, 6). The resilient potentials of perambulatory practices figure in the historical tropes of the *flâneur* and the *dérive*, as modes of spatial investigation that uncover the messiness and plurality of life. The Situationist *dérive* relied on defamiliarization of well-known places (Hollevoet 1992) and the exploration of new and unknown locations, whereas the *flâneur* as figured in Baudelaire poems and Benjamin's writings underpinned the act of strolling itself (Benjamin 1973). Nonetheless, as cartographic strategies flânerie and dérive both underline the sensuous and affective potential of a body always and already in motion. As I elaborated on before, Nanna Verhoeff proclaims that "we see how we move, while how we move enables vision" (2012, 134). This idea resonates with phenomenologist Maurice Merleau-Ponty's concept of "lived perspective", which is a merging of movement and vision that strengthens a sense of self-awareness ([1945], 1962). This implies that when we walk our bodies sense the the spatiotemporal qualities of the world around us. In this phenomenological experience, Merleau-Ponty does not distinguish between self and the world, as meaning is created through perception and movement.

In *AKA Jihadi*, the filmscreen is not a window onto foreign lands, but opens up new spatial transformations. Here we an draw an analogy between the mental activity that the act of walking provokes and a spatial survey, one that not only emphasizes but foregrounds the inevitable processuality of photographic images. Agency is obtained in the act of walking, when one moves the body across space. This is a firmly embodied practice. Rebecca Solnit, in her work *Wanderlust*, stresses how the act of walking is grounded in an interaction between the internal and the external, an analogy between movement through landscape and the creation of a thought (2001, 6). The viewer of the film then is not an immobile and disembodied eye caged inside the black box of the cinema or the white cube of the gallery. The film rather allows the mind to wander. Paths comprise the lines of thought that carve out boundaries between myself and the other. However, these paths are vaporous, and resist being fixed in any time or place. A navigational reading of *Also Known as Jihadi* thus moves beyond a

traditional art-historical focus on meaning in representation towards incorporating the embodied mental existence of the viewer. The experience of an artwork comprises both matter and meaning.

1.7 Self-reflexive Cartography: Indeterminacy and Embodied Circularity

The spatial mobilities of groups of people and individuals across Europe and the Middle East have deepened certain rifts that allow the construction of a sense of "them" as opposed to "us". In line with this, Bruno Latour contends that whereas the project of modernity has always attempted to surpass boundaries, there is an intensification of one particular boundary: the border between the human and the non-human ([1991], 1993). As such, the concept of modernity implies a clear break in time that is always associated with a rift between human and non-human worlds, i.e. landscape. As a result, a disenchanted understanding of material nature emerges, that constitutes an object world outside of us, human subjects. This stable subject-object relation has been emphasized in classical film theory's focus on the disembodied spectator seated in the darkened auditorium. In *AKA Jihadi* the screen does not separate subject from object but embraces the ontological indeterminacy of the object of study in the film. Who is the protagonist, we have never see him, we hardly know anything about him. As is stressed by Karen Barad (2007), all relationality depends on indeterminacy. We might be looking at ourselves then, when we realize that monstrosity might be a shared human condition. The viewer is left wondering, are the clues for this story to be found in the cartographies of our minds, rather than the physical landscapes?

The conclusion of the film remains ambiguous. It neither condemns nor excuses the actions of foreign fighters. In *AKA Jihadi* the cartographic interacts on a material and metaphorical level. The notion of territory implies a division between self and other, which is vigorously obstructed in *AKA Jihadi*. As I have underlined in the previous paragraphs, the practice of cartography is not reducible to a distanced survey in order to map a landscape that is out there. Instead, it is a highly embodied and physical, and therefore a partial practice. As Jeremy Crampton observed, an increasing number of scholars put emphasis on the map "as existence (becoming) rather than essence (fixed ontology)" (2009, 840). The truth-producing element of cartography has a circular propensity. It regards putting things on the map, a performative act that grants them significance. As such, the "real" impact that maps have on our spatial and environmental reality makes them performative rather than reflective. The performative implications of cartography shape our movements across space.

Following the idea of performative cartographies, I would assert that the spatial indeterminacy of cinematic and viewer positions transforms the film's diegetic space into a reflexive space. Trevor

Paglen coined the term experimental geography to denote self-reflexive spatial practices, recognizing that cultural production and the production of space cannot be separated (2009). Although he argues that such experimental geography is less concerned with the practice of mapmaking, the concept of experimental geography is productive to examine the way people sculpt and mold the earth's surface and vice versa, how the earth's surface molds us in turn, and eventually it denotes how cartography intervenes in our physical and mental worlds.

As previously mentioned, the process of mapping as such can be multi-directional. There is a continuous flickering back and forth between places to be mapped and the maps themselves, a process that mutually informs and constitutes each end. This inevitably means that we are never able to fix a spatial position. As fully knowing something is a boundary-drawing practice, after all it entails to enclose something and apprehend the extension of its parameters, the radical indeterminacy that *AKA Jihadi* is founded on then drastically reverses this conception. It is rather a process with ambiguous boundaries and an uncertain extent. Matter loses all its viscosity, density and vigor when it is subdued to an object. When we acknowledge the productive and disruptive potential of materiality, a new space of inquiry opens up.

1.8 Conclusion

As empirical knowledge transmitters, maps and photographs tend to obscure their lineage by presenting themselves as mimetic images. As a result, both media have become objectified. In firm opposition to these essentialistic readings of reality and technology, I have proposed a non-representational, navigational analysis of photography as technology of spatial mediation. This chapter has explored the photographic mediation through the analytical lens of cartography. I proposed to dramatically expand the notion of cartography in order to examine its potential as a analytical tool as well as to highlight the affordances of different media technologies and the spaces they intervene in on In order to embrace its indeterminacy and inherently relational potential I have employed the cartographic mode of navigation to theorize photography.

On the most elementary and formal level, the cartographic aptitude of photography resides in the way the image conveys spatial relationships. However, as I have demonstrated, the navigational proceedings of photography are affective in a much more profound way, and cuts across techno-material and discursive faculties. I probed the navigational trajectories of the vertical view in Alphonse Bertillon's metric photography and aerial reconnaissance as diagrammatic tools. In Google Street View the angle turns ninety degrees to a horizontal, landscape gaze. The navigational trajectories start to take place

within the image. Finally, we have seen how the navigational trajectories of *Also Known as Jihadi* include the mental space of the viewer. The image invites mental walks that cut across artificial boundaries between landscape and human subjectivity, film space and viewer space, subject and object. Distinctions between the space of the viewing subject and the portrayed object become diffuse. As I have emphasized repeatedly, the intersection of cartographic and photographic mediations occurs concurrently in various modes, spatiotemporal, technical and perceptual. The hybridization of photography and cartography then reveals the processuality of the photograph proposing to perceive photography as doing rather than object. Following this line of reasoning, in the next chapter I will focus on entanglements of photography and cartography through the conceptualization of the "cut" as the ultimate photographic gesture.

Chapter 2 **The Photographic**

The Image Cutting Through

It is the first of August, 2014. Rafah, a Palestinian city located at the southern edge of Gaza close to the Egyptian border, is startled with a sudden burst of violence. A ceasefire between Israel and Hamas collapses and roughly two thousand Israeli bombs and missiles are dropped on the city of Rafah. The airstrike will last four days and kill 91 Palestinian civilians. (Forensic Architecture 2017)

This series of events became known in international mass media as Black Friday and prompted Forensic Architecture to start an investigation. Forensic Architecture is an architectural firm affiliated with Goldsmith University, London. However, it is no ordinary office committed to designing future buildings but would more aptly be described as an autonomously operating research-based detective agency that works in relation to specific cases to build evidence independent from state-controlled forms of forensics. In an increasingly surveilled society, Forensic Architecture aims to uncover the hidden facts of potential state-crimes. As stressed before, the meshwork of social media that is interwoven with our daily lives have inaugurated a continuous flow of images that provide new technological testimonies with regard to conflict. To Forensic Architecture's investigators the images distributed in an online realm are especially valuable when either buildings have been demolished or when the scene of the incident cannot be accessed physically. In these instances, researchers are completely reliant on filmic and photographic material.

The exponentially expanding stream of imagery that contemporary cultures produce pinpoints the increasing discrepancy between art and photography discourse and the way that the photographic actually persists in society. The gap between both poles demands a critical intervention that acknowledges that neither photography nor cartography can be defined narrowly. In the previous chapter I have looked at the navigational trajectories that different sorts of mediation afford. In this chapter I will shift my theoretical focus towards the photographic procedure as an activity that halts the flow of time and mediation. To this end, this chapter traces the argument from the cartographic operation of navigation to the *cut* and spatiotemporal specificity of the photograph as critical device.

2.1 Mobilizing the Referent: The Photograph as Proxy

It is May 1865 when the German engineer Albrecht Meydenbauer visits an exhibition and is struck by two particular photographs featuring serene Alpine landscapes, framed and hung as a diptych. Both

images present a majestic mountain peak, seen from two different angles. It was the composite placement of the adjacent images that catch his particular attention. Only a few moments earlier had he presented technical drawings that he created after photographic images. The pair of mountain landscape photographs made him realize that any direct measurement of a building or terrain could be replaced by indirect measurement, by deriving them from photographs. Photogrammetry, as this method was called, fuses the science of mathematics and the technology of photography to draw measurements from images (McClone 2013, 1081). To art historian Jan von Brevern the story of Meydenbauer insinuates that the method of photogrammetry was not invented but only discovered (2011, 57). Given that photogrammetry relied on the same geometric principles that inform the photographic process at large, this implies that every photograph is a potential survey image. Simultaneously, we can trace the conceptual premise underlying photogrammetry to the common historical moment of photography and cartography, the geometric convergence of image and world materialized the fifteenth-century humanist Leon Battista Alberti's perspectival drawings (Hoelzl and Marie 2015, 94). Therefore, in photogrammetry the technical procedures of photography and cartography collide.

