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# An Earthly Response to Movement. Moving Images Diffracted Through New Materialism

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University of Plymouth

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**UNIVERSITY OF  
PLYMOUTH**

**An Earthly Response to Movement**

Moving images diffracted through New Materialism

by

Emilio Chapela

A thesis submitted to the University of Plymouth  
in partial fulfilment for the degree of

DOCTOR OF PHILOSOPHY

School of Art, Design and Architecture

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*To fog*

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### **Signed author's declaration**

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Doctoral College Quality Sub-Committee.

Work submitted for this research degree at the University of Plymouth has not formed part of any other degree either at the University of Plymouth or at another establishment.

All images by Emilio Chapela, except for Figure 1.1, by Philippe Henarejos, whose has given me permission to publish that image.

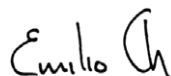
Please refer to the following webpage for accompanying artworks (which are referenced at the end of this thesis):

<https://www.emiliochapela.com/phd-videos>

Some of the works here presented were part of my solo exhibition *En el tiempo de las rosas no envejece el jardinero*, at the Laboratorio Arte Alameda (2019) in Mexico City.

I presented parts of this research at the following conferences and symposia: *More Just Sustainable Futures* (2021) at Plymouth University, *Latin American Video Art Cohabitation* (2021) at University of Zurich, *Imperfect Cinema* (2017) at Plymouth University.

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Emilio Chapela  
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## **Abstract**

### **An Earthly Response to Movement**

Moving images diffracted through New Materialism

Emilio Chapela

This practice-led research follows my exploration of the Sierra Negra astronomical observatories in Mexico, as well as other sites and temporalities where my practice has drifted: it flows from the heights of two volcanos, across Idaho during a total eclipse of the sun, and into the waters of the Usumacinta River. It proposes an ‘earthly’ (Latour 2016) moving image practice that considers the planet as a source of movement, effects and, affects: a vibrant entity that is not seen as static or mechanical, but one that ‘is moved’ (Serres 1995) because it is agitated by the liveness of matter and by the impact of our anthropocentric endeavours.

How can a moving image practice be developed (or reworked) in response to the Earth’s various movements and temporalities, whether atmospheric, geological, astronomical, climatologic, or agential? Consequently, how can this practice be put in motion in attunement with these various movements, even when they become turbulent, unstable, precarious, or extremely slow? I explore these questions by appealing to New materialist philosophy associated with Karen Barad (2007), which is a theoretical framework in which entities are not seen as being determined before the interactions: their qualities, capacities and boundaries emerge from the interplay with matter within a phenomenon. New materialism is “fascinated by affect, force, and movement as it travels in all directions” (Dolphijn and Tuin, 2016, p. 113). It is within this context that I subscribe to what Barad describes as response-ability (2015), a form of engagement that entails a capacity to respond by being accountable in relation to other entities, matter, and movement.

I work with the notion of diffraction, a methodological approach for “reading insights through one another in attending to and responding to the details and specificities of relations of difference” (2007, p. 30). Accordingly, I employ diffraction as a means to



read 'moving images' and 'New materialism' through one another to find out what emerges from such an encounter; and to explore if this strategy facilitates less anthropocentric relations with humans and nonhumans alike.

The practice that emerges from this research is concerned with a material vitalism (Bennett, 2010) that considers matter as enthusiastic: I refer to clouds, fog, rocks, rivers and light; but also, and in agreement with filmmaker Elke Marhöfer (2015), to the camera and other apparatuses of the moving image. This form of materialism challenges the predetermined inherited Cartesian categories that relate with the moving image when presented in the form of subjects, objects and cameras; human and nonhumans; time and space; fast and slow.

The various video works submitted for this doctoral project are in dialogue with the writing component. Together, they tell the story of a research committed to movement and flow; a process in that dialogue with what Isabelle Stengers calls 'Ecology of Practices' (2013), which are non-neutral tools for thinking and practice that are inseparable from the problem they aim to explore: this entails openness, change and transformation through time.



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## Introduction

Motivated by an artistic interest in astronomical observatories at the Sierra Negra volcano in Mexico and its remote habitat, this practice-led research considers movement as non-mechanical and agential (agency seen as the capacity to affect and be affected). How can moving images respond to the world's various movements and temporalities, whether atmospheric, geological, turbulent, astronomical, climatologic? What moving images emerge from enabling collaborations amongst humans and nonhumans when looking at New Materialism? In exploring these questions, I aim to challenge the homogeneous and universal notion of time associated with anthropocentric endeavours.

I arrive at these inquiries from the perspective of an artist working with video art, here referred to as moving images: a practice that started with the arrival of video cameras in the mid-1960s, and that has taken a central stage in contemporary art in recent years (London, 2020). I also feel inspired by Malcolm Le Grice, who explains: "I am primarily a film-maker and artist, my inclination is to work-things-out, or work-things-through by making films". (Le Grice, 2001, p. 164). Similarly, this research is an attempt to think and work-things-through in relation to movement by means of the moving image.

I propose moving images that emerge in attunement with and in response to a world that is seen as a source of various movements, forces, and effects: a vibrant entity that is not static or mechanical, but that it is moved by the liveness of matter. It concerns a move away from the imaginary that depicts the world from outside or a nowhere position: ungrounded and dismissive of a whole gamut of movements. It is in that sense that this practice is *earthly* (Latour, 2018). The moving images presented here are the result of inhabiting the planet, regardless of whether its movements are turbulent, vital, unstable, slow, fast or precarious.

This research follows my exploration of the Sierra Negra astronomical observatories in Mexico, located in a remote location at the top of an extinguished volcano. It takes the opportunity to be curious and attentive precisely in a place designed to look far away into the Universe. “I am a creature of the mud, not the sky” (Haraway, 2008, p. 1) declares Donna Haraway, referring to the place, as a trained biologist, from where she thinks about the world amongst *earthly* critters. This practice inhabits the world troubled between mud and sky, as it pays attention to the practice of astronomy while collaborating with the clouds and snow, submerging in water, and looking at the soil while walking up the mountain entangled with my beating heart: these words will be clearer later in this text when I explain my practice in detail, but this research, affected by material conditions at the observatories, has travelled too. It drifted from the heights of the Sierra Negra volcano, across Idaho during a total eclipse of the sun, into the waters of the Usumacinta River, and back into the mountains. Immersed in these overlapping locations, temporalities, scales, and movements, I turned to New materialism (Dolphijn and Tuin, 2016), which is a term used to identify the thinking of authors, researchers and artists who propose a material, comprehensive, interconnected, multidisciplinary and non-cartesian approach to the world.

I concentrate on the thinking of Karen Barad (2007), who challenges the notions of linear causality, also contested by Manuel DeLanda (2015) and associated with the formula that assures that the same causes, bring the same effects, always. This is the case of the Newtonian understanding of motion, where objects remain stable and behave the same way given that the conditions that cause movement are secured, and that no external force alters their movement. In opposition, Barad explains that there are no preexistent qualities, capacities or ‘external’ forces prior to entanglements. Instead, phenomena (here pertaining to movement) are subject to constant reworkings that can produce various and heterogeneous effects, even when considering similar causes. Sometimes even a small change in intensity can

bring unexpected results (DeLanda, 2015). That kind of nonlinear causality brings novelty and transformation, like in the flow of a river, the formation of clouds, or in turbulent waters when falling down a cascade, which are forces that are in continuous negotiation with various qualities, capacities and territories, where “it is impossible to differentiate in any absolute sense between creation and renewal, beginning and returning, continuity and discontinuity, here and there, past and future” (Barad, 2007, p. IX)

Barad’s ideas on agential realism (2007) insist on the emerging qualities of entanglements by proposing intra-actions, instead of interactions, in which objects are not taken for inert and passive entities, but as active and emerging subjects prone to enact, affect and be affected (agency), along with other entities like humans and apparatuses (like in the case of cameras and microphones) and also with ideas and discourses that participate as matter too (2007). All these intra-acting entities, continues Barad, can be determinant to the reconfiguring and dynamism of causes and effects that produce non-mechanical movement, which is a central concern to this research.

Some of the agential movements that interest me, like turbulent flows (as in a river) and weather systems, are accounted for in the work of Isabelle Stengers and Ilya Prigogine (1984) and are described as emerging processes that move towards apparent states of order or disorder but do not remain stable throughout time. The authors recognize the difficulty in disentangling the meanings of ‘order’ and ‘chaos’, by inquiring, for example, if a forest is an orderly or chaotic system? (1984, p. 169). The history of individual entities inside the forest, like species, explain Stengers and Prigogine, appears accidental and contingent, when described by the Gaia hypothesis (Margulis, 1998; Lovelock, 2016) explained later in this text, while the overall interaction and diversity of patterns of the forest appear orderly. I believe that is also the case with a river, where it is easy to observe various overlapping qualities, rhythms and transformations like flows, chaos, order, stagnation, evaporation, and so on.

I have also approached the moving image practice from the perspective of New Materialism with the intention of revisiting the divisions between subjects, objects, and camera; culture and nature; human and nonhuman; and other categories. But I do not come with a recipe to re-assign roles arbitrarily: referring to New Materialism, DeLanda explains that “we should not attempt to build such a philosophy by ‘rejecting’ dualisms or following any other meta-recipe” (Dolphijn and Tuin, 2016, p. 43) that constructs new general categories, but to follow the continuous reworking of emergent particularities, qualities and capacities, as Barad suggests (2007), which also means to stand on moving grounds or interstices and recognizing the instability of Cartesian divisions.

Furthermore, Michel Serres points to an Earth that moves not only in mechanical planetary motions, but one that it is also moved by the action of humans transformed by our doings. “We are disturbing the Earth and making it quake!” (Serres, 1995, p. 86). We are not in front of a crisis of the intellect like in the Galilean revolution, which was an epistemological transformation, but one of time, weather, and survival; continues Serres. This is the ecological and geological crisis brought about by the actions of humans and described by some as the Anthropocene (Lorimer, 2012), a worldly transformation that is making us shake, sicken, migrate, drown and flee. The earth is trembling, but, in our heads, we have left the Earth, follows Bruno Latour, who insists on finding ways to land and inhabit this Earth (2018), by redirecting our attention to the earthly and terrestrial, not only as an imaginary, but also by “multiplying viewpoints, *registering* a greater number of varieties, *taking into account* a large number of beings, cultures, phenomena, organisms, and people” (2018, p. 12). That is how one can complicate the provincial and unifying view of globalization, explains Latour further. This research adds to that effort, putting special consideration on the heterogeneity of movement. To do so, I look to New Materialism as it is “fascinated by affect, force, and movement as it travels in all directions.” (Dolphijn and Tuin, 2016, p. 113).