The establishment of photogrammetry as one among an array of standard topographical methods relocated certain aspects of land survey to the image. The logic underpinning photogrammetry assumed that a landscape could be fully substituted by its photographic image. Apart from known obstacles such as lens diffraction or earth curvature, it was believed that the image did reveal many topographical aspects better than on site. In particular, a photograph contains an indefinite number of projection beams that coincide with any point on the terrain's surface. An important advantage in this survey method was, as Von Brevern underlines, that the referential marks from the landscape to be converted to topographical data could be determined at a later moment (59). As such, the photographic image became a stand-in for the landscape itself. Nevertheless, I would suggest a photographic image is not a simple replacement of a physical landscape but operates on the survey as a proxy.

The term proxy is derived from the Latin *procurator*, an agent that is authorized to legally act on behalf of someone else. As such, the procurator is a substitute or surrogate that temporarily replaces the host actor. Today, the common usage of the term proxy designates an intermediary computer that manages requests between different computer networks (Levin and Tollmann 2016, 522). As a manifestation of the networked age, the proxy thus implies a displaced and distributed authority interwoven in a heterogeneous fabric of data. Similarly, Von Brevern points out that the elaborate task of photogrammetry altered the status of the single image. The photographic referent is no longer confined to that one image but becomes dispersed across multiple images. In other words, the referent

is mobilized when landscapes are mediated through multiple photographic images, that are turned into topographical data. Furthermore, Von Brevern asserts that the mobilization of the photographic referent also created a new viewer in possession of skills to identify similar terrain marks on different images.

The photograph as mediator between landscape and map is of crucial importance to the work of Forensic Architecture's investigators where access to the ground is often restricted. Furthermore, satellite imagery provides overviews of much larger territories. Forensic Architecture intends to use these images as device to perform analysis by proxy. However, as opposed to the legal surrogate in court and the photographic substitute of the distant land, the digital proxy is commonly unauthorized. Vera Tollmann and Boaz Levin, co-founders of the research center for proxy politics, describe how proxies are dialectical figures that exemplify contemporary post-representational politics (2016, 521). The double nature of the proxy shapes the battleground of control and regulation concerning the passage of information. This is the field that Forensic Architecture operates in.

The firm's investigations draw heavily on, what founder Eyal Weizman calls "video-to-space analysis" (Umolo 2012), a method of harvesting and converting spatial data from digital video footage into a three dimensional architectural and spatial model. In this photogrammetry space and time are interrelated, as visual trade-offs. Especially with digital compatible media, portable smartphones and widespread internet connection, citizens increasingly play an active role in the act of collecting, processing and disseminating information. The forensic team was denied access to Gaza and the city of Rafah and was therefore forced to adopt a methodology of remote sensing to acquire information on the events of that particular day. In contrast, citizen journalism is a form of reporting that is profoundly situated. This collaborative form of reporting is epistemologically emanating from the conditions that it aims to capture and therefore blurs or even inverts the distance between observer and observed. Forensic Architecture's method of remote-sensing enacts a paradoxical relation between situatedness and non-situatedness. Here, the proxy acts as a filter, that both reveals and obscures. Within today's complex meshworks of digital data, art critic Elvia Wilk suggests, responsibility for change is distributed among human and non-human actors and "all the proxies therein" (2017). Forensic Architecture's photogrammetry is adding a political and ethical dimension to the proxy, as a form of embedded resistance that maintains the dialectics between situatedness and distance.

2.2 Cartophotographica: Spatiotemporal Maps

Whereas the theoretical focus in visual culture is still often placed on single images, Forensic Architecture rather considers the image-data-complex, which is the "nexus of a huge multiplicity of

images taken of a site/incident from different perspectives and by different media" (Weizman and Dufour 2015, 234). As Weizman explains, within these image-data-complexes, each image forms a piece, a building-block that can be compared, cross-referenced and opposed to any other piece of data within the complex. This implies that the photographic referent is further mobilized and hybridized, turned into data points that can be plotted on a spatial layout to reveal their reciprocal relationships. The image-complex is a dynamic constellation, building on what Soviet filmmaker Sergei Eisenstein called "dialectic montage" (1977). These dialectics denote a tension between two subsequent shots and the gap between them where the potential insight can be found. As such, the image-data-complex both draws attention to the the possible disparities between government's accounts of events and the situation on site as the inherent incompleteness of photographic representations.

In classical photography theory the image has often been regarded as an indexical trace that endows it with specific temporal and spatial parameters. As such, the photograph is intricately affiliated with time and history. This idea is synopsized in Roland Barthes' notorious description of *ça-à-été* or that-has-been, that denotes the necessary existence of the photographic referent ([1981], 1993). The photograph preserves a moment of history the way that it appeared before the lens. A map, in contrast, produces and conveys spatial knowledge by linking landscape, document and vision (Cosgrave 2008). The distinction could also be clarified in terms of its spatial and temporal dynamics. As media theorist Cheryl Gilge writes: "whereas maps offer visual diagrams of spatial information, photographs offer documents with spatio-temporal specificity" (2016, 16). In the previous chapter I have laid out a diagrammatic scheme of photography. Here, I will explore the temporal specificity of cartography.

For the Black Friday Report, Forensic Architecture's investigators selected three different video images from their image-complex that reveal what appears to be one and the same bombardment, taken from different locations in the city of Rafah. Each of the images features a smoke plum that rises from the neighbourhood. A bomb cloud is inherently temporal, it is a building in the past tense, torn apart into a million fragments. At every moment in time, the shape of the smoke clouds is unique, and the unfolding morphology of clouds reveals detailed temporal information. The inauguration of digital photography cameras has yielded possibilities of attaching information to specific photographs. These metadata concern information about the type of camera body, lens and aperture. Also, metadata includes a time stamp for each photograph and through GPS sensors on the camera the photograph is geotagged. However, these settings are prone to manipulation and error, and therefore signs of weather, shadows casts or smoke plums following the impact of a missile provide more reliable temporal information. Where the metadata attached to the digital images proved inadequate, the smoke clouds seen on the

image fill up that hiatus. Smoke clouds from bomb impacts evolve quickly and distinctly. Their idiosyncratic forms hold detailed information about space and time. The cloud thus performs like its virtual counterpart, it stores spatiotemporal metadata.

Each of the three videos from the image-complex starts at a different moment in time. By slowing or halting the clips and comparing the smoke configuration in each image, the researcher is able to synchronize the clips temporally. In each frame the dimensions of the plume are measured and combined with the perspective of the respective images to establish the location of the three cameras on a satellite image and mark the impact of the missile on the intersection of each image' perspectival axis. Juxtaposing these images in the image-complex along a spatial and temporal axis into a three-dimensional model configures a map with spatiotemporal specificity. Even though maps are also constructed temporally, they have not traditionally been thought of having a distinct temporal trace inscribed in the way a photograph does. In the *Rafah: Black Friday Report*, the spatiotemporal specificity of the photographic image is a crucial element within the cartographic model used to reveal the relationships between elements in space and time. Accordingly, the result of the photogrammetric effort of cross-referencing images by mobilizing the cloud as photographic referent creates a map with spatiotemporal specificity.

2.3 Photographic Procedures: From Navigation to Cut

Photogrammetry, as a process that determines reference through a cascade of inscriptions exemplifies the navigational procedure of cartography as put forward by November, Camacho-Hübner and Latour and therefore epitomizes the mapping impulse I have set out in the previous chapter. In contrast, traditional theory often equated the photograph with instantaneity and the snapshot. Film theorist André Bazin characterized photography with an act to preserve, that were "to snatch it from the flow of time" (2005, 9). This idea is reiterated in the theories of both Christian Metz and Peter Wollen, who have linked the photographic process metaphorically to ice and the state of being frozen (Metz 1991, 19; Wollen 2007, 110). Metz argued that photography's true nature lies in its "silence and immobility" (2003, 140) that works through its mechanical function. Throughout its history, the mechanical automatism of the technology has been celebrated for allowing another perception onto the world. One of the earliest 19th century photographic pioneers, the British Henry Fox Talbot already suggested that photography was able to record the tiniest details that the human eye would overlook. It was philosopher Walter Benjamin, however, who wrote most influentially about the optical abilities of photography ([1936], 2002). Benjamin points at the stop-motion and enlargement that became possible with the filmic apparatus and the

photographic print. These devices, he suggests, make things or aspects of reality visible that could not be noticed or seen altogether with the naked eye.

With the advent of digital technologies, the photograph is no longer confined to the still that reduces the image to the static realm. As a result, the boundaries of photographic and filmic images become muddled both on a perceptual and technical level (Cohen and Streitberger 2016, 7). However, there is one fundamental operation underpinning both photographic and filmic images which is the procedure of the "cut". In his iconic article "The Work of Art in the Age of Mechanical Reproduction" (1936) Benjamin draws an analogy between the cameraman and the surgeon to differentiate between the older medium of painting and new photographic technologies. Whereas the painter can be compared to the magician, who keeps a discrete distance from the audience, the camera dissolves that distance like the surgeon cutting right through their patient. As the camera acts like a knife that cuts across time and space, photographic mediation comprises sequences of chopped up partitions such as camera edits, close-ups and zoomed-out overview shots. Each image still displays another level of detail that is taken from a different point of view. The camera captures that which escapes natural optics, things that are either too small, too large, evolving too slowly or too quickly or situated geographically dispersed to be discerned by human eyes alone. This is what Benjamin refers to as the "optical unconscious". The cut of the camera makes it possible to isolate constitutive elements of operations and therefore reveals new potential structures of matter. The metaphor of the surgical cut thus identifies the affordances of the camera to structure the world as we see it.

The photographic operation of the surgical cut resonates with physicist Karen Barad's concept of the agential cut that I briefly referred to in the introduction to this study. To Barad "cuts cut "things" together and apart, cuts are not enacted from the outside, nor are they ever enacted once and for all" (2007, 179). As opposed to the Cartesian cut, that eternally demarcates the *res cogitans,* or thinking substance, from the *res extensa*, or extended material substance, the agential cut emerges in a diversity of dynamic material-discursive practices. This implies that boundaries between entities we commonly perceive as objects are not natural nor existing *a priori*. It is rather the specific situations we find ourselves in that draw these boundaries. Therefore, to Barad, the cut is always agential, as separability is enacted by distributed agencies.

According to Barad, the agential cut is an intervention across phenomena, mediations, networks or assemblages that is at once conceptual and material. That is, when defining a body, we demarcate its material parameters and simultaneously attach a concept to the terrain within. The cut is a temporary resolution of ontological indeterminacy, that stabilizes the world in defined entities. Bearing this in mind

we can revisit the photogrammetry discussed earlier. The cut in each photographic image is always necessarily partial in the process of photogrammetry, i.e. once other images are included, different potential relationships will emerge. The cut is also always an interpretive process since it materializes in social intra-actions. Barad prefers the term intra-action to interaction, to emphasize the relationality rather than assuming two independent entities that interact. The cut is thus both a scientific as interpretive practice that reconfigures complex situations into manageable slices that become meaningful.

In Forensic Architecture's cloud analysis, the "cut" is a pivotal component of the research process, considering that the cut denotes a temporary suspension of the flow of events and, specifically in this case, the unfolding of the cloud. As film scholar Laura Mulvey suggests, at the end of the twentieth century digital technologies made possible new perceptive modes in film. It can now be "halted, slowed or fragmented" (2006, 181). Pausing the moving image with new technologies brings to film a resonance with the photograph. Mulvey refers to Raymond Belour's argument that stillness in the moving image calls upon a pensive spectator, who is able to reflect on film. The conceptual pensive spectator anticipates the thoughtful reflection on the film image that is now possible, as a way of seeing into the screen's images, shifting them and "stretching them into new dimensions of time and space" (195). This digital format empowers the viewer to take control of the flow of image and story. Similarly, the digital platform of Forensic Architecture's dynamic image-complex affords techniques of halting, delaying or speeding the images and diegetic time of the footage that allows investigators to isolate and consider particular details in the images.

Forensic architects aim to virtually piece together snippets of data in a momentary piece. Here we see that knowledge and evidence is thus built and assembled together through a sequence of agential cuts. Each of them marks different boundaries within the image-complex and the wider phenomenon of the event. Furthermore, Forensic Architecture's testimonies uncover how imaging technologies and other analytical instruments are not passive and objective tools of measurement. Rather, these technologies are entangled within the act of interpretation. Forensic Architecture aims to free such imagery from self-evident examples to active knowledge producers. This implies conceiving the built environment itself as a methodology to uncover narratives that lay hidden beneath the bricks and concrete of the city. Although Forensic Architecture's court cases are heavily reliant upon a navigational operation, the way that I laid out in the previous chapter, it is within the diverse cuts that freeze certain moments temporarily in which the researchers align themselves with their object of study.

Thus, Forensic Architecture does not reproduce the event as such, but makes a cut to allow the phenomenon to be observed.

The dynamics of process and cut are symbiotic. As social theorist Jess Bier puts forward, the steadfastness of cartographers holds a complex relationship to the landscape they are positioned in. As imposing a cut involves a temporary stabilization of a situation, it compares to what Bier describes as "stasis". Stasis particularly pertains "struggles to establish and maintain a presence within a geographical landscape, as well as the work of maintaining the landscape itself" (2017, 56). The act of mapping substantiates a composite constellation of mobility and stasis: in order to survey an area per standard practice, cartographers not only have to travel there, but they also need to remain to study the frame. Thus, stasis is just as crucial to surveying as mobility is (Bier 68). Stasis and mobility do not sustain a binary opposition, they rather co-emerge. In a similar vein, navigation precisely operates through temporary cuts within space. I would argue that eventually navigation itself is a cutting through an infinite possibility of pathways.

2.4 Google Earth: Cutting Through the Flow of Mediation

In an ongoing attempt to narrow the gap between map and territory, digital maps continuously seek to embody more lifelike reflections of the world they chart. On a quest to upload the entire planet on its server, Google aims to produce a digital mirror image of the earth. Supposing that the public realm is a fact that can be recorded, mapped and subsequently redistributed in a virtual domain, the corporation promises the world at your fingertips in yet another spatial platform, Google Earth. When it launched in 2001 it was considered groundbreaking, as for the first time one could marvel at the shapes of our planet from one's home computer. When starting the application, the first view one encounters is an image of the planet from orbit, from which the user can explore the globe through a search function or panning left and right and zooming in or out. The experience of roaming the planet through Google Earth seems more fluid than the faltering experience of drifting through alleys in Street View. The user flies across the bulging Earth while zooming in closer to reveal detailed renditions of landmarks in cities and landscapes. The global views are produced through satellite imagery, whereas the close-up views are taken from airplanes. Five cameras attached to the plane capture the earth's surface from different angles, one looking down, the others looking forward, backward, left and right. These different lines of sight supplement the zenith as quintessential cartographic position with perspectival bird-view images. The collection of taken images are combined into 3D images that disclose more of the grandeur of the earth by hinting at its curvature.

The three-dimensional mapping images are generated through a software process called texture mapping. This technology was developed in the 1970s by Ed Catmull and involves the application of a flat image onto a 3D object (Valla 2012). Generally, textures simulate the surface qualities of an object and, as such, they form the skin of the model. In Google Earth these textures are satellite and aerial photographs stretched across topographical models of the Earth to suggest depth and three-dimensionality as if the viewer can peer into their computer screens and see what lies beyond. Photographer and computer scientist Clement Valla points out how the viewer is actually looking at two spaces at once. More specifically, viewers look at the surface of the texture like they would be looking at the surface of a sculpture, whereas simultaneously looking through the photographic image plane towards the space that lies beyond (2012).

Valla contends that Google Earth imagery is actually different from photographic images, it omits the specific spatiotemporal indexical bond that ordinary photographs maintain. The images produced and displayed in Google Earth are rather hybrids of photographic and topographic data taken from a variety of sources, processed and meshed together in a continuously updated model. Valla contrasts our default way of looking along the lines of snapshots - our biomechanical eye perceives in separate images - whereas Google's mind seems to be thinking in continuity. The result is a Google Earth image as a frameless ever-extending photograph that is built from a disparate set of data with diverse spatiotemporal origins. Tens of millions of images make up the seamless virtual space of Google Earth. Yet, looking beyond the objectified globe in Google Earth reveals a very specific presentation of the planet.

Weather conditions pose the greatest challenge to the acquisition of images, as the overall aesthetic of the platform has a desire for cloud and haze free photographs. In Google Earth it is springtime and day time everywhere on the planet simultaneously. The software re-produces a specific world, by neatly cutting up the world in certain ways that necessarily and inevitably excludes possible alternatives. It seems that Google Earth is not a borderless image after all. Its boundaries are drawn through the flow of mediation, effacing images that do not answer to the preset parameters and qualitative traits. Thus, despite the lack of a concrete sense of *ça-à-été* in the photographic referent and the continuous changing appearance of the image, Google Earth selectively edits its data into a very particular model of the planet. The image as such is not photographic in the traditional sense of an object with a distinct material trace to a specific time and place. The model of reality that is put forward in Google Earth is however a boundary-drawing process in this ongoing flow of data and by doing so is inherently photographic.

In its latest incarnation, Google Earth has teamed up with amongst others NASA and the BBC to create a set of tours through the massive expanse of the internet. Voyager opens up different lenses to the world through a collection of curated content. It offers a thematic entry into Google's vast database, with images, videos and stories, carefully selected and edited. In a sense this recalls what media theorist Jason Farman refers to as the participatory culture of Google (2010, 880). He contends that Google Earth emphasizes the un-static nature of maps as indefinite signs that can be engaged with in flexible play. Even though the possibility to reconfigure map data by user activity is incorporated in the map software, the potential to recontextualize within the existing infrastructure of the map can offer resistance to the master narrative of the map (882). This means, that from inside the confines of the platform users are able to redefine the way they perceive the world and their relationship to its spatial representations. Not only do these strata of different visualizations of data subvert the master narrative of the map, the collaboratively generated content distributes the agency of the map-making process, while users can carve their own paths through the comprehensive atlas Google claims to be. In line with this, media theorist Federica Timeto asserts that mobile annotation leads to a convergence of data and practices of space (2015, 100), as space is figured and practiced simultaneously.

The principal act of photography, according to media scholars Sarah Kember and Joanna Zylinska is "cutting through the flow of mediation" (2012, 71). This cut, they argue, operates at multiple levels at once: technical, material, perceptual and conceptual in a matter-transforming process. As a result, these multivarious flows of mediation produce what we perceive as distinct photographic objects. Therefore, the frame or cut leading to a *photograph* is only a part of a complex photomediation. The cut makes an incision in duration that temporarily halts the flow and stabilizes the dynamic meshwork of mediation into discrete media, yet it also includes the potentiality of all those cuts and photographs that have yet to be made. Google Earth operates through the semantic web, a web extension that dispenses meaning to otherwise flat data. As such, the platform links disparate data based on their meaning by incorporating and linking text blurbs from services like Wikipedia to certain places on the virtual globe. In these operations Google Earth cuts across media practices at large.