I use diffraction (Barad, 2007) as a tool for thinking and practice, not as a place from which to reflect into my own practice (as if looking into a mirror), or to critique my own work, which according to Barad is associated with “subtraction, distancing and othering” (Dolphijn and Tuin, 2016, p. 49), but as a way to read and map diffractively the emerging differences that matter, as explains Barad: not simply to add, but to be suggestive and creative (2016, p. 50).

Diffraction is a methodological approach for “reading insights through one another in attending to and responding to the details and specificities of relations of difference” (Barad, 2007, p. 71). Accordingly, I employ diffraction as a methodology to read ‘moving images’ and ‘New materialism’ through one another to find out what emerges from such an encounter and to understand if such an approach facilitates a less mechanical and anthropocentric understanding of worldly movements.

Thinking diffractively is used here as a tool and praxis to approach matter attentively and avoid bypassing, assimilating or eradicating differences, atmospheres or intensities. The practice here developed is about paying attention, responding to registering the emerging manifestations of what movement does. Diffraction is not something that throws or renders concrete immediate results, but a process that entails time and transformation. The works here presented emerged from spending time reading, thinking with and discussing New materialism. I recommend reading this text (and story) diffractively, that is by paying attention to how it changes and advances in time and how it can relate, transform, or be passed through other ideas and practices.

Using New Materialism as a tool and method for thinking and practice provided me with resources to understand movement as a lively and emergent force. But it was the practice itself that enabled me to get



entangled with movement. This project has been about observing, experimenting, and paying attention through the moving image. I travelled frequently to the observatories and the mountains: on every trip I would attempt to work with the material conditions that I would find, relating to the weather and paying attention to my body while recording images and making photos. And while I have a lot of material, some of which is not included here, the images served as tools for working-things-through when thinking about movement.

In the last few years, there has been growing interest in new materialism and diffractive methodologies, and how can they be used to inform art practices, or be used as methodological devices to create artworks that can be described as ‘diffractive art practices’, here understood as “the ‘always-already’ entangled practices of art, namely the entanglement of material practices and the entanglements of the ways we articulate the practices of art and the practices themselves” (Pritchard & Prophet, 2015, p. 11)

In the context of moving image and film, for example, there has been particular attention given to the materiality of the filmstrip, the camera, and how the image is produced. Amba Sayal-Bennett (2018) uses Barad’s ideas to diffractively read Cory Arcangel’s and Steve McQueen video works, by analyzing how images are produced through processes of digital distortions, as in the case of Arcangel’s work; or how certain techniques of the moving image are re-signified, for example, by throwing the camera from hand to hand instead of cutting a scene, as in McQueen’s video *Catch* (2017).

While McQueen’s video is relevant to this research, as it incorporates a form of movement that is agential instead of mechanical, I am also interested in the use of Barad’s diffraction by the artist and researcher Jol Thoms, as a form of radical relationality to read the multiple and entangled characters (natural or cultural) of a specific landscape where a neutrino observatory is being built underneath the lake Biakal in southern Siberia (2021).

According to Thoms, the water inside the lake, which plays an active part in the observations, should not be taken merely as infrastructural support, but as an integral part of the observatory. He follows Barad's ideas to help him situate the apparatuses, including the astronomical devices, the lake, and the mountains themselves "in the otherwise overlooked contexts that generally lie outside the scope of a physicist's descriptions or disciplinary concerns" (2021, p. 237). This strategy echoes my own research as I have been concerned with understanding the Sierra Negra observatories not only as tools to observe faraway places from the perspective of astronomy, but as comprehensive devices through which we can learn more about our relations to this planet. In this regard, in the section Black Hole (p. 98), I describe how the planet becomes an active participant in the observing of a black hole and discuss the possible motivations and philosophical consequences of doing so.

The filmmaker Elke Marhöfer also explores new materialist methodologies and practices by deploying an animist methodology that aims at forming connections with matter and within specific relations: "the project mobilizes and is mobilized by affects, precepts and sensations of the more-than-human" (2015, p. 3). By 'becoming with' animated objects, sorcerers and fabulists, Marhöfer investigates the power of objects and their capacity to do things, including the camera.

Despite the different theoretical approaches to new materialist philosophies (Lemke, 2015) and the variety of its possible enactments into the art practices, the field remains contested terrain, especially in its capacity to incorporate geopolitical issues that could help us describe the Anthropocene not only as a geological and atmospheric crisis, but as a critique of liberal capitalism, race, colonialism, and extractive practices, such as in the work of Elizabeth Povinelli (2017) and Kathryn Yusoff (2013), whose ideas direct attention to the pervasive effects of the material configurations and

unbalances of power and politics. Povinelli explains that the climate crisis cannot be blamed on all humans but on the activities associated with liberal capitalism and with “a specific mode of human society [...] and even there, specific classes and races and regions of humans” (2017). Yusoff’s thinking invites us not only to consider the racial dimensions and the histories of slavery as part of the critique of the Anthropocene, but to seriously consider the geological or “mineralogical dimension of human composition that remains currently undertheorized in social thought and is directly relevant for the material, temporal, and corporeal conceptualization of fossil fuels” (2013, p. 779).

While Barad does not explicitly engage in a critique of liberal capitalism as Povinelli does, she maintains a critical stance, for example, on the imbalances produced by the imposition of a homogenous time associated with progress, capitalism, and militarism. This form of time, she continues, tends to separate those who can ‘keep up’ with the accelerated rhythms of capitalism from those others that cannot, and that are therefore left behind or relegated: when time is universalized “it is inevitable that in the big picture of human history some peoples will be viewed as ‘on time’, ‘ahead of time’, or ‘running late’ (2017, p. 60). This form of violence is seen frequently in Mexico, and it is manifested in the Sierra Negra, where the surrounding communities to the observatory (an advanced scientific and expensive device) suffer from high incidences of illiteracy, poverty, inequality and violence associated with organized crime like gasoline theft, drug trade, and murder. I approach these inequalities in my video work *The alpine tree line is not a line but a gradient* (2016) that is described later in this text. (p. 42)

Barad stresses that diffraction is a methodology that entails relations of obligation and ethics of response-ability. However, when reading Barad, it is possible to feel like there is more to say about this, especially how this ethical framework can be mapped out — through case studies — to specific geopolitical situations. For example, in the context of rivers, a subject matter relevant to this project and connected to research that I have

been developing in parallel to this research, Duncan Ifor revises riverine stories deeply entrenched with violence, where rivers act as archives and materialization of narratives “that mediate the stories and traces of those who have been lost”. He does that by looking at specific cases of violence and avoiding taking water as universal and abstract (2019).

Whether new materialism and diffraction can account for these geopolitical inequalities, is a matter that is worth exploring, and both Povinelli’s and Yusoff’s ideas provide a strong framework to do so, but it is a question outside the scope of this research. I recognize that new materialism can encounter some limitations and I do not intend to bypass the geopolitical agencies and social inequalities related to the Sierra Negra communities. They exist and are part of any encounter. As an artist with an interest in scientific thinking and practice, I engage with the new materialism associated with Barad’s ideas, to produce artworks that are attuned to the world’s agential and complex movements and to recognize a shared responsibility to the places and temporalities that I became entangled with. I describe these intra-actions in detail throughout this text, which are also manifested in the artworks that accompany this text.

There is also a critique of whether scholars associated with new materialism have rightfully acknowledged and referenced Indigenous scholars that have spent many years working with comprehensive ideas and ways of living that welcome non-human agency, relationality, and vitality for generations (Sundberg, 2014; Rosiek, Snyder and Pratt, 2020). I agree we need to do more to avoid what De Sousa calls the ‘monoculture of scientific knowledge’ and move towards an ‘ecology of knowledges’ (2008), including Indigenous cosmologies. This, at least to initiate a dialogue that allows us to understand similarities and differences: not only to avoid the violence of “reinforcing ongoing practices of erasure of Indigenous cultures and thought” (2020, p. 332) but also to understand if new materialism is different —and in what ways — from Indigenous epistemes, as we have to

be careful not to assume that new materialism is only repeating the same that others have long said before.

With this in mind, at the end of this text, and as a result of my entanglement with the ecologies at the Usumacinta river in Mexico, I initiate a dialogue with the ideas of Ailton Krenak, an Indigenous leader from Minas Gerais in Brazil, who among other things, invites us to pay attention to nonhegemonic narratives, including our dreams, the place where we can go, he explains, in search for knowledge, learning, and inspiration (2020). I will continue to explore this further beyond the scope of this research.

This research also pays attention to the agential capacity of matter and its vitality (Bennett, 2010) through a combination of methods that look at movement by means of attentiveness, attunement (Stewart, 2011) and ‘response-ability’ (Barad, 2015), which is the capacity to enable responses to those with whom you are intra-connected, regardless of their proximity. Astronomy, like the moving image, is a practice in which entities can touch at a distance, like the case of light that travels through the Universe to reach a telescope, or a video camera. Touch as it is described by Barad is a form of entanglement that entails responses (2015) Touching is how we can move from interpretation, representation and observation to a change in the world (Puig de la Bellacasa, 2009).

This research also looks at Henri Bergson to understand movement, not as a form of spatial fragmentation, where time becomes a homogeneous measurement that can be discretely separated to be analysed in seconds or frames, but as a continuous force that it is experienced in its intensity. The emotion of looking at a shooting star, explains Bergson, comes from the undivided experience of the event taken as a whole (Guerlac, 2006). Amy Herzog expands on the work of Bergson in relation to film by explaining that film “is not a question of representing or perceiving movement, but of thinking through movement, of creating new movements and new images of thought” (2000, p. 12)

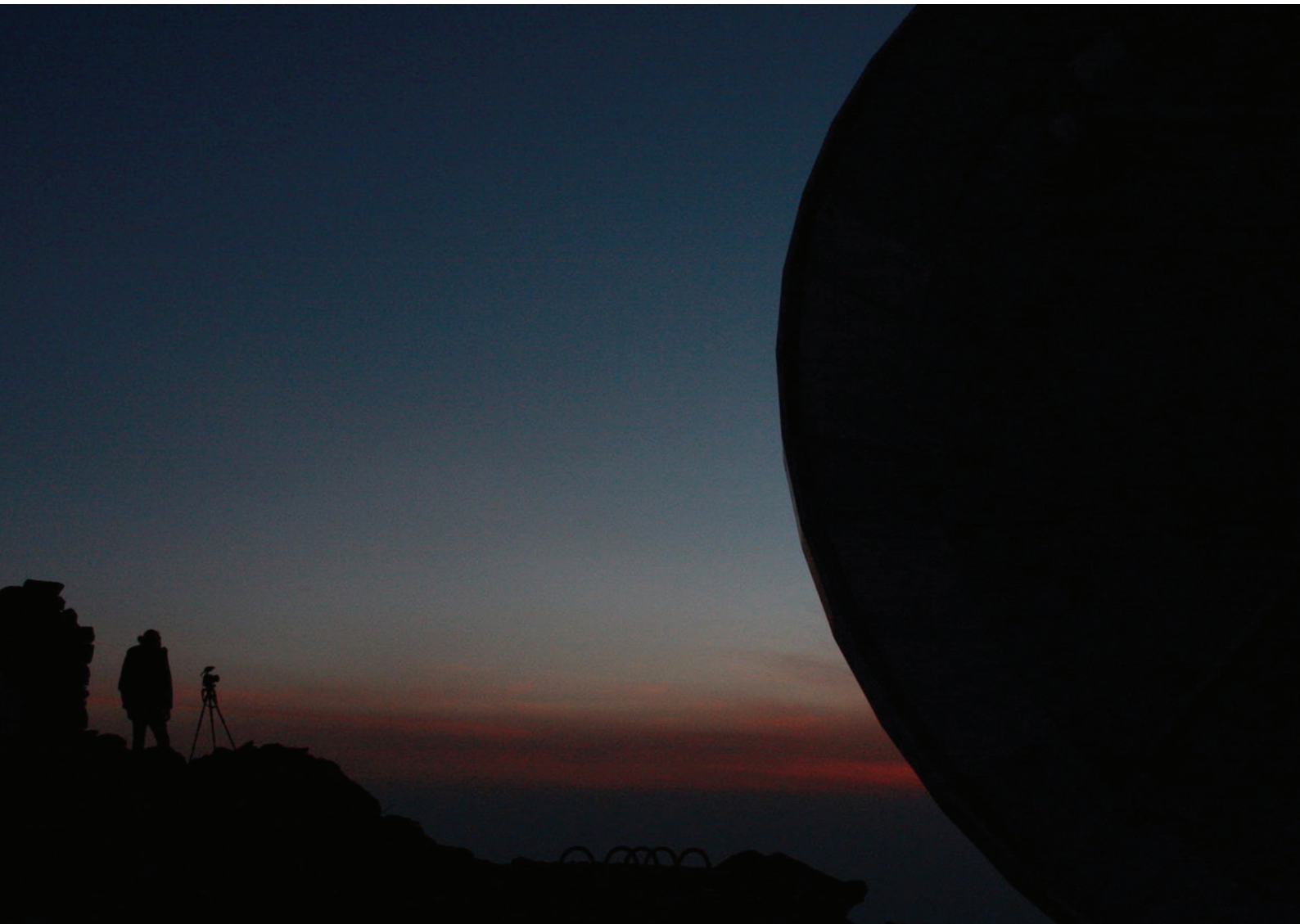


Figure 1.1. Emilio Chapela recording video at the Large Millimeter Telescope at the top of the Sierra Negra.

Image credit: Philippe Henarejos

## Order + Contents

This text serves various purposes: it is the written companion to the development of my practice, but it is not a passive tool of research. It has helped me think and inform my practice: I started writing notes at the beginning of this project, which I have been incorporating and adapting into this document. Also, during the development of this project, I have continued working in various media: I have made drawings, sculptures and installations that have been transformed by the doings of this research. Nonetheless, I will concentrate here on the moving images only, while keeping in mind that this process might be helpful to artists and researchers in various fields, not only within the specific context of moving images and film.

These words also constitute the written component of my doctoral project and describe the project's motivations, questions, reach and methodology, along with the discussion of the contributions this research makes. The challenge has been to present that information while responding to a narrative that accounts for the events and findings related to this research (when and how I travelled, recorded, and produced), which is told, most of the time, chronologically. I decided on this approach, as I am committed to following the transformation that entails thinking in close relation to New Materialism. Another reason to keep a temporal chronology of events is that during the progress of this research, I had to adapt and respond to a series of criminal activities at the mountain that happened at the Sierra Negra observatories, after which I was forced to move my research into new territories like the Usumacinta River and the Iztaccíhuatl volcano.

This marked an important turn in the narrative that is accounted here in chronological order: it was an irruption that is also marked, somewhat abruptly in this document, which is separated into three main parts, that are broken into sections. However, the separation is marked with a narrative intention: the conceptual and theoretical preoccupations flow continuously through the document. All projects are linked to each other.

‘Part I’ (p. 18) covers my motivations, and the theoretical context related to New Materialism that diffracts through this research, as well as the development of my practice related to the Sierra Negra observatories, which mainly deals with moving image attunements, emergent atmospheres and agential movements, clouds, contingency, nonlinear causality, and astronomy.

‘Part II’ (p. 109) brings in active collaborations with human and nonhuman entities at other locations where my practice drifted. For example, I engaged with the forces of turbulence in the Usumacinta River, where I threw underwater cameras to be taken by the river’s current. In this work, the fixing of moving image categories becomes futile, as the river can be seen as the subject, object and camera at the same time. Following a similar path, and by relinquishing control of the moving image artefacts, I performed an experiment in the work *En la memoria del volcan nunca mueren las estrellas* (2019), where the velocity of a video is mapped to the active participation of various entities like the available oxygen and the steepness of the terrain, coordinated by my beating heart with the use of a heartbeat sensor while hiking up a mountain.

‘Part III’ (p. 134) is a general discussion of the contributions proposed by this research, which is distributed across this project and invites consideration of this research’s capacity to remain open and mobile. In recognizing this openness, I suggest further questions that this research has already motivated within my practice. This project is particular to the ecology where it acts, but others are welcome to diffract —or learn through it— to develop theirs.

Although this text is presented in the form of a story which evokes images, thoughts, and references to my practice as they unfolded, the project (as the world to which it aims to attune) is not linear. There are not clearly defined chapters that exhaust a given topic before continuing to the next. The sections in this text do not seek to compartmentalize, but rather to point to



events, supporting arguments, stories and moving images that concatenate each other. I have alluded to the methodology used in this research by explaining how the moving images have emerged diffracted through New Materialism when engaging and attending to movement at the sites of my explorations, but it is hard to enunciate methodology in one specific chapter, as the methods continued to develop along with the practice. Diffraction, as well as Stewart's attunements (2011) and Barad's notion of response-ability (2015), are methodological tools that entail a continuous sensing, experimenting, and reworking of that what is happening in the world, and how it is transformed in movement. They are methods that align with what Stengers describes as an ecology of practices: tools which do "not approach practices as they are [...] but as they may become" (2013, p. 186). In this spirit the methodology unfolds throughout this research and it is revealed through that same logic within this text. However, in the closing arguments of Part III (p. 134), I discuss things further, stressing the importance of using open-ended and emergent methods like diffraction that change along with the questions that animate them.

The sections, which are interconnected by the main narrative, sometimes seem to break, or diverge into scientific notions, ideas, and other movements and themes that inform my practice, like turbulence, infrared photography, physics, and astronomy. They do it, only to return and advance on the story, and the development of this research, little by little, at times repeating and insisting on similar arguments.

I know that I ask a lot from the reader, but it is preferable to go through the entire text, as well as to see all images and videos to better understand this project. If for some reason that is not possible, I would advise the reader to browse for words like attention, attunement and response-ability, but especially diffraction as they are keywords for this project's methodology. Much about diffraction and New Materialism can be found in the section 'Beginnings' (p. 32) and 'Moon' (p. 22). It is also useful to read the section 'Earthly movements' (p. 51) that explains how mechanical interpretations of movement are insufficient to discuss an ecological approach to the moving

image, and introduces agential and *earthly* movement instead as the main concern of this research.

I will continue to go into detail in describing how I produce the various works that I present here, but I begin with the story of the first artwork I did in relation to the Sierra Negra in the context of this research, as it brings non-mechanical movement to the conversation, which you can find in the section ‘Moon’.

The videos that accompany this research are placed in this document through links that point to *vimeo* files outside this document, where the videos will remain accessible to support this research. It suffices to click on the images themselves, or on the link below the picture, and the videos will open in a browser.

There are various videos that have emerged from this research, some of which were presented as part of a solo exhibition at the Laboratorio Arte Alameda in Mexico in 2019, a show that was rooted in this research and that considered various and heterogenous temporalities, from the immeasurability of the temporal dimensions of astronomy, to the ephemeral fragility of a rose. The exhibition title was *En el tiempo de la rosa no envejece el jardinero* (Chapela, 2019a), which translates to ‘In the Time of the Rose, the Gardener has Never been Seen to Age’, and it included other sculptural works and installations that are not included in this thesis. I will discuss two immersive video-installations that were part of the exhibition and that are important to this project as they bring together various strategies that enabled more-than-human (Whatmore, 2006) collaborations by means of movement: as in the case of *Usumacinta* (2019), a work of art that aims to synchronize to the various velocities of a river, and *En la memoria del volcán nunca mueren las estrellas* (2019), a large immersive video-installation, where the velocity of the video, as seen in the exhibition wall, is mapped to my heartbeat frequency as I hiked up a mountain.

I will include a list of artworks at the end of this document, but it is important to mention that most sections introduce or relate to a video work, some of which are finished artworks while others are here because they have emerged from this research and they have given back something to it. These are videos that have helped me ‘work-things-through’ and have participated as tools played in a ‘minor key’, in the sense explained by Stengers (2013, pag. 188), as they do not take a central stage, but they provide context to other ideas and artworks. They are constitutive of an ‘ecology of practice’.

Many of the works here presented feature audio, and while in most of the cases I decided to use the direct sound picked up by the camera, there are some works that needed postproduction and sound design, like the immersive installations discussed earlier. Nonetheless, I will not go into detail to discuss sound in this project. Not because it lacks importance (which it was properly given), but because I will concentrate here on the images that emerge when looking at agential movement. Thinking about audio and sound design from an *earthly* perspective and New Materialism is another interesting problem to pursue but is outside the realms of this thesis.