Kember and Zylinska's project breaks up object-centred views prevalent in media scholarship by re-inserting the co-constitutive technologies into processes of mediation that frame discrete media objects. Photography is intrinsically entangled with time, as it slices up the duration and flow of life, but it also temporarily stabilizes the flow of algorithmically updated images into a graspable unity. The cut thereby temporarily stabilizes the world into "representations". Google Earth foregrounds the cut as a structuring device that is carving the world. This becomes clear in a number of screenshots that Valla

has collected subsumed in the series *Postcards from Google*. These digital ready-mades reveal the technologies at use to construct the Google Earth image. *Postcards from Google* displays uncanny situations found on the platform, such as distorted bridges, that reveal the competing data inputs of the system. The digital turn also heralds the screenshot, that grasps the visual facade of the media interface. As such, the screenshot is the opposite of an operative image, as it resists the ongoing data flow of algorithmic updating. We could suggest that the standardization and compatibility of the Google Earth image has created an anachronous screenshot.

The cut inside this curated content demarcates the boundary between that what is included, but also what is effaced. This is epitomized well in Clement Valla's screenshot takes that reveal the imagery that will be cut out and replaced by images that have fixed the anomalies. The strange images are disappearing, only preserved in the counter-archive of Clement Valla. The screenshot does not halt the cycle of updating but takes an image away from this circuit. Valla's images disappear, symptomatic of the cut that is enacted. Google Earth is a structuring device that we use to make sense of the world, by cutting it into graspable fragments. The image on our screen is an incision in the immense database of Google and as such it is not a total mass image of the globe, but a very particular cut that provides us with an image of the earth.

2.5 GiGapan Technology: Visualizing the Invisible

As I alluded to before, photographic technologies have been praised for their capability to capture that which the human eye fails to see. Within this field of tension, photographer and filmmaker Zachary Formwalt's work *An Unknown Quantity* (2015) deals with the impossibility to photographically visualize the flows of capital. As part of a film trilogy that zooms in on the architecture of the stock exchange, *An Unknown Quantity* is set inside the empty former Grain Trading Hall of the Amsterdam Beurs van Berlage. The bourse was built in the early 20th century after a design by socialist architect H.P. Berlage to accommodate the evaluation of grain. In the 1970s the first European options exchange opened in the building, replacing the physical effort of grain assessment in natural daylight with a battery of computer monitors trading in option contracts. This financial instrument projects future values based on samples of the past, rather than physically evaluating goods in the present. The options contract has put forward a new step that separates the market from human perception. As a result, the allocation and accumulation of capital is ultimately hard to depict as it does not entail a visible activity or an observable process.

Similarly, the history of photography hinges on the threshold between visible and invisible, or detectable and indetectable. *An Unknown Quantity* traces these historical moments that mark the concurrence of early photographic experiments with developments of financial technologies and the burst of capitalism. A pivotal event for instance regards the attempts by Eadweard Muybridge to examine whether a horse lifts all four hooves off the ground simultaneously at any one moment in the course of their movement. Such a moment could never be perceived in isolation by human eyes alone, yet by separating each moment of the gallop with a special device containing multiple cameras Muybridge could prove that there was a moment of suspension in the gallop of a horse. The absurdity of this moment could be resolved when the cut is reinserted into its "natural" sequence, i.e. presenting the image as one continuous movement. Another key aspect of photography that parallels financial technologies is that early photography, due to technical limits, was incapable of registering moving bodies. As a result, 19th century street scenes were lacking human beings as their movement escaped photography's grasp. In *An Unknown Quantity* these technical thresholds echo Karl Marx' description of capital as self-creating source of its own expansion. As Formwalt notes, "the workers have left the scene" (2015, 38), only to be replaced by computer monitors and mathematical formulas.

Although photographic technologies did catch up with industrialization, it could not grasp the actual movement of capital. However, it was through stop-motion studies that photography was able to sustain the Taylorization of production, breaking down every action into simple segments to advance productivity. Photography thus promoted efficient production and facilitated the acceleration of capital accumulation. In other words, time becomes money (Doane 2002, 7). The standardization of time in scientifically ordered workflows is reflected in the zenithal gaze that *An Unknown Quantity* employs, where the territory is plotted on equally scientific terms. The film starts with a close-up view that slowly moves across the surface of a vault spanning the entire length of the grain trading hall in one steady, continuous motion. The panning view of the brick wall's abstract grid is accompanied by a series of comments uttered in a slow voice-over that emphasizes the incredibly slow progress of the film. Slowly the camera tracks the ornamental frieze that lines the interior walls and uncovers the images brick by brick, yet without indication of their precise location within the whole of the interior.

The lack of perspective that is generated by the fixed-camera view gives way to an increasing abstraction, at times only revealing the surface of a brick. It is this deprivation of orientation that diffuses the relation between the specific and the whole, or as art historian Eric de Bruyn writes, "between lived experience and the abstractions of global capitalism" (55). De Bruyn observes how the global organization of capitalism is itself a kind of media system, in complete control of what is to be seen and

what remains in the shadow. In other words, it is this capitalist organization of life that in a guise of objectivity draws a boundary to highlight the rational efficient marketplace from which the actual labor is effaced. Central to *An Unknown Quantity* is this tension between the efficiently rationalized marketplace that is revealed in the open - compressed through a list of numbers on the stock index - and the very material production processes that are cast in darkness.

Throughout the entire film the camera pans in a continuous movement to scan the complete interior surface of the bourse as if surveying a parcel of land. The complex geography of the image reveals itself once the viewer realizes that this is not a regular film of an architectural structure. The image that unfolds through the movement of the camera actually is a panoramic sequence of still images, stitched together into one composite view through a technology called GigaPan. GigaPan allows the user to mount a regular camera on a robotic device that is pre-programmed to capture a scene in meticulous detail by taking a large number of individual photographs and stitching them together in post-production to create a coherent panorama. Once the panoramic meshwork is finished, one can zoom into specific parts of the image that once again reveal the original frames. In an unusual employment of a zenithal view that produces a rationally structured space, GigaPan technology robs the image of a horizon from which one can obtain a perspective.

Writer and filmmaker Joshua Simon characterizes the medial logic of the film as follows: "in *An Unknown Quantity*, Formwalt activates that gap of photography and finance, by depicting the visual operations of digital photography" (161). Simon notes how filmmaker Jean-Luc Godard asserts that the turn to digital cameras equipped with LCD screens has had profound effects on the photographic gaze. Previously one photographed with one eye closed and the other peering through a viewfinder. With the turn towards the LCD screen, Godard points out, we start shooting photographs with two eyes. Whereas the closed eye subsumed the world of potential and the historical perspective that counteract on the seeing eye. This image then paradoxically becomes a monocular image, as an image that lacks perspective. Similarly, the monocular perspective that the GigaPan device enables whereby each image part is taken separately obliterates perspective.

Whereas the first historical moment tracing the material transformation of capital was identified before at the introduction of option contract trading, contemporary trading increasingly happens at nanosecond speed executed by fast computers in a global web of privatized fibers enveloping the earth. Rather than inside the stock exchange building, this trading materializes at vast data farms in remote areas, far away from our daily lives and experiences. The myth of transparency and efficiency that always seems to surround the idea of the "free" market has incongruously been shattered by algorithmic

trading, an activity that is rather a procedure of secrecy and obscuring. In order to gain advantage by front-running other traders, larger trades are cut into smaller portions to remain under the radar and not attract attention from others. These flows of capital thus remain under the threshold of detectability, by reducing them to a size smaller than pixels. Similarly, GigaPan technology evens out the image by giving equal consideration to each pixel in the final image, rather than one central focus point. Like the trade cut into small pieces that nobody cannot be projected back to the one trader, GigaPan levels the entire image as there are no depth cues. GigaPan technology creates a gigapixel surveillance image that gives the clearest possible view. However, there is not much to be seen. *An Unknown Quantity*, being an ambiguous photofilmic image par excellence, is simultaneously dethroning both photographic mediation and free market trading as transparent, universal technologies. The tiles of the ornaments break down the image into grids. That is similar to the construction of the film as animated photographic stills.

The animation of still frames leaves the viewer in doubt of the photographic or filmic nature of the work. Near the end of the film the image slowly moves out towards a full 360-degree view of the entire grain hall. This full 360-degree field of view of the bourse' interior captured robotically with GigaPan technology is animated through algorithms. This action instills the image with movement and duration. The duration of the film is however only a consequence of the algorithmic animation, it is not a captured time that is lived, but rather a hollow, mathematical time.

2.6 Capital as Performative Cartography

The spatialization of capital has resurfaced through the built environment, where the only material aspects of capital accumulation are the impressive high-rise buildings one can find on Wall Street or similar business areas. In contrast to the imperceptibility of capital, the market constitutes a physical place, as a spatial equivalent to capital. The market is the place where capital flows and congeals. Or in Formwalts' words, the market reifies the relations of capital. These traditional sites of capital accumulation have given way to large server farms. Trading also has become more complex, with traders reducing risk by spreading their trades across a multiplicity of parties. The dynamics of these processes are left in the hands of computer programs, bringing up Adam Smith's old metaphor of the market's invisible hand. Paul Virilio stressed how "we no longer have time for reflection. The power of speed is that democracy is no longer in the hands of man, it's in the hands of computerized instruments" (Virilio and Lotringer 1997, 61). High frequency trading thrives on competing temporalities and spatialities. *An Unknown Quantity*'s ultimate failure to visualize capital as it accelerates and circulates across the planet refers in a sense to what Evgenia Giannouri describes as equating "site with the

eventuality of non-sight" (2016, 187), recalling land artist Robert Smithson's site/ non-site distinction that punctuates the dialectic between the inaccessibility of sight and the photographs, films and maps conveying the spatial and topographical information. As such, *An Unknown Quantity* pinpoints the constructed dichotomy of what can be seen and what remains hidden.

The once fecund distinction between the world's financial centers and the periphery have been inverted. Electronic trading and its subsequent algorithmization of capital have reterritorialized the flows of finance, from the financial centers such as the bourse, to the periphery. Instead, the periphery becomes the place where the actual action occurs and the nodes of the financial worlds like London, New York, Hong Kong and Tokyo are not the principal sites of financial activity anymore. The real action potentially occurs precisely at the in-betweenness, the sites of action are more dictated by their "being optimally located in geographical space in a way that minimizes the impediments of time" (Tiessen 2012).