## Write as flow

I am in agreement with Stengers and Kathleen Stewart's accounts for the need for "critical narratives that populate our worlds and imaginations in different and varied ways" (Stewart, 2014, p. 550). Writing as tool for thinking can encourage this, especially, as Stewart argues, when used as a generative mode of attunement and response.

Stewart's writing is challenging not necessarily in its theoretical content but because it submerges us in various and sometimes disparate emerging qualities and possibilities that attune to the situations and intensities that she discusses. It is because she writes through the problems: "I write through four stories of ordinary scenes in which a form of sensing, thinking, or perceiving is emergent" (2012, p. 517).

In "Road Registers", Stewart uses "a creative non-fictional [...] form of writing/theorizing to attune to the American road as an assemblage of objects, scenes, situations, social formations, laws or figures" (2014, p. 551). She attunes to the atmospheres of the road proposing a form of analysis that challenges traditional critique. This creative form of writing is also proposed by Martin Lee Muller who, in his book on human and salmon relations, who invites us to develop alternatives to traditional narratives that are rooted in Cartesian divisions. He calls for stories driven by a sense of wonder that helps us to renew our understanding of humans in relation to other species: "Earth and earthlings are entirely inseparable from one another. [...] We're earth. Earth is us" (2017, p. 93)

In her doctoral thesis, "Ecologies of Practices and Thinking", Marhöfer (2015) imagines how it would be to write as a plant. She does this as an invitation to "escape formalizations and to discover and acquire fresh experiences and sensations" (2015, p. 33). The exercise is not intended, as Marhöfer explains, to diminish the abstract capacities of language or to humanize nonhuman things by providing them with a symbolic voice, but to use words to help us think, feel, and sense differently, to

facilitate creative ways of thinking and being empathic. To write as a plant “destabilize[s] the anthropocentric grounds of knowledge production through different linguistic constructions. It blurs the line between the ‘self’ and the ‘other’” (Marhöfer 2015, p. 33)

Using rivers and plants as forms of attunement for writing does not imply giving nonhuman things a voice, unlike the video work *The Great Silence* by Allora and Calzadilla in collaboration with Ted Chiang (2014), in which the text that accompanies the evocative images of the Arecibo astronomical observatory in the Puerto Rican rainforest, tells a story from the perspective of the endangered parrots that refers to human concepts and constructions for example, when the parrots talk about protecting their traditions and rituals. While the film makes an interesting and valuable contribution to reorienting our interest in nonhuman communication, the humanized voice of parrots becomes a barrier more than an enabler for more-than-human elaborations. This is because embedding human preoccupations in the voice of parrots can lead to an erasure of our differences.

The form of writing that I here propose aims to use language as a form of attunement that opens ways to relate to nonhuman ecologies and atmospheres, while presenting an opportunity to talk and write imaginatively in the context of artistic research. This resonates with Stengers’ ‘ecology of practices’ (2013), which are tools for thinking and practice that are inseparable from the problem they explore. A flow of writing, as it is presented here, is a tool for thinking that is concerned with and affected by the material specificities of the collaboration in which it participates.

These words are always interrelated: they have been productive, affected by and susceptible to change in dialogue with the moving image practice, books, texts, colleagues, the mountains and the river. While I write, I doubt; I read, edit, change, reorder, undo, delete, shift paragraphs, make annotations and review and incorporate comments from my supervisors. Circling as in in a vortex, I find the same paragraph that I have written multiple times, but slightly changed. Also, when I read back these words,

even if only a few minutes have passed, I find them changed; I meet myself changed.

I suspect that is the case with most texts, and while I expect to finish and publish this in a coherent and fluid form, I will not obscure the process nor my shortcomings. Rather, and this holds some therapeutic value, I recognize the trouble and difficulty to keep this text open and in dialogue with itself, the moving images, and the reader.

This text flows in entanglement with the moving image practice. It is a tale of diffraction: words flow freely when narrating the processes derived from my experiences, and they will fall mute when the video practice can speak more clearly. They might sound personal and relaxed but also thoughtful and precise when diving into ‘deeper waters’ to discuss the philosophical ideas that nurture this research. The rhythm and tone changes as elements condense and expand, the writing becomes thin ‘air’ or dense ‘clouds’. The text will jump back and forth exploring ideas and describing artworks that contribute to the leading argument — in a river this is called the thalweg. However, I will not try to depict the writing in likeness of a river, as a representation, but as a process that is open to drift, stagnation, turbulence and, slowness. Paragraphs, like this one, might expand as I try to leave them, while others contract, return and repeat, forming swirls.

The words here written are already entangled with the moving images that emerged from this research. Videos do not carry the writing as if it was embedded inside containers, rather ideas are dispersed and diffracted through the practice. Both moving images and text, ‘become with’ each other together by flooding into one another, as true ‘companion species’ (Haraway, 2008).

Somehow like the tides, this research flows backward and forward between the writing and the practice. This movement is not sterile but creative. The swinging informs the moving image practice, which in return, moves back to the ideas. This echoes Katie Macleod’s *seesaw* method of artistic

research, in which the writing and practice are troubled by a productive movement that shape one another continuously. To explain the seesaw, she provides examples where “the written text was instrumental to the conception of the art projects but the projects themselves exacted a radical rethinking of what had been constructed in written form” (2000, p. 3)

This ecological approach to the moving image emerged by being deeply immersed in the thinking related to New Materialism, by spending time reading texts, making videos, discussing with colleagues and giving presentations. Knowledge is diffracted and distributed in various times, spaces, artworks and texts. I encountered New Materialism at the beginning of this project and some of its ideas already feel part of me: I will quote what I can in this text, but I can no longer retrace the origins of all the thinking here presented. The ideas have permeated my artworks, writing, daily life, and ethics. I am also thankful to Barad for inspiring me when she explains that writing is not a “unidirectional practice of creation that flows from author to page” (2007, p. IX), but rather a ‘mutually constitutive’ practice. There is no ‘I’ in writing, she insists: only ‘we’. I think that is also the case for artmaking. The video works here presented, mean little without someone watching. Thank you

**I**



## **Moon**

I put my head out the window and started recording. The car was moving on a dirt road. I pointed the video camera at the moon. It moved chaotically around the frame, slipping in and out. I could not stabilize it; I did not want to. I thought it looked interesting.

I experimented with the camera's shutter speed: At lower speeds it made a smooth trail of light, as if the moon was drawing on the frame. The camera responded to the accidents on the road, acting in the manner of a seismograph, or as some kind of handwriting, registering the intricacies of various movements. The moon was not recognizable. In contrast, when I used higher shutter speeds, the trail would disappear, and the moon looked sharper but still agitated. The moon would tremble.

It was September 2017. I was on my way from Mexico City to the Large Millimeter Telescope at the top of the Sierra Negra extinguished volcano in Mexico, where Dr. Arturo Gómez, a young astrophysicist from the Instituto Nacional de Astrofísica, Óptica y Electrónica (INAOE) had agreed to meet me during his observations. I had been introduced to Dr. Alberto Carramiñana, who was at the moment in charge of INAOE, and to whom I had presented this project to collaborate with the astronomers, arguing for the capacity of art practices, not as tools to illustrate the findings of science, but as a form of knowledge that can elaborate questions through multidisciplinary practices and take into consideration the multitude of entities surrounding the observatories that participate in, or hinder, the work of astronomers, as it is the case of the weather. I received full support from Carramiñana and the INAOE to make recurring visits to the observatories, during which I talked and met other astronomers and engineers.

The work of the astronomers at the Sierra Negra is physically demanding due to cold, dryness and scarcity of oxygen: after working all night calibrating and performing observations, astronomers go back to the base camp, a research residence in Ciudad Serdán where they can rest and eat.

It is a challenging drive made more difficult by the density of fog that sits frequently around the towns of Texmalaquilla and Atzizintla.

On that night, we were driving directly from Mexico City to the top of the Sierra Negra, an extinguished volcano whose name means literally ‘black mountain range’. The name was coined in colonial times but is imprecise as the mountain is not a range but one single volcano. I will take the opportunity to recognize the mountain’s precolonial names, including *Iztectepetl Ici*, which means ‘Brother of the White Mountain’, in reference to the neighbouring *Citlaltépetl* (‘White Mountain like the Salt’), and *Atlitzin*, which translates to something like ‘Venerable Woman of the Little Waters’.

I was travelling in the passenger seat; the sky was clear. It was possible to see the massive radio telescope that sits all the way up at the top of the Sierra Negra at 4,600 meters above the sea level. We left the freeway to ascend the mountain, driving through a steep and narrow road that alternates pavement with dirt.

The moon was full, or almost.

I wanted to photograph or record it on video. But it was hardly the best moment to do so: I did not have the ‘right’ equipment or the time to make a good image. There is a preconceived idea of what is a compelling image that is associated with a specific way of making photographs or videos: I am referring here to my own ideas and predispositions that surface from my training as a photographer or from the influence of our visual culture—for example, from the images published by NASA and other space and technology agencies, where nebulas, stars and planets are detailed, sharp, crisp and colourful. Doing a search for ‘moon’ on the internet reveals numerous images that feed that imaginary: the moon looks bright, covers most of the frame and it is possible to see its craters. The images are almost interchangeable.



Figure 1.2. Composite image made with nine different photographs of the moon.

Achieving those images not only admits predefined ideas about what a compelling image entails but it also reveals an *a priori* delimitation and separation of subjects, objects and apparatuses. The photographer must execute the image by framing the moon —its subject matter— while keeping other undesirable objects outside the borders of the viewfinder. A telephoto lens is needed (it is called an objective) and the camera and tripod (apparatuses) should remain steady and immobile.

In this imagined scenario, movement is not desirable: the camera should be set to a high speed in order to ‘freeze’ the image of the moon cancelling all other movements like the pulse of the photographer or a sudden gust of wind. In astrophotography, it is recommended to choose a suitable shutter speed to counteract the Earth’s rotation that would otherwise render a blurry image. There is also the case of cameras and telescopes that move in synchronicity with the observed object and in compensation for the Earth’s rotation so they can render a still image. Paradoxically, movement is desirable inasmuch as it serves to produce a still image. While these photographs are not easy to produce, the right settings for aperture and speed are widely documented in photography manuals, which make it possible to follow instructions or learn a set of tools that are later used upon recognition every time they are handed, as when given a fork or a hammer. Umberto Eco explains that the “book is like the spoon, scissors, the hammer, the wheel. Once invented, it cannot be improved” (Eco and Jean-Claude, 2011, p. 4). These tools are efficient in part because they are recognizable.