The world of finance is increasingly commanded through the operations of technology which have material and spatial consequences. Competing traders seek microscopic spatiotemporal advantages by optimizing the location fiber cables and server centers to be able to front-run the market. To geographer David Harvey space-time compression refers to a system that either reduces or makes spatiotemporal distance irrelevant (1990, 240). Technological change has symbolically reduced the world into a global village (McLuhan 1962). Simultaneously, we have entered what Carmen Leccardi describes as a "high-speed society" (2007, 27), to refer to the phenomenon of social acceleration. The contemporary trading floor embodies these spatiotemporal phenomena. Any photograph can be regarded as space-time compressions as it presents an isolation and recontextualization of a spatiotemporal cut at once in the photographic frame. *An Unknown Quantity* brings to the fore the conjunction of spatial extension and temporal compression of contemporary financial accumulation. The financial landscape has become shattered and fragmented. The performative cartographies of capital thus have reorganized physical space. Explicitly referring to Karl Marx' *Grundrisse* in the accompanying voice-over, *An Unknown Quantity* comments on the way that capital is tearing down every spatial barrier, and subsequently annihilates space with time. The goal of capitalism is to shorten the time of circulation in order to raise the profits. Time then performs as resistance to the accumulation of capital. Digital practices in finance have inaugurated new ways to circumvent spatial and temporal resistance to the accumulation of capital: previously trivial material factors can now produce the difference between capital lost and capital gained.

Thus, *An Unknown Quantity* attempts to visualize the invisible flows of cash and capital, by presenting the operations of photography. It explores and broadens the thresholds of the visual and reveals cartography and photography's complex entanglements with finance. Visualizing the invisible and its relation to machine-sight technology will take an ultimate turn in the final chapter of this thesis, the algorithmic.

2.7 Conclusion

Having argued that the dynamic, lived quality of photography can paradoxically be attributed to its stilled appearance, this chapter laid out a spatiotemporal scheme of cartography. I probed the "cut" as the quintessential photographic procedure inflicted by a photographic device. It is the moment of freezing that acts as a temporary cutting-together and cutting-apart which temporarily stabilizes the world into entities often perceived as objects. The crossbreeding of photographic and cartographic mediations can thus be theorized through the analytical model of the cut. Yet a photograph never exists on its own and have multiple manifestations. Therefore, the photographic as theoretical model complements the navigational procedures that were discussed in the previous chapter.

Chapter 3 **The Algorithmic**
The Image as the Space of Negotiation

A sturdy single-masted vessel sails out to the jagged shorelines of eastern Greenland. At the helm is captain Sigurdur "Siggi" Jonssón, who fearlessly navigates the sailboat along the coast, one of the least charted regions on the planet. The thousand miles of uninhabited coastline did never present much reason to map this area. Rather than using state-of-the-art digital mapping technologies, Siggi relies on his intuition and an eclectic collection of maps from different time periods to ensure his boat does not land on rocks.

Symbolizing the adventurer appealing to the public imagination, the British newspaper *The Guardian* followed Siggi to report for a longread on empty spots on the world map (Parshley 2017). The steady rise of digital cartography we witnessed in the last decade might have created the impression that the entire planet has been charted, mapped and documented for redistribution in an online realm. Yet, there are still black holes in this mass map image. Captain Siggi here is not an anachronism. In the era of satellite imagery and the hegemony of Google Maps he becomes the very personification of the notorious rift between map and territory. As the ship's commander Siggi navigates his craft safely through dangerous waters by comparing a variety of maps, ranging from public satellite imagery, aerial photographs from the 1930s and old driftwood cut-outs, to the always-changing situation he observes from aboard the vessel, backed up with his previous experience as a sailor. Whereas the first two chapters each explored the cartographic and the photographic as modes of mediation that do not confine to pre-meditated boundaries of the medium as object, this chapter extends the theoretical focus to the intervening algorithm. To this end I aim to trace the critical shift from analogue to digital in light of the murky figure of the algorithm. To put it another way, this chapter discusses the continuities and discontinuities of the turn toward widespread digitization of many aspects of quotidian life by taking the algorithm itself as a device to observe the digital turn and the implications it has on the image.

3.1 Projection: The Birth of a Cartographic Humanism

Cartography as a scientific practice developed slowly, but the insight that the earth is spherical was reached early, at least dating back to Greek philosophy (Snyder 1993, 1), alongside a recognition of the problems that arise when depicting the earth on a two-dimensional surface. The period stretching roughly between 1300 and 1600 AD, generally referred to as the Renaissance, facilitated an important

stimulus to the practice of cartography. Voyages of exploration and discovery radically expanded the territories beyond the *oikoumene*, or the known world, and the demand for functional maps increased. The result was an explosion in the production of map images, as explorations both created a need for topographical information and produced a substantial amount of cartographic data. Furthermore, as humanist scholars, 15ᵗʰ century cartographers started to study the work of their ancient and recent predecessors in order to improve the functionality of the maps they had created. As such, interest in the mathematics of map projections increased substantially, as developing techniques to convey spatial relationships was of fundamental importance to the authority of the image (Ballon and Friedman 2007). Obviously, the depiction of the curved surface of the earth poses significant problems to the cartographer. However, before European monarchs set out on exploration campaigns overseas these issues did not bother cartographers so much. With larger tracts of lands surveyed to support the Western conquest of previously unknown lands, the curve of the earth did become an obstacle. Geographers and cartographers started experimenting with different mathematical projections that served specific objectives. One projection method in particular came to dominate West European culture ever since. In 1569, the Flemish cartographer Gerardus Mercator presented a world map projecting the earth's surface through a cylinder with each pole at an open end. Eventually the map image is produced by opening the coil into a flat surface plane. Mercator's cylindrical projection proved effective in nautical navigation as it was based on the preservation of the globe's parallels and meridians in perpendicular position. Therefore, lines of constant bearing are straight segments on the map. Other map projections required frequent recalculation during seatravel as the course of the ship would slowly deviate from the direction it should sail. Mercator's map allowed a constant bearing determined using a wind rose.

Another significant development in this era comprised the introduction of type printing. The rise of printing technologies as another instigator of the Renaissance, turned maps into what Bruno Latour has termed "immutable mobiles" (1986). According to Latour, the printed map could be produced on a large scale without the risk of being altered somewhere along the way. The immutable mobile, as an endlessly duplicable and thus transportable thing, became a vehicle for (re)producing and mobilizing the Western ideological system, thus allowing European science (and capitalism) to rise and spread. As a result, the world was reduced to a coherent flat and transportable idea. In this sense, the mathematical methodology of projection thus permanently settled the image as fixed and static. This perspective reiterates what philosopher Martin Heidegger described as Welt-Bild or world picture. He describes the modern world view as the world becoming-picture. Yet, it is not so much the world actually becoming a picture than the world "grasped as picture" (69), where it appears as a "re-presentation for man", i.e. the

world is out there for us to see. Thus, simultaneously with the world becoming a picture, man comes forth both as subject and as the foundation of knowledge. Several authors have asserted that it is through this system that the event of modernity has stabilized the positions of subject and object, as the regime of perspective projection presumes the world as exterior image, and the map as static representation of its spatial relationships (Uricchio 2014; Hoelzl and Rémie 2015). Both whom are strictly opposed to human subjective experience. As such, Mercator's functional map came to symbolize the static image that current scholarship on the digital image reacts against.

3.2 Processing: Digital Cartography

The idea of a map as essentially a representation of spatial relationships epitomized in Mercator's projection, as an image that corresponds to a situation existing in the world out there, still seems to be a general rhetoric. Nevertheless, a fundamental change to the operation of the map and the map image took place with the advent of digital technologies. Maps have not simply started to cease to exist predominantly in physical formats - folded, wrinkled and covered in coffee stains - the map image itself transformed fundamentally when it migrated to the screen. This development, that already set about in the 1990s, accelerated about a decade ago. As media theorist Tristan Thielmann asserts that "parallel developments of a spatial turn in media studies and a media turn in geography" has followed the propagation of locative media and mediated localities (2010, 5-8). He subsumes these developments under the term "geomedia" (5). Indeed, our relationship to computers started to change radically towards the end of the 2000s. They became portable - their owners started carrying them around in their pockets - and intimate - they became trusted with our most personal data. As a result, also the development of digital cartography took a spur, considerably altering the map image as a result. Whereas the paper map can be turned or folded at will, the spatial layout of the image remains the same. In contrast, the digital map has no rigid shape, but its appearance constantly changes as the user moves and navigates. As such, the user co-produces the map image in the process of utilization.

Nonetheless, this shift towards mutable map images (Lammes 2017) did not happen overnight. In the early 2000s one would have had to print a series of directions from a computerized databank and rely on their co-driver to get them through. In the 2010s the prodigious rise of the smartphone has more deeply altered the way we locate ourselves and navigate through turn-by-turn instructions. The digital map has demonstrated to be effective because these maps are able to calculate the shortest route for travellers to get from A to B. Increasingly, the map is performing the navigation for us, telling the driver when to take a turn. Although digital maps started to be developed in the 1990s, the launch and rise of

Google Maps after 2004 made digital cartography mainstream and widely available. All the more, the application has become a synecdoche for a new generation of computer maps that continuously subverts the classical conception of a fold-out map.

The introduction of radio navigation and GPS in the 20th century and, more recently, satnav systems brought a new sense of positioning and situatedness that started to tear down the wall between map and user. The latest versions of Google Maps also provide real-time travel information, obtained from location data of its users. A prerequisite for using Google Maps as a navigation aid is to grant the application access to your location data. Thus, every time one queries the database for directions, location data is sent back to Google's servers. By collecting all this information into one data pool the traffic feature assembles and maps the density of users in order to reflect the traffic and possible congestion at any moment in time. Google Maps knows the traffic and how much delay it will cause eventually. As such, Google Maps is more than simply a map, but a complex navigational platform that maintains a continuous feedback loop between user and map.

It is precisely this feedback process that indicates that apart from pixels there is another transformation at the heart of the digital image. Image theorists Ingrid Hoelzl and Remi Marie characterize the digital turn as a new paradigm inciting the algorithmization of the image (2015), by which they refer to certain protocols that determine and alter the ways an image is presented, transmitted or stored. These protocols have altered the prerequisite of the picture from a hard to a soft image (2015, 4). Along similar lines, to media theorist William Uricchio the algorithmically constructed image heralds a radical break with "visual economies of the past" (2011, 25). He marks this break in the transition between algorismic to algorithmic. The former he characterizes as "a calculable sum, whose value lies in the correctness of its results", whereas the latter "a (finite) process, a formula capable of accommodating different values and different results". To him, the algorismic would pertain the stable and fixed view of the physical map, whereas the algorithmic paradigm foregrounds the mutability of the digital map image. The image is then based on an *algorithmic* assemblage of pluralities of time, space and authorship, continually changing the appearance of the map. The map as immutable mobile has been replaced by the map as mediator supporting a mutable image, whereas the immutability has been displaced to server storage (Lammes 2017). Furthermore, the navigation architecture of Google Maps does not rely on a single algorithm. The operations of the maps have become so complex that each consequent function is tied to a different algorithm. For a start there are algorithms to draw maps, algorithms to understand queries from users, and in the process of wayfinding algorithms are at work to

perform what is called geocoding, converting addresses to points on a map and vice versa. Eventually, the map image is (re)configured through a dynamic constellation of these algorithms.

3.3 The Algorithm as Intervening Space

These digital cartographies reveal how our daily lives are increasingly supported or even governed by computer-generated knowledges. We perceive these algorithms as pieces of "technological magic" so to say, yet they perform all kinds of cultural work, engaging in tasks that organize human culture. Therefore, it is imperative to move beyond the hype of algorithmitized society and take a closer look to unpack the algorithm as a concept in relation to the cultural products they generate. What precisely is an algorithm? Simply put, algorithms are a set of cascading rules a computer follows in order to solve a problem. An algorithm thus bears resemblance to a recipe, as it demands a logical sequencing. One fundamental feature is that it delivers anticipated results within a limited timespan and is therefore a reliable tool to trust with complex calculations.

The algorithm as such is framed in a rationalist setting, making it the ultimate vehicle of computation. However, the algorithm does not belong exclusively to the idealized realm of code. As I have pointed out regarding Google Maps, the algorithmic construction of the image is based on a heterogeneous data constellation that is deployed for various functions. As opposed to the foldable paper map, there seems to be an immediate link between the map image and the circumstances on the ground, that might be altered in real time. This might be experienced best when one, deliberately or not, fails to perform the directions the map dictates. Updating the location of the user in real space, the map instantly recalculates the quickest route to a destination based on the new departure location.

The notion of computation suggests that these processes are logical and impartial. Therefore, the default conception of the algorithm is one of a self-contained entity. Although algorithms enforce a solution that is practical and repeatable this inevitably means that they also reproduce, isolate or enlarge existing norms and prejudices. Therefore, algorithmic structures might implicitly lead to a biased system (Pasquinelli 2016). To literary and digital theorist Ed Finn, the algorithm is a vital combination of mathematical logic and the cybernetic principle of feedback. As such, algorithms both provide abstractions of reality and implement abstractions into reality. In other words, algorithms negotiate between the messy space of reality and the idealized space of computer code. This means they are not complete, rounded-off computer programs, but complex assemblages involving "human labor, material resources, and ideological choices" (2017, 7). Although the algorithm seemed uncomplicated at first

sight, what they precisely are, is hard to define, therefore I proceed to take the algorithm as focus of methodological analysis.

To explore the potential of the algorithm as a methodological lens I would like to turn back to Ed Finn, who contends that as scholars we ourselves need to take an algorithmic stance with regard to digital artifacts (52). As these computer programs are complex and layered, and their mechanisms concealed, their analysis requires an effective procedure. This process of algorithmic reading that Finn adheres to attends to the processual and imaginative faculties of any cultural expression, and therefore suits the objectives of this research. In Finn's analysis algorithmic reading comprises three key concepts: abstraction, process and implementation. First and foremost, computational models, like social or economic models, always fall short of reality. They include certain aspects, but there is always an infinite extent that is necessarily neglected. Therefore, algorithmic systems produce abstractions. Second, algorithms embody a sequence of steps that must be followed in a certain order, thus they are inherently processual. The final aspect of algorithmic reading concerns the implementation of rational sequences in lived reality. Or put differently, the abstractions that are produced and processed only become meaningful in implementation. As the core concept to this study, implementation signifies the embodied presence of computation in a material reality. Deciphering the forces that moderate the gap and constitute the temporary boundaries and connections to other "culture machines", is by itself an algorithm. The metaphorical doubling of the algorithm as a problem-solving procedure foregrounds the critical potential of the algorithm as an analytical figure.

The dream of a Cartesian *mathesis universalis*, a universal scientific language to describe the universe in order to grasp reality in a rational structure, formed an impetus to the Renaissance explorations and the subsequent Enlightenment. The Enlightenment desire to understand the cosmos in its entirety, has found a more elaborate expression in today's computational systems. By rendering data compatible to minimize the gap between map and territory, paradoxically the ideal of computer vision has had very material consequences. Algorithms span this gap by negotiating between computational and material realities. Therefore, it is a valid question to ask where one ends and the other begins. Along these lines, Clement Valla writes that "understanding the gap between the map and the territory becomes the work of understanding the biases in the algorithms, the sensors, and the mechanics of the map-making apparatus as a whole" (2012). Valla thus already frames the algorithm as agential being. He emphasizes the places where the computational world view does not coincide precisely with our human world view. It is here, I would say, that the space of implementation is revealed.

The algorithm seems to be ambiguously balancing the ends of rationality and magic. But rather than studying the output of the algorithm as culture machine, I will take the culture machine itself as starting point of inquiry. The desire for ubiquitous computing, rendering everything detectable by the algorithm, reiterates with Borges' map that equals the territory (Borges 1975). In a similar effort, tech enterprises have been in the process of connecting different data constellations into an encompassing layer of sensors that is enveloping the earth (Paglen 2014b). The notion of feedback loops is crucial to the running of algorithms, therefore the algorithm operates on us as human beings as well. The process of implementation is thus a material, embodied and situated procedure.

3.4 An Algorithmic Cartography: Google Maps and the Power of the Byproduct

With its ever-expanding platform Google embodies an entire worldview built on algorithms, that is amongst others reflected in Google Maps. The interface layout of Google Maps is refined continuously. Recently Google has been adding the contours of buildings to its map image. Earlier, the significant buildings in larger cities were marked on the map, but this effort has now been extended to the footprints of residential buildings even in insignificant towns. Even more, not only buildings but also the outlines of smaller structures, such as garden sheds, have started to appear in the map image. These built formations are rendered with an increasing level of detail, precisely following the shapes of the building including embossments, bay windows and air conditioning units placed on roofs.

Another recent cartographic innovation of the map interface regards color coding the map image. To increase readability, especially in the zoom-out overview mode, Google Maps employs different hues to differentiate between classes of areas within cities, e.g. residential, business or commercial areas, and to convey the density of businesses. These so-called "areas of interest" are not marked as the result of ground surveys. They are created algorithmically by stitching together areas with a high concentration of specific kinds of businesses including stores, bars and restaurants, into oddly shaped orange blobs (Li and Bailiang 2016). To cartographer Justin O'Beirne these "areas of interest" reveal how Google is using its mapping byproducts in an astonishing clever way. In fact, he posits, Google is creating new data from the data it collects (2017). In other words, the Google Maps image is not only an ensemble of "facts" collected and documented from the world out there, but a reality created from computerized data. For instance, Google deduces the layout of built structures from the archive of aerial imagery it shoots for the Google Earth platform. The shapes are rendered from the aerial photographs and subsequently added to the map. O'Beirne points out how the rendition process is automated, as in certain areas the roads have not yet been added to the maps, whereas the image already reveals the buildings located at

these roads. Such a map image produced through computer vision recalls the concept of the operative image that I have discussed before. The ongoing impact of these image categories has been investigated by Trevor Paglen. His assessment is that "we're quickly approaching (and have in fact probably long past) a moment where most of the images in the world are descendents of the "operational" images in *Eye/Machine*: namely images made by machines for other machines" (2014b). Pointing at the huge scale and magnitude of "operative" imagery to be found in systems today ranging from automated car licence trackers to quality control systems in manufacture and CCTV, he concludes that these images are not only expanding in sheer numbers, they are invisible to the general public, or human eyes all together. These contemporary operative images are invisible images that are embedded in some sort of functional or pragmatic enterprise that reinforces localization of people and objects in space, with utmost precision. Therefore, these images are turning into infrastructures, supporting networks that are invisible and ungraspable. The meat-eye is no longer effective enough to comprehend the processes interior of these images. This ultimately implies that the modernist convergence of vision and representation is no longer hegemonic.

3.5 New Machinic Assemblages: Computer Vision and Autonomous Vehicles

The previous paragraph has foregrounded the way Google has been on a quest to chart the planet, at a resolution of a pixel to an inch. This quest to map the entire world has been transformed from an effort of mapping for the world, to a process of extracting data from the world. Google is not only mapping the world's surface, but also the lives of its inhabitants by compounding all the data from its different platforms. To Google Maps, Google Street View has two important functions. Driving the vehicles up to every road of the world is a significant controlling mechanism to check whether routes are actually accessible and have been mapped correctly. A second feature is extracting information from the photographs. Information from geo-imagery, both the Street View and Earth platforms, is read and incorporated in Google Maps. This includes for instance the automatic extraction of street names and business names that appear on the street. As such, the camera cars and the corresponding Street View image platform intervene between route and map. Street View is thus a form of ground-truthing Google Maps, i.e. checking the result of machine learning against the reality on the ground.