In contrast, this research is interested in methods that produce unique results (by this I mean singular), like the ones suggested by Stenger and described as ecologies of practices: tools that “can be passed from hand to hand, but each time the gesture of taking it in hand will be a particular one” (2013, p. 185). The tools must be adapted: they entail a process of learning, experimentation, attentiveness, and differentiation. These unique methods, that can be further adapted by others, are diffracted throughout this research, and will emerge in dialogue with the artworks and the ideas related to New Materialism.

It is interesting to notice how few video recordings of the moon are widely available on the internet (I have not found many). I wonder if it is because we have expectations for things to change dramatically over time. We like to see movement, or at the very least we expect it within the context of moving images. That is the case with video recordings of eclipses of the sun, which are extraordinary and dramatic events that have been documented extensively (I will later in this text relate my own experience recording a total eclipse of the sun in video). It appears contradictory that while we expect things to change and move (under assumptions described before) we do not easily welcome chaotic movements produced by a handheld camera, or by a moving tripod. The apparatus is expected to remain still, which also explains the multiple devices and effects aimed at restoring the stability of the image: a steady image is frequently associated with a 'professional' use of the camera.

There are, of course, numerous examples of the moving images that move in opposition to these arguments in which the camera moves, tilts, pans and zooms erratically, mechanically or accidentally like in the work of Michael Snow, Jonas Mekas, Pipilotti Rist and Daenis Beaubois, to name only a few.

I do not intend to argue for, or favour, or against, a moving camera. The purpose is to discuss some of the preconceived ideas of the moving image, and to recognize the separation we impose on subject matters, objects, apparatuses (cameras), and audiences; as well as the differentiated role they play in our expectations. It is not my intention to challenge these conventions arbitrarily, but to leave them aside and pay attention to how the various participating aspects of the moving image emerge by forming alliances, borders or exclusions. Personally, I find great surprise when discovering things rearranged differently from how I had imagined or structured them beforehand. That night, on my way to the observatory, I did not feel compelled so much by the moon (what I had initially taken as the object of my observation) but by the phenomenon of the trail of light produced in coordination with the moving car and the camera settings.



Video I. *Position and Momentum are Mutually Exclusive* (2017)

Duration 3:01 minutes

<https://www.emiliochapela.com/moon>

With this example in mind, it is possible to consider ways to think differently about subjects, objects, and apparatuses: instead of the moon being the object of my recordings, I could think of it as a source of light or as a tool, or an apparatus of a sort, like the moving car or my hand, which served as a physical support for the camera. Similarly, the camera's shutter, as well as the road, can be thought of not only as tools but also as the very subjects of transformation of the image. Reconfiguring or exchanging the preconceived notions of objects, cameras and subjects— like imagining the road, for example, as an extension of the camera, or the moon as light source rather than as the object of interest—help to destabilize fixed categories of the moving image, like that of subjects, objects, apparatuses and audiences. These exercises are capable of 'animating' and 're-forming' borders that bring the self and the other closer to each other, to use Sara Ahmed's words (1997). Ahmed proposes this as a means of rethinking the role of intimacy despite borders and distance in the context of the contemporary feminist debate: "being touched, causes ripples and movement which re-form rather than overcome such borders, giving them animation" (Ahmed, 1997, p. 28).

Barad takes things further, in suggesting that the entities do not preexist the interaction at all, which means that qualities like, self or other do not exist until they are formed (if they are formed) as they come in contact with each other through intra-actions (2007). For Barad, subject, objects, borders, distance, closeness, ideas and apparatuses, are in constant renegotiation: that constant re-shaping is described by Barad as agential capacity, which refers to the potential manifestations of agency participating in a given phenomenon. Agency is here understood as relational capacity to affect and be affected: agency is not something possessed by humans, or nonhumans for that matter. It is an enactment. (Dolphijn and Tuin, 2016, p. 54).

Barad uses the term agential realism to describe these productive relations, in which qualities, capacities and boundaries are emergent and agential, instead of predefined and fixed categories. In an agential realism, entities do not have inherent qualities prior to their interaction. Instead, objects, artefacts and subjects participate actively in intra-actions where qualities, alliances, borders, and exclusions emerge (Barad, 2007). She uses this term to distinguish them from the usual interactions: “Existence is not an individual affair. Individuals do not precede their interactions” (2007, p. IX), rather individuals emerge through ‘becomings’ or entanglements, to use Barad’s words, that are constituted as intra-active and productive phenomena. In the context of science, she explains, artefacts, objects and scientists participate actively in determining what emerges from the experiment. It is because things are entangled that certain events happen and not others. I here explore if that is the case for the moving image too.

To introduce her ideas on intra-action and agential realism, Barad revives the old but relevant discussion about complementarity in physics and the Heisenberg uncertainty principle, which are of great interest to me, and that I will try to explain here in my own words after reading Barad’s account on the work of Neils Bohr (Barad, 2007). Complementarity is a principle that explains that the determination of certain qualities negates the possibility of others. According to Bohr, for example, we cannot know a particle position (spatial information) and the momentum (temporal quality) simultaneously.

They are mutually exclusive properties: the more we know about one, the less we know about the other. In order to determine the position of a moving particle, a fixed apparatus is needed, while in order to know the momentum (velocity multiplied by mass) a movable device is required. The measuring apparatus cannot move and remain static at the exact same time, which makes the simultaneity of measurements impossible. But the impossibility is not rooted in an epistemological difficulty in which we do not have the tools to know both things at the same time, but rather in the fact that “particles do not *have* determinate values of position and momentum simultaneously” (Barad, 2007, p. 19). By choosing a specific experimental arrangement, one becomes determinate, excluding the other from being. We have the potential to measure both position and momentum, but if one is known, the other will not be defined at all. Thus, it is not a property that can be measured.

In other words, Barad explains, position and momentum, as well as other complementary properties, are particular to a given phenomenon and cannot be separated from the agencies of observation to be studied: “just like position, momentum, wave and particle, time itself only makes sense in the context of particular phenomena” (Dolphijn and Tuin, 2016, p. 66). It is not the case that these things have inherent qualities that we fail to know because they are inaccessible to us. That would be only a problem of epistemology. But Bohr, according to Barad, “is making a point about the nature of reality, not merely our knowledge of it” (2007, p. 19). The issue presented here is both an epistemological and ontological understanding of matter and the agencies of experimentation. For Barad, ideas, interpretations and discourses participate actively and materially in the phenomenon.

“What he [Bohr] is doing is calling into question an entire tradition in the history of Western metaphysics: the belief that the world is populated with individual things with their own independent sets of determinate properties” (2007, p. 19)

Barad does not use the ideas about position and momentum to make assumptions or build analogies that suggest that because particles behave in certain ways, other things do similarly. Neither do I intend to do so for mov-



ing images. She uses Bohr's thinking as the foundation to propose agential realism, which she brings forward as a form of knowledge, something that can be used to map differences and transformations that matter. In a similar way, I come close to Barad's ideas, to follow the effects of change when bringing my moving image practice close to her thinking, a process described as diffraction first by Haraway (1997) and later developed in detail by Barad (2007).

More specifically, and within the context of the moving image, I aim to see what moving images are produced by the entanglement of the various participating entities like myself, the camera, the mountain, telescopes, microphones, editing software and exhibition decisions, as well as other aspects such as the velocity of the film, the size of the projector, the camera, its movements and other accessories, all renegotiated as collaborations with more-than-humans (Whatmore, 2006). It is important to clarify that the terms more-than-human and nonhuman are not meant to categorize or to be taken as oppositions (Marhöfer, 2015, p. 12) that separates humans from nonhumans, or as a way to claim the end of humans, as Simon Pope explains (2015, p. i). Instead these terms should be taken as an invitation to move together and reconcile humans and nonhumans in our shared spaces, temporalities and histories. DeLanda (1997) brings attention to our long-shared material and geological histories by explaining, for example, that our bones are formed by the very same minerals that constitute the Earth, which reminds me of this famous quote by Carl Sagan:

All of the rocky and metallic material we stand on, the iron in our blood, the calcium in our teeth, the carbon in our genes were produced billions of years ago in the interior of a red giant star. We are made of star-stuff (1973, p. 149)

Back in my studio and looking at the footage of the moon I had shot, I studied how its image would lose its detail completely as the trail of light (that I described earlier) became visible when opening the camera's shutter speed: as more light goes into the camera sensor, the image is overexposed, which blurs the moon and produces an elongated trail of light.

In opposition, when closing the shutter speed, the trail would disappear, and the moon would shake rapidly while recovering detail. This is the kind of settings one would use when recording a fast-moving car or a waterfall to achieve a crisp image. By looking at these videos, I thought right away about Bohr's indeterminacy and how these two alternating modes of recording were complementary or mutually exclusive: the appearance of the trail of light excluded the possibility of achieving a detailed image of the moon. The more detail on the moon I wished to achieve, the shorter the trail would become. To my knowledge, it is not possible to achieve both because of the way the camera works. In consequence, these specific images (and not others) emerged as the result of the material arrangements, the agencies of observation, its exclusions and its relations: the settings on the camera, the bumpy road, the movement of the car, the luminosity of the moon, my pulse and other qualities and capacities that became determinate, as well as those that are excluded.

My intention here, I insist, is not to negate the existence of boundaries and delimitations, whether temporal, spatial, or epistemological (those that refer to subjects, objects, and apparatuses). What I resist, is the *a priori* definitions of those categories and practices. It has been through experimentation in my practice that things have been defined, in an open negotiation with the things I have engaged with. For example, while doing the work about the moon, I experimented with the shutter speed while looking at the viewfinder, responding to what I was seeing, improvising, or performing. That is what Andrew Pickering refers as a 'dance of agency' (Pickering, 2011), a performative enactment involving humans and nonhumans.

## Beginnings

I am a visual artist from Mexico City. I studied Mathematics in college for a couple of years before graduating with a degree in Media Studies. However, a relationship with science has accompanied me all along my development as an artist. I participated in an experimental program on photography and related media in the Centro de la Imagen in Mexico City, where I was introduced to the history of contemporary art, but it was the conceptualism associated with John Cage, Joseph Kosuth, Joseph Beuys and others that influenced my work the most: Sol Lewitt provoked us to consider how “in conceptual art the idea or concept is the most important aspect of the work” in his seminal article *Paragraphs on Conceptual Art* published in *Artforum* (1967). Conceptualism became resonant with my interests in science and philosophy, which provided a fertile place from which to think about ideas that interested me like chance, uncertainty, and unrepeatability, and it became the grounding from which I developed my artistic practice.

From there, my work diverged: I incorporated various interests that expanded my practice to more critical, aesthetic and ‘poetical’ space that incorporated reflections on technology, politics and its relations with human communication (and the lack of it). Also, my curiosity in technology, steered my interests to astronomical observatories, antennas and other artefacts (some of them in the form of ruins) and their relationship with the environment. But the ‘ecological thinking’ and practice that informs this doctoral project came later inspired by New Materialism (Bennett, 2010; Parikka, 2015; Dolphijn and Tuin, 2016; Gamble, Hanan and Nail, 2019), Haraway’s ideas to ‘becoming with’ (2008), and Latour’s invitation to land in earth (2018, 2020) and to inhabit Gaia (Lovelock and Margulis, 1974), which are ideas that caught my attention during the development of this research. I found them when looking for a comprehensive way to better integrate my interests ranging from technology, ‘nature’, time, outer space, astronomy and human endeavours. In a New Materialist account, explains DeLanda, entities are the result of historical processes “produced as part of cosmological, geological, biological, or social history” (Dolphijn

and Tuin, 2016, p. 39). Additionally, my particular attention to Barad's work emerged from her interest (which I share) in science and physics, and how she uses (by means of diffraction) quantum theory to develop a philosophy concerned with feminism that reworks Cartesian epistemologies, and that it is explained in detail in her now seminal book *Meeting the Universe Halfway* (2007). Accordingly, and in dialogue with Barad's work, I developed a moving image practice that is diffracted through New Materialism in which the habit of constructing fixed ideas of subjects and objects, and other dualisms, is resisted, or at least troubled.

New Materialism and other non-Cartesian and relational ecologies have become influential in current academic thinking. Nonetheless, it is important to acknowledge, as I do here, by referencing the work of scholars like Juanita Sundberg and Zoe Todd, that the necessity to overcome Cartesian categories and embrace more comprehensive metaphysics and cosmologies, is not a global concern but rather a problem associated with Western thinking. As Sundberg explains: "literature repeatedly references such dualisms as if they are universal foundations of thought, which only serves to perpetuate their presumed universality" (2014, p. 35). Consequently, the first step to avoid the 'structural colonialism' that Todd denounces (2016) is to steer away from presupposing that all philosophies and thinkers need a reworking of its Cartesian heritage. This, of course, while keeping in mind that the politics, and even violence embedded in Cartesian traditions have affected humans and nonhumans alike almost universally, regardless on the comprehensiveness and openness of people's traditions and worldviews.

Sundberg explains how post-humanist theories have failed to collaborate with Indigenous authors and their cosmologies (2014), some which have had long histories and comprehensive non-dualistic relations with nonhuman entities. Todd exemplifies this by explaining how Inuit populations have talked about 'Sila', a concept related to that of Gaia, long before Lovelock and Margulis introduced it (2016). She also criticizes Latour for failing to acknowledge these forms of knowledges, although, she explains, it would be far worse to simply appropriate or misinterpret them. She recognizes this

tension, and gives value to post-humanist debate within scholarly research while being attentive to avoid erasing “Indigenous epistemes and locations” (2016, p. 9). However, this awareness came to me later, as I arrived at New Materialism and the ecological thinking associated with Gaia, Stengers and Latour in search for a comprehensive worldview. I came to it, while immersed in the context of my artistic practice informed by science and conceptualism in the context of contemporary art.

At the start of the doctoral process in 2016, I presented this project to a group of potential supervisors and students to whom I expressed my interests in exploring the connections between technology, humans and the environment around the astronomical observatories at the Sierra Negra extinguished volcano. However, as I write this, I realize that the initial framing assumed these domains revolved around human endeavours, not the mountain or the observatories. For example, I expressed my interest in Marshall McLuhan’s ideas that propose media as extension of man (1964), which understands the telescope or the video camera, as extensions of the human eye or mind. This idea raised questions by some of my colleagues and supervisors who were trying to suggest to me a less anthropocentric framework. But it takes effort to subvert such views, not only because they seem deeply entrenched in the thinking associated with Western Philosophy but also because telescopes and observatories are machines designed specifically to help humans see and hear things that are far away. That is why humans build them. What I failed to see in that moment was that in observing we form alliances: “We cannot magnify the object without magnifying the medium” said the astronomer William Herschel (in Peters, 2003), meaning that in order for the object to appear bigger or clearer, one must modify the telescope. I see that now as a logic of alliances.

Recognizing the capacity of technology and other objects to affect, that is, to enact agency, troubles the humanist notions of observation, which rely on static objects and artefacts. And here is where the work of Barad on the agencies of observation, which she calls agential realism (2007), becomes useful: not only as a tool to understand how we approach scientific

knowledge, or how observatories, microscopes, and telescopes work, but to propose the video camera and other artefacts of the moving image as active entities with the capacity to affect and be affected.

To better understand this, Barad explains agential realism through an example where a bio-anthropologist is asked to keep a distance (allegedly a condition of objectivity amongst some researchers) when approaching baboons. The researcher fails to perform any meaningful observations because the primates become too attentive of the outsider's behaviour. In an effort to keep a distance, the scientist is disturbing the animals, and it is not until she responds by being familiar, instead of "detached" that the study can proceed as she wants it: "Objectivity is a matter of responsibility and not a matter of distancing at all," explains Barad (Dolphijn and Tuin, 2016, p. 57). This example challenges the epistemological view of an outside observer who approaches phenomena from a distance, conveying preexistent qualities with the intention of interpreting or reflecting on a phenomenon that it is already given and that it is out-there, as the idea of nature is frequently portrayed.

Other scholars in multispecies studies, geography and ethology interested in cultivating forms of attentiveness and immersion with plants, animals and other entities like climate systems are already "taking a cue from artists to more fully embrace the work of observation as part of an ongoing performance in the world" (van Dooren, Kirksey and Münster, 2016, p. 10). Jamie Lorimer (2010) looks at the potential of moving images to turn away from representations that objectify and illustrate behaviours or depict things from afar, and instead to focus on evoking interactions, encounters and affective entanglements in the context of more-than-human geographies. Also in this regard, Stengers insists that "there can be no relevant ecology without a correlate ethology" (2013, p. 187). She expands on this argument, by explaining that practices have no independent identity that is unconnected to their environment. Learning from these approaches, the practice here presented does not aim to represent or describe behaviours but to coexists in close distance with the specificities of the locations that enable

it. In the context of artists working with moving image, I propose here a less anthropocentric account of movement, which moves away from mechanical motion, in which neither the artist nor the camera, are passive or detached entities that act from afar. Instead, the artist is present and attentive to the emerging relations and atmospheres, even when feeling vertigo.

To doubt the existence of intrinsically *per se* entities is an idea that interests me. However, it is not the goal of this research to engage in such discussion but instead, to adapt (or diffract) the relational thinking of Barad to develop a moving image practice that emerges rooted within phenomena. In other words, it is through the relations, exchanges, boundaries and exclusions between the camera, me, the mountain, the observatories and all other participating entities like the screens, projectors, exhibition spaces and the audience, that the practice emerges or materializes. In this way, and supported by various entities, artefacts and temporalities, the moving image can be proposed as an ‘ecology of practices’ as it is described by Stengers, a form of knowledge that does not approach practices as what they are, but as what they may become (2013). Haraway uses similar words when she talks about companionship: “The partners do not precede their relating”; they ‘become with’ together (Haraway, 2008, p. 17).

I share Haraway, Stengers and Barad’s determination to challenge ourselves to find these entangled territories. This research is preoccupied with building relational collaborations, it reaches to contribute to the ample ecological dialogue, but it does so in movement, stirred up by the moving image practice. It contributes to the discussion aimed at paying attention to the emergent entanglements or ecologies where moving images cannot be disentangled from the context where they were created, to use Stengers’s words (2013).

It is possible to argue that every practice emerges from the ecology that produces it: However, what I propose here is not simply to acknowledge that a film is always the result of certain material conditions and not others, but to propose a practice that pays attention and responds to the very things that

produces it. Simon Pope asks who else takes part in an effort to develop a practice that is attentive to more-than-human participations (2015). It is also important to ask: What else emerges? What is created? What is left behind? The careful acknowledgement of both participating and emerging entities calls for practices of consideration, collaboration and responsibility — responsibility not as a way of finding out the ‘truly’ responsible part, (Stengers, 2013) but as a way of responding to others that are involved, whether they are humans, telescopes, cameras, mountains, rivers or clouds. Later in the text I expand the notion of response-ability as a call for ethics of response and entanglement based on the work of Barad and Haraway.

Prior to the start of this research, I had been making films that explored relations between technological artefacts and their surrounding landscapes, which led me to the production of *The Space Around* (Chapela, 2015) a film that I shot throughout an entire year in an abandoned building in New Jersey that was once part of the iconic Bell Laboratories. I was interested to see how the passing of time reflected on the ruinous artefacts left after the decline of the company. The film spoke about time in relation to the landscape and the fast obsolescence of technology. Working in that project renewed my interest in astronomy, which led me to a visit in 2016 to the Sierra Negra extinct volcano in Mexico, a remote site where two massive observatories sit at an altitude above 4,000 meters: The Large Millimeter Telescope, at the very top of the mountain that is used for observing the formation of planetary systems, galaxies and black holes, and the High Altitude Water Cherenkov (HAWC), a massive array of water detectors designed to observe high energy particles and events.

However, my approach to the sites can be summarized in the differences noted by Barad and Haraway between reflection and diffraction: reflectivity, which I associate with the process explored in the Bell Laboratories project, is a critical practice of reproduction that displaces the same elsewhere (Haraway, 1997). It is like taking a ‘step back’ (as someone does when looking in the mirror) to reflect (Bozalek & Zembylas, 2017): “reflectivity is based on the belief that practices of representing have no



effect on the objects of investigation and that we have a kind of access to representations that we don't have to the objects themselves" (Barad, 2007, p. 87). Contrarily, diffraction, as it is understood by Barad, is a way of thinking and practice that is concerned with mapping differences and the effects caused by those differences: diffraction is not about sameness, but about "heterogeneous history" (Dolphijn and Tuin, 2016, p. 51). Thinking diffractively is used here as a tool and praxis to approach matter attentively avoiding erasing, assimilating or eradicating differences, atmospheres, movements and intensities. The practice here developed is about paying attention and responding to what movement does and registers in the emerging manifestations and qualities of movement. I understand diffraction as a process of transformation when traversing, flowing, learning, affecting and being affected: it prepare us to be more attuned to how differences are created in the world (Geerts and Tuin, 2016).