The next stage in transportation seems to be around the corner, the introduction of vehicles that are able to drive autonomously. Accordingly, the most recent leaps in digital mapping technology constitute the evolution of three-dimensional maps to reinforce the navigation and movement of autonomous vehicles. This means that yet another transition in cartography lies ahead, as self-driving

vehicles pose a new set of cartographic problems. Also, the responsibility of proper maps now comes to lie with car manufacturers. Thus far, digital mapping interfaces have been successful platforms of navigation by helping us to select the best route from A to B and guiding us there by reminding us when to turn right or left. However, for automobiles to be able to move themselves safely and efficiently, the maps they use as navigational device has to meet other additional requirements. The maps now demand details such as the precise positions of lanes, the height of a speed bump and the width of traffic separators. The map thus has to equal the territory, as in the Borgesian empire that is mapped on a scale of one to one (Borges 1975). Yet, in Borges's story the infinite map made itself redundant by rendering the territory in all its complexities.

Yet, I take the opportunity here to argue otherwise. Our quotidian technologies of the future, like our smartphones today, require location awareness to function. In turn, for location awareness maps are required. Furthermore, autonomous vehicles have to be able to see. Although the digital revolution produced cameras with increasing megapixel resolution, to take a photograph is not equal to seeing, as seeing equals comprehending your environment. Seeing is an embodied cognitive activity, that cannot be simply reproduced in a machine. Although we live in a technologically advanced society, our computers still struggle with the task of making sense of what they see. Digital photography transforms light into pixels, however the image-taking machine cannot comprehend the image itself, or in other words, these pixels do not bear any meaning to them. Apart from computer vision, these machines need a sense of place. Autonomously driving vehicles are reliant on the map, in a much larger degree than their human-driven predecessors. Yet, the way it read the maps will start to diverge. The car must focus primarily on the things that are changing, whereas stable factors are stored on the map in the car's memory.

Then, how does an autonomous vehicle make sense of its surroundings? For its self-driving cars, Google employs lidar technology - a portmanteau of light and radar - that beams light pulses and uses their reflection to calculate distance to surrounding obstacles. The cars are programmed for possible situations to be encountered on the road. Yet not every situation a car could possibly encounter can be pre-programmed. Therefore, these cars now rely on machine learning systems. By analyzing thousands or millions of images the algorithms learn how to recognize different actors in traffic such as pedestrians, other cars and cyclists and obstacles or road cordons. There is an infinite number of factors that exercise influence on the vehicle. How would such a vehicle move on unpaved roads? It has to distinguish between puddles and potholes, and how would it react to weather conditions such as heavy rains, gusts of wind or snowy roads.

An autonomous vehicle must understand the environment it is positioned in. In other words, this machinic vision is far from detached and virtual, but rather embodied and situated. Through the cybernetic feedback loop sustained in algorithms the car is able to be aware of its own positionality, dimensions and the speed at which it traverses space. Self-driving maps thus epitomize a new stage in digital mapping. It relies on exceptionally accurate real-time updates. The map is no longer meant to be read by a human being but will be read by a machine. In other words, the map itself becomes the operating system. Eventually the map will be absorbed entirely by the machine. The human being, technology and nature thus are not three separate realms, but co-operating to such an extent that they are co-emerging.

3.6 Black Box: The Limits of the Algorithm

As we have seen in the above paragraphs, algorithms are set to reach a pre-specified goal and therefore they produce abstractions as their output. Following this, algorithms are often assessed according to their input and output, whereas its inner workings remain opaque. Nevertheless, a prerequisite characteristic of the algorithm is its limit. For the algorithm to perform its task, it must be unambiguous, i.e. its instructions clear and boundaries strict. Therefore, I would assert that the confines of the black box are as significant to an understanding of the algorithm, as the workings of the algorithm itself. This is an issue that echoes the previous chapter, where are these boundaries drawn?

The input-output relationship of algorithmic mediation is reversed in the artwork *Orogenesis* by Catalan artist Joan Fontcuberta. This art project that spanned the years 2002-2006 both draws on the landscape genre at large and photographic representation in a series of digitally constructed images. Although it may seem incongruous to discuss *Orogenesis* in terms of photographic imagery, it is crucial for a better understanding of the digital algorithmic image. For one, *Orogenesis* moves beyond post-photographic anxieties in a virtual world. As such, it questions the status of the photographic image now that it has dissolved in the jumble of digital images, thereby both losing its historical specificity and its position as document.

The term *Orogenesis* designates the collective geological processes that allow the formation of mountains in the event of interaction between plate tectonics. The collection of algorithms that underpins this image is called Terragen, a procedural planet generation program created for military and scientific purposes. It is a reverse photogrammetry, as not the terrain itself, but a cartographic translation of this terrain is the starting point. This software enables the user to build a photo realistic model of the territory the map data refers to. Terragen transforms height maps, i.e. maps that offer information about elevation

in rasters, into accurate visualizations through atmospheric engines. When soldiers or combat groups were to explore unknown terrain, this software helps them to visualize the landscapes they might encounter as potential battlefields. Terragen algorithms generate a scenery that could have preceded the map that served as input to the system. On those grounds, Terragen is the updated advanced military reconnaissance routine. The high altitude of the image perspectives underscores its role as survey image.

In *Orogenesis*, instead of using cartographic material, Fontcuberta allows Terragen to read canonic images from the art-historical landscape genre. The result is a familiar yet slightly uncanny image of mountain ranges. For their habitual appearance art historian Geoffrey Batchen calls them postcards (2005). *Orogenesis* comprises different sections. In one section, titled *Landscapes of Landscapes*, Fontcuberta feeds the software reproductions of famous artworks by artists as Rothko, Cézanne and photographer Carleton E. Watkins. In another one, that bears the title *Bodyscapes*, he inserts photographs of his own body parts into the program. In these datascapes, Terragen produces an artificial landscape from a real object, being either works of art or body images from Fontcuberta. However, *Orogenesis* underscores how there is no dichotomy between reality and model: there is only one idealized landscape that is transformed into another idealized landscape. As such, Terragen subverts any concept of natural landscape and thoroughly questions the authority of both the cartographic as the photographic image.

The output images are fictional landscapes that have never existed physically to be experienced. Interestingly, the re-processed image that is the output of the Terragen software still has an indexical bond to its mother image. Such a relationship I have termed algorithmic indexicality elsewhere (Scholtes 2017). Updating the theoretical focus on photographic indexicality, I argued that a virtual space is not a pre-existing void that waits to be filled, but rather emerges through a trajectory of heterogeneous and material data. Yet these images seem depictions of empty landscapes, without reference to events of human existence. Terragen seemingly robs the image of its history, however the output images paradoxically return as maps to navigate the artworks that served as input material. This resolution imbues the image with a new history, a new temporal reference, and a new spatial memory. The remapped images pinpoint the problematic relationship between pictures and the real world. The Terragen algorithms highlights the interpretation and translation that maps, and photographs are always conditioned on. Thus, the algorithm, like any language, operates in the twilight zone between reality and its description

Orogenesis twists the post-photographic anxiety that came to dominate photography debate after the introduction of digital technologies. Art journalist Robert Shore notes that post-photography operates in the forcefield of what always defined modes of photographic production, and what transcends them (2014). *Orogenesis*, as media theorist Sarah Kember points out, reminds us that any photographic image is only a constructed idea of the real (1998, 11). The uncanniness and unease that *Orogenesis* calls upon with its constructed "reality" is cloaked by the allegedly neutral and objective quality of documentary photography, or the algorithm. Once again, photography is only a tool that constructs a reality before our very eyes. As such, *Orogenesis* both critiques the map and the documentary photograph as markers of detached neutrality.

The algorithm has a limited vocabulary and does not suppose a coherent system. Rather, any working algorithm is itself a constellation of multiple sequences that are each confined to their own specific task. The algorithm is the preset that determines how to read the photographic image or the work of art and transform the data into a photographic depiction. The dynamic relationship between data and data underpins the algorithmic image. The tones, lines and shapes of the inserted images are seen as indications of landmarks, rivers or elevations. Or put differently, the algorithm attributes meaning to the visual clues it is presented within the parameters that are pre-dictated. The virtual image technologies employed in *Orogenesis* are restrained to a small vocabulary of geographic terms, mountains, valleys, rivers or oceans. By treating any visualization as an unknown territory, *Orogenesis* upsets the distinction between cartography and photography in advance.

3.7 Algorithmic Imagination: Orogenesis

In *Orogenesis*, similar to Google Maps, the algorithm creates a new spatial realm, that answers to its own laws. As they seem to be referring to no "real" landscape, these images have also been signified as "landscapes without memory" (Batchen 2005). The images exist somewhere between the natural and the artificial, or the imaginary and the perceived. The *Orogenesis* images lack history, memory and place, but they bring to the fore hidden assumptions about the construction of photographic imagery. The artwork suggests that the parameters of cognition and inspiration have been readjusted and altered by computation. When do they deserve credits for their part in creative operations, for they are increasingly active and collaborative agents. In *Orogenesis* the result of the creative process of image production is partially handed over to the algorithms that comprise Terragen software. The notion of authorship thus becomes a distributed function.