The massive building at Bell Labs, where I recorded the film back in 2015 before starting this research, occupies two million square feet and is completely covered in mirrors on all sides, reflecting the surroundings in every direction and making it impossible to see inside the building during the daytime. It is possible that my idea to document the transformation on the landscape as reflected on the architecture and the technological artifacts, came from the building itself. Also, the fact that I used the word 'landscape' to describe what I saw denotes a form of distancing, as it creates a separation between the landscape (surroundings) and the subject who stands in front of it. Diffractive methodologies and New Materialist thinking, like the ones that moves through this research, replace the notion of landscape with entanglement, by unsettling the authority of the human subject that relegates objects as landscape or background.



Figure 1.3. Still from *Space Around* (Chapela 2015).

After my first visit to the observatories at the Sierra Negra, I was especially interested to hear about the science and technology used by the astronomers to capture light coming from far away in time and space from the farthest places in the Universe. Telescopes are machines that see into the past: “To gaze into the depths of the universe is not only to look far off into space but far back into time” (Peters, 2003, p. 405). I was curious about the technological artefacts and the engineering behind the construction of these massive observatories, the lives of the astronomers and other workers who suffer the harsh conditions at the mountain at high altitude. But mostly, I was fascinated by the volcano. The telescope is situated above the alpine tree line, where there are barely any animals or vegetation except for a few small plants and flowers that grow sparsely in the gravel. The landscape feels remote. It is common to see the clouds sitting down below the mountain or ascending rapidly to cover the telescope. On the first visit to the observatories, I was attentive to the changes in my body too. I could hear my heart pounding. I felt a strong material connection to the atmosphere. The lack of oxygen was making my body react.



Figure 1.4. Large Millimeter Telescope. Sierra Negra, México.

That same day, full of excitement and while going down the mountain, I decided to embark on an artistic project around the observatories. But my interests were split between the fascination for the technological artefacts, the poetics of light coming from outer space and the remoteness and uncanniness of the mountain. I wanted to find something that connected all these various interests, but the time scales seemed incommensurable: the light coming from the past; the deep time of geology; the movement of clouds, the weather, and my body; the time of the camera and the duration of a film. How could I consider all these temporalities and spaces at the same time?

This research proposes a non-anthropocentric practice that considers technology, humans, and the environment as entities that are already entangled and constantly redefining, animating, excluding, and reconfiguring their relations and borders, where no domain or entity serves another in a predetermined way. For example, in this project, nature is not seen as a preexistent concept to that of humans or technology: “Don’t try to define nature alone, for you will have to define the term ‘culture’

as well” (Latour, 2017, p. 15). This means that we are not dealing with separate domains, but with a concept (or phenomenon) that is already bounded, adds Latour, even when facing tensions. Haraway refers to these correlations as *naturecultures* (2008), which are entanglements that recognize the inseparable connections formed between nature and culture that Cartesian ontology puts in opposition: “By establishing the human being as a privileged, rational entity, Descartes laid down the ontological premises, based on a mind/body dualism, that shaped modern philosophy,” (Rae, 2014). In that same text, Gavin Rae speculates about the origins of Haraway’s ideas in accordance with Latour and Barad, and in opposition to Descartes, maintaining that humans and nonhumans, like machines, nature, and culture, exist with and through one another. Haraway invites us, explains Rae, “to think an ontology of human entanglement as opposed to an ontology of human exceptionalism” (Rae, 2014, p. 510).

In this, I diverge from Timothy Morton who proposes an ecological thinking that abandons all together the notion of nature, claiming that it is an over-aestheticized and romanticized construction that relies on rhetorical thinking that tends to isolate and objectify the very objects described as nature (2009). Beyond human constructs, he explains, the concept of nature becomes ungraspable. In consequence, he criticizes Haraway for presenting, somehow naively, *naturecultures* as something new and different. T. J. Demos also contributes to this dialogue by insisting that the idea of nature should not be abandoned: while it is crucial, he explains, to avoid nature’s objectification and ontological isolation, humans need to be understood as “fully integrated in and part of the natural realm” (2016, p. 21). In this sense, I follow Haraway’s *naturecultures* that problematize the discussion of humans as independent entities from nature: wilderness, like void and other presumably empty spaces, are no more than constructed ideals (a point on which I agree with Morton) that have been used as tools of colonialism (Barad, 2019) by means of a rhetoric that portrays spaces as inert and empty, and that in consequence, can be occupied or exploited.

I will frequently refer to the sites of the observatories at the top of the volcano as remote places: it is a description that entails scarcity of living

organisms, people, and oxygen, but not ontological disconnection or isolation. The massive observatories; the small, impoverished towns on the lower parts of the mountains; the road that leads to the top of the volcano; the electrical installation; and other significant infrastructural works are all clear reminders of human presence at the mountain. More importantly, and moving to the scales of the geological, recognizing the effects of humans as a major geological force known by many as the Anthropocene, the habitat of the mountains has suffered a significant impact: the tree line in the Sierra Negra and other high-altitude mountains in Mexico has raised steadily because of climate change with an impact on vegetation and animal life (Jiménez-García et al., 2021). At the same time, the neighboring glaciers at the Pico de Orizaba, like most others in the world, are reducing in size and facing their demise.

The protected natural areas that span across many kilometers and in various altitudes, the state-of-the-art scientific instruments used by the astronomers, and the few small mainly Catholic communities with diverse indigenous roots, which suffer from lack of basic services, high incidences of crime, poverty, and analphabetism, constitute a unique ecosystem, in which it is unavoidable to consider the contradictions that emerge when thinking about astronomy, a practice about looking at objects outside this planet, while considering, here on Earth, the precarious realities of surrounding communities. Thus, what kind of tools are needed to reconcile these differences? Latour's notion of the earthly can be useful to think about astronomy while reorienting the attention to this planet, its atmosphere, its people, and other nonhuman entities. As I inquiry later in this text: what can we learn about our material relations to this world —for example— when trying to observe the black hole at the center of our galaxy? The earthly is also used in this project, as a tool of the moving images to approach and describe the heterogeneity of matter and movement at the observatories and their surrounding areas, like in the artwork *The alpine tree line is not a line but a gradient* (2016), which attempts to describe some of the disparities and inequalities that are lived in the context of the Sierra Negra from an earthly perspective. I made this work by putting together hundreds of photographs

that I took as I drove up the mountain on my way to the observatories documenting various social and economic activities, human lives, animals, animals, fog, plants, rocks, cemeteries, and so on. As the video progresses by continuously gaining altitude and mapped to the geography of the mountain, the landscape changes not only to show the variations in the vegetation caused by the alpine tree line and the drastic changes in the weather but also to show other forms of differences and gradients like those coming from the geopolitical structures and cultural identities. Thus, the artwork, traverses through various intra-acting worlds, pointing out how differences are manifested, and worlds overlap. Like Latour's ideas about the earthly, Spivak's notion of the planetary abandons the world seen as a blue marble that can be fitted into a computer screen (an image of the world easily frequented by astronomers) opening to a diversity of epistemes: it is about embracing difference and sharing collectively and responsibly.



Video II. *The Alpine Tree Line is not a Line but a Gradient* (2016)

Duration 3:07 minutes

<https://www.emiliochapela.com/treeline>

In his lecture “A Tale of Seven Planets” (2018), Latour overly complicates the notion of the earthly by introducing other terms like ‘terrestrial’, ‘worldly’, ‘planetary’, ‘contemporary’, and so on. He uses these notions to map various ways in which we imagine the Earth, its politics, epistemologies and ideas to inhabit the world accordingly to each of one them. I found his effort confusing. Nonetheless, in “Down to Earth: Politics in the New Climatic Regime” (2018), Latour concentrates on the notion of the earthly as an invitation to land, that it is, to abandon the view of the planet from outside and consider a “whole range of transformations: genesis, birth, growth, life, death, decay, metamorphoses” (2018). And in doing so, to resist the pervasive view of the globe seen as a blue marble, the uncluttered, and allegedly vantage point from which the global is configured that motivates no movement or responsibility (a timeless view from an undefined position in time and space). Spivak too, invites us to abandon the discrete view of a globe that can fit into our computers. It troubles me, for example, that there are no clouds, rain or storms when we see the globe by using Google.

The notion of the globe as it is interpreted by Spivak and explained by Jennifer Gabrys, presents a total view of the Earth (in this it resonates with Latour). However, in the case of Spivak, it is term that makes more emphasis on domination, control and the politics of militarization and globalization: “The detached and distant view of Earth produces an entity that could seemingly be managed—or programmed” (Gabrys 2018). This total vision, however necessary to understand the overreaching problem of climate change, explains Gabry, needs to be abandoned to initiate a praxis of inhabitation that unsettles the global vision and its figures of authority, and that involve “protests, and struggles for ways of being on the world” (2018). To do so, Spivak introduces the notion of the planetary, a notion and a praxis that is not fixed or settled, and that can resist the construction of “uniform epistemic representations” —like that of the globe— and to revise the structures associated with technology, power and capitalism: “The notion of the planetary cannot be addressed without also reworking divisions of the human, and the injustices that result from these limited modes of being” (2018).

Similarly, Latour uses the earthly as an invitation to develop situated knowledges by identifying connections and relations that have been neglected by total views of the Earth. This research learns from Latour and Serres, resisting to imagine the world (the land and soil) as a universal and neutral space. From the perspective of water, Neimanis too, invites us to recognize ourselves in commonalities of bodies of water, suggesting perhaps not earthly practices, but specific watery entanglements and spaces where we take part.

It is misleading to think of technology and other cultural constructions as things detached from what we usually describe as nature. Technology can be thought of as a tool for human endeavours, but it also defining of what we are: "the ship alters the sea, or rather makes the sea navigable at all" (2015, p. 104). The invention of the ship transformed not only the seas by making them susceptible to navigation (that quality did not exist before) but it transformed humankind too. Ships, humans, and sea cannot be understood separately. And that is also the case for astronomical observatories: by observing the Universe far away, we expand the horizon of what humans can see and detect and the desire to understand it better, visit or even colonize it. Telescopes like video cameras are bounded with the light they capture, the object observed and the person who observes, which are all parts of the phenomena of observation. It is not clear when looking at a distant star if one is studying the star, the artifact used to observe it, or ourselves. Technology is more than just a tool or an extension of human endeavours, it is an active transformative force: diffraction allows you to study both the nature of light and the apparatus itself (Dolphijn and Tuin, 2016, p. 52).