Orogenesis demonstrates how the algorithmic imagination includes prediction and the way it yields unexpected results by building epic landscapes. This can be viewed as a form of imaginative thinking in its own right. The imaginary potential of algorithms lies in their capability, as problem-solving sequences, to envisage a reality that does not yet exist. Therefore, I would argue that considering the agency of the inverning algorithm in the aesthetic analysis of *Orogenesis* as artwork is crucial. As a whole, *Orogenesis* emblematizes the digital image. The digital economy of the image is more complex than a dynamic image on screen. It is subject to methods of compression such as jpeg or mpeg formats for data transfer across network infrastructures. *Orogenesis* becomes a metaphor for the process of digitization as it echoes the displacement and dispersion of the digital image on the vast networked infrastructures of the web. Or as Donna Haraway puts forward, "it is in these visualization technologies in which we are embedded that we will find metaphors and means for understanding and intervening in the patterns of objectification in the world—that is, the patterns of reality for which we must be accountable" (1988, 581).

The Terragen algorithm interferes between the familiar and the unknown, and as this happens inside the black box, it reveals the precarity of the balance between the two. Whereas the algorithm's operative power is limited to the confines of the black box, the limits of its implementation are the limits of the universe. As stressed before repeatedly, digital transformations of the materiality of images into code have enforced a different compatibility of images. The algorithm is pre-set to read the photograph as a map, that bears some similarity to the processes described in chapter 1. The only pre-existing constituents are the outer boundaries of the algorithm that makes sure the process proceeds according to a certain logic.

Orogenesis' mysterious landscapes typify what Matthew Hart terms the "cartographic uncanny" (2006, 46), the map that has familiar looks and feels, yet it turns out to be a chart of something else entirely. The idea of the cartographic uncanny reveals that the acts of mapping have failed, yet despite their failure they continue to be subject to cartographic reason. *Orogenesis*' cartographic turn is not an act of trickery, as the algorithm simply does not care what image it is presented with. Art theorist Jason Wee has pointed out that *Orogenesis* employs art-historical tropes to bend the discipline of art history (2006, 25). In an act of *détournement*, *Orogenesis* takes the work of art from its previous context to submit it to a strict regime of principles. We therefore need a radical rethinking of the work's aesthetics. As it is not about the surface material it presents, but the elaborate system of rules and agents underpinning that surface and constantly regenerating the surface, just like captain Siggi and his vessel.

3.8 Conclusion

In this chapter I aimed to probe photographic and cartographic manifestations in the digital age through the ambiguous figure of the algorithm. Departing from the Icelandic explorer captain Siggi who draws from a diversity of cartographic sources that are fortuitously at his disposal, I have attempted to put forward a broader understanding of the algorithm as mediator between abstract code space and the pluralities of lived realities. To me Siggi captures the ideosyncracies of the cartographic algorithm, that is a constant mediation between different technocultural systems and actual lived space through a process of feedback. What has become clear throughout this chapter is that algorithms do not belong exclusively to the realm of computation but intervene in lived space. In its many instances, the algorithm bridges the gap between theoretical ideas and pragmatic instructions. Yet, how did this negotiation between abstraction and material reality change with the arrival of digital image technologies? Or, how can the algorithm as analytical tool tell us how the constellation has shifted? I found in the algorithm a productive concept to study and theorize the rift between map and territory, or photograph and reality, a gap that is constantly renegotiated. As I have demonstrated, map and photograph increasingly internalize operations like navigation. The image truly has become a space of negotiation. Maps and photographs have always afforded actions and operations in a human-technology-environment assemblage. The algorithm thus cannot be confined to computation and digitization alone. But the constellation through which agency emerges has shifted towards the image space.

Conclusion

Traversing Photographic and Cartographic Mediation

The advent of digital technologies has mobilized a shift in the way we encounter and create space. As a result, it seems that boundaries between technologies of mediation start to fade or do not even apply any more. Likewise, the borders between the micro and macro scales or the tangible and intangible have become confused. I have recognized this shift as a particular historical moment that we find ourselves in, yet one that does not mark a radical break in time. Both photography and cartography have always-already been closely associated to one another, for example as tools to explore new territories. Throughout this study, I have identified the alliance between cartographic and photographic mediation as one of mutual effect. Yet, the relationship linking both forms of mediation has started to shift against the backdrop of digital technology.

Although I have not referred continuously to these theories throughout the chapters, this research is heavily informed by Karen Barad's ideas on the entanglement of matter and meaning (1998; 2003; 2007). Along the lines of new materialist discourse, that is posed against the linguistic turn where the real exists only as a product of language, I have argued to recognize agency as distributed. Therefore, concepts are always-already entangled with matter. As Barad contemplates, "discourse is made possible through specific material practices" (2007, 148). Or in other words, the discursive needs to be materialized in order to come into existence. This study has examined possibilities to theorize the entanglement of meaning and matter, by taking up photography and cartography as analytical devices. In a performative gesture, this study explicitly draws a cut across media phenomena to emphasize that these media cannot be apprehended in essentialist terms. As this study pivots around photography, cartography and digital culture, I have chosen to separate these three constituents into three different theoretical tropes. By no means do I intend to suggest that these concepts are actually separate. Instead, this research explored the entanglement of the theoretical and the material. As such, in this study I have temporarily dichotomized between two technologies of spatial mediation. At large, this is what any researcher does in the practice of science when analyzing parts of the universe.

I have found both photography and cartography to be ambiguous terms, notions that are both semantically and ontologically unstable. Yet it is precisely because both media refuse to be grasped in a simple definition, that a new space of inquiry opens up. Therefore, I have taken up on the flexibility of both photography and cartography and recontextualized both technologies as methodological concepts. The cartographic condition is expressed in terms of the navigational trajectories that each image affords.

These foreground the motion, processuality and dynamics of visual practices before and after the digital turn. When employing the photographic condition as a theoretical lens, I have found the cut as an apt device that emphasizes the temporary stillness and stasis of the photograph that stabilizes the flow of mediation. The idiosyncrasies of the photograph pertain the operations of a lens that inflict a cut in time-space.

These two ends, the cartographic as opposed to the photographic, mark a tension field or a dialectic between two seemingly opposite ideas. Yet one trope does not exist without the other, and together they maintain a precarious balance that is always prone to be disturbed, only to regain another new harmony in coexisting stillness and motion. To add a third element to the matrix, I have introduced the algorithm as the principal carrier of digitization. Similar to photography and cartography, the algorithm turns out a relentlessly slippery notion. Stripped to its base the algorithm is a negotiator that connects the abstractions of mathematical code space to the messy worlds we find ourselves living in. The algorithm negotiates between abstraction and practice, and as such epitomizes the entanglement of matter and meaning. As such it also ensures that neither end will become fixed in a static image.

I have established the tension and contrast between the focus on movement in the first chapter, and the focus on stillness in the second chapter, as a productive metaphor of non-dualism. Simultaneously this temporary cut provided opportunities to create a space of reflection. To bridge the gap between them, the last chapter focused on the algorithm, as not only part of digital culture, but as a prolific trope to study the properties of spatial mediation. The algorithm is a paradoxical figure, a binding glue that always (re)produces a space of in-betweenness. As such, the folding together of photographic and cartographic media practices in digital times pose a theoretical problem with important ramifications. The triparition that I have made does not reflect a situation pre-existing to my analysis, it is rather an active intervention that I make as a researcher. Agency emerges in-between, as discursive concepts activate certain parts of practices and practices motivate theoretical concepts.

To that end, this study is set up as a contribution to a renewed scholarly interest in materiality. Thereby its significance is primarily found in its challenge of representational paradigms that still prevail in traditional theorizations of art, photography and cartography alike. The research as a whole is an exercise in diffractive reading. Using these media as analytical concepts, i.e. reading them through one another, helps us emphasize certain aspects of the case studies and practices and activates agency from the spaces in between. Through an investigatory method of diffractive reading I have employed photography, cartography and algorithms as concepts to read photographic and cartographic practices.

Diffractive methodologies draw our attention to the gaps and insights produced through the boundary-drawing practices that we employ to make sense of our worlds.

All things considered, I have demonstrated that it is within the relationship of the concept and the practice that agency materializes. I recognize further significance of this perspective in art and media studies, for instance in the field of aesthetics. Many contemporary media practices and artworks urge the theorist to move beyond representational approaches that produce and maintain distance between the analyzer and the analyzed. As digital technologies continue to evolve and expand into all facets of daily life, this asks us to constantly revisit the theories we have devised to make sense of the universe. To account for the dynamics of the visual, I have proposed to displace the focus on the media or object to the space in-between. This perspective holds potentialities for further research in media studies, geography and art-theoretical discourse.

This study as a whole underlines the processuality of mediation. The digital explicitly reveals the image as process, as we see this more as a practice rather than an object. Whereas the digital image might at first sight turned into a piece of software that is eternally mutable. Any image always comes into being into a complex constellation that traverses production, distribution and reception. The digital turn has foregrounded the processuality of engaging with images, yet it has shrouded other aspects. Above all, digitization has marked a moment in time, but also invites us to look back at the historical entanglement of both media technologies. To recall Bruno Latour once again, when such a reflective moment occurs, "our past begins to change" (1993, 11). This study has argued that digital technologies have made us reflexively aware of the relationality of imagery and mediation. It is because the relationship we maintain with past events changes, that we intra-act with the past in a different way. In other words, we notice different aspects of past things.

This historical moment leaves room to reconceptualize reciprocal relationships between cartographic and photographic mediation. Therefore, I would like to end my argument by pointing again at the significance of the digital turn, that initially sparked my interest to research the myriad of intersections linking photography and cartography. It turns out that the digital embodies a moment that is far more complex and does not merely affect the (infra)structure of the image, but also our attitude towards conceptualizations of image and media. To recapitulate Latour, we have never been modern. We have merely been forced to revisit established ideas and concepts thereby changing the relationships between them. Notably, this is a reciprocal force, as it is the practice that makes us aware of something that in turn changes our relationships to that practice. The advent of digital technologies thus makes us post factum aware of the always-processuality of mediation.

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