From the perspective of New Materialism and inspired by Haraway's *naturecultures*, Jussi Parikka describes media and nature as 'co-constituting spheres' that form *medianatures* and that can be described as relational entities that are connected by a long history of geological relations (or intra-relations) that are also extended into the future. For Parikka, informed by DeLanda (1997) past, present, and future are intertwined and affect



each other through material relations. For example, the matter used to produce micro-components and batteries, like silicon and lithium, has a deep geological past that also carries the violence of its exploitation and the pollution caused by its disposal, which will have an impact on the future of the planet. In this regard, Kathryn Yusoff invites to consider the biological, geological, and geopolitical importance within the context of the ecological crisis, manifested in the context of the Anthropocene, and in our social and political relations with fossil fuels and other materials (2007). *Medianatures* and *naturecultures* (perhaps there is no need to distinguish between them) like video cameras, telescopes, pixels, and videos, but also rivers, clouds and mountains, form entanglements where Cartesian categories and dualisms become inoperable. This acknowledgement, I hope, can provide the grounds for a less anthropocentric art practice.

In the context of my solo exhibition at the Laboratorio Arte Alameda in Mexico City in 2018, where I showed some of the works discussed in this research, the curator José Luis Barrios, wrote in the curatorial text that the dimensions and temporal scales of the Universe are so disproportioned that it is impossible to compare and apprehend them in terms of the objects themselves. Instead, we must rely on our ideas, representations and artistic practices, so we can apprehend them (2019). The world precedes that of its representations, implies Serres in *The Incandescent* (Serres, 2018b), by explaining that the existence of human language, for example, is only brief in comparison to the age of the planet or the Universe. This notion is supported by Haraway when she adds “we are in a world of immeasurable results, a world that exceeds its representations” (1997, p. 2) Does that mean that these disproportions remain inaccessible to us? I refer here to the very distant, the unreachable, the older-than-human, the gigantic, the minuscular or the invisible. Can these things be recorded with a video camera? Can we relate to them through the moving image? Perhaps the world is indeed inapprehensible, which does not mean that we cannot get closer and touch it. That is what Barad means by ‘meeting the universe halfway’ that stands out as an invitation to meet the world by relating and being responsive to that which one touches — a form of touching that is ontological, epistemological,

and ethical (2007). Another title for this research could have been 'Meeting the Universe Halfway: experimenting with moving images'. While I do not provide concrete answers to these troublesome questions, the moving images that make up this thesis, emerged from thinking and living with them, and flow productively throughout this research.

## Introduction to Movement

As an introduction to his research on media geology and materialism, Parikka poses a question for those interested in approaching materialism: from where do the “notions of materiality stem, and what is their ground?” (2015, p. 3). As I see it, the question encourages us, not only to find an anchor that orientates ourselves within the various voices of materialism and New Materialism, but also to develop methods and ideas that connect to the material specificities that relate to the problem that we have at hand. This, while avoiding generalizations and representations that treat matter homogeneously by wiping out differences.

Matter is incommensurably diverse, and it is easy to get lost in its manifold manifestations, which is why Parikka grounds his research in the long geological trajectory of materials and compounds involved in technological processes. But he also is keen to ask: “What other modes of materiality deserve our attention? Issues of gender, sex, embodiment, and affect? Of labor, global logistics, modes of production” (2015, p. 3). Similarly, and in an effort to map the various forms of New materialism that Rick Dolphijn and Iris van der Tuin had already begun to chart (2016), Thomas Lemke explains:

“New materialist scholarship does not represent a homogeneous style of thought or a single theoretical position but encompasses a plurality of different approaches and disciplinary perspectives, ranging from science and technology studies via feminist theory and political philosophy to geography and archeology” (2015, p. 2).

Lemke insists on using the plural form of ‘New Materialisms’ to describe the various voices that appear today on scholarly texts, many of which are relevant to this research, like the work of Jane Bennett, DeLanda and Barad that is referenced throughout this text. This diversity it is also noted in the art practices and the moving images, especially those explicitly informed by New Materialism, as in the case of filmmaker and researcher Marhöfer, whose practice is rooted in an animist methodology derived from New Materialism that seeks to actively relate with humans and nonhumans like

things, food, plants and animals (2015), like in her film *Prendas - ngangas - enquisos – machines* (2014).

There are also numerous films that explore the many faces of the Anthropocene, the rights of nature, politics of extractivism and global warming, many of which are accounted for Demos (2016). While I support the ecological and relational practices that adhere to the thinking associated with Demos and the aforementioned artists, this research does not situate at the centre of that debate: the works here presented deal with a form of making moving images rooted in agency and movement, more-than-human collaborations and the ethics (and politics) of entanglements and response-ability, as understood through the work of Barad and Haraway.

The literature that explicitly associates New Materialism with the moving image is still scarce but growing with the increased attention to the ideas of Barad. In the context of this project, I reference Kate Mondloch and her feminist materialist approach to New Media Art (2017) that looks at the work of Pipilotti Rist, which is relevant to this research as an example of a moving image artist working with non-mechanical forms of movement and multi-sensory experiences. In Rist's immersive installations, explains Mondloch, you are provoked by the artwork "to experience yourself as embodied, sensuous, and contingent" (Mondloch, 2017, p. 3). This form of 'coconstituted' embodiment with other bodies and entities was useful for the development of the two immersive installations that I produced as part of this research and that are described in detail in Part III of this text (p. 134)

I also look at other artists and filmmakers whose work I find to resonates with New Materialism, who, that to my knowledge, do not mention it directly, like Chris Welsby, Tacita Dean and Francis Alÿs. In relation to movement, I find the work of Denis Beaubois relevant, especially *The Fall from Raiatea* (2007) in which he drops five cameras from a building while recording the fall, which results in a yet coordinated, but contingent and chaotic movement, as the videos are projected simultaneously in a five-channel installation: we see the cameras falling together until they are destroyed at the end the film. Also, the work of Guido van der Werve, has

been important for me, particularly *Nummer negen, the day I didn't turn with the world* (2007), a time-lapse film in which we see the artist standing at the geographic North Pole with his back to the sun. The film follows the artist as he turns 360 degrees in 24 hours following the trajectory of the sun, which never sets below the horizon and turns around in a complete circle during the summer. Because he moves in opposition to the Earth's spin (maintaining the relative position of the sun in relation to his back unchanged) is why he announces that moment as the 'day he did not turn with the world'. I find this kind of responsiveness and collaboration with nonhuman entities and movement especially interesting and resonant in connection to the artworks I present here. However, more than engaging in an extensive dialogue with other artists that also work with movement but that do not engage in a discussion with New Materialism, I will concentrate here on the dialogue with New Materialism and the thinking of Barad, to see what kinds of moving images emerge from that creative entanglement.

Consequently, I follow Parikka's challenge and invitation to ground the notions of materiality when engaging with New Materialism. I take this as an invitation to follow the roots that ground this research: Where does the materiality stem from? What is the very matter of this research?

This research stems from the materiality of movement. However, it does not imagine mechanistic and linear movements manifested through well-defined and repeatable causes and effects, but a world where movement is agential, troubled, stirred up, affective and vibrant.

## Earthly movements

*Consider for a moment the velocity at which you are moving. Perhaps you are traveling by train or subway; or flying on an airplane. You look through the window. There is movement, the world is alive, you think. Alternatively, it is quiet, you read in a room with no windows. You hear nothing: no wind, birds, or traffic congestion. You perceive no motion. Yet, the ground beneath you is moving remarkably fast. It is spinning. The room, the walls, the roof, the air, the very chair where you sit; you rotate and tilt describing circles around the centre of the earth. Always in motion, the planet transits around the sun. In turn, the sun rotates around the center of the galaxy. The Milky Way, which is only one of many galaxies, moves in relation to other objects like black holes, nebulas, or universes —or pluriverses. We can look as far as into the cosmological horizon, to the very oldest thing that we can see: a fossil light remnant of the Big Bang; and even there, in that subtle cartography of the universe, we find movement.*

It only takes a moment of sensing, observing, and thinking, to realize that movement is a condition of the Universe. But in times of Galileo, this awareness was entirely novel, and even dangerous, which is why Galileo allegedly whispered in front of the inquisition that the earth was one of many planets that moved around the sun instead of sitting motionless at the centre of the Universe, eliciting a radical cosmological adjustment that challenged the entrenched conservative social beliefs of his time.

Bertolt Brecht, in his play *Life of Galileo*, describes this radical shift (in the words of Galileo as a character in the play) not with anxiety but enthusiasm: “The universe has lost its center overnight, and woken up to find it has countless centers”. Suddenly, he continues, “there is a lot of space” (1980, p. 8). The play describes how this cosmological shift changed the entire fabric of society: “Shake the cosmic order and the order of politics will be shaken as well” (Latour, 2020, p. 13), explains Latour in the introduction to the Exhibition Catalogue *Critical Zones: The Science and Politics of Landing on Earth*.

Galileo's telescope, explains Peters, "helped place our planet in a solar system unimaginably more vast than the geocentric vision" (2003, p. 399). The earth, which we humans unrightfully call ours, became another amongst many. The thinking of Galileo created a very prolific space for knowledge. However, this epistemological movement, as Serres explains, introduces nature separated from the social realms of law and religion. Science acquired independence from the subject: "Nature then becomes a global space, empty of men, from which society withdraws". (1995, p. 85).

The objects of nature, already separated from subjects, revealed early signs of the triadic divisive structure of subject-object-apparatuses identified later with Cartesian epistemology: "the world appears as if it consists only of active human subjects who confront passive objects and their law-governed mechanisms" (Bennett, 2010, p. xiv) The artefacts of observation like the telescope, arguably discovered by Galileo, amplified this separation even further. In optical astronomy, the lens is called the objective and it is used to amplify the objects that the subject aims to observe. This triadic arrangement comes as a predisposition from which New Materialist thinking aims to resist.

The laws of physics developed by Isaac Newton, who was born at the time of Galileo's death, set the foundations of a model of the universe where time and space are seen as absolute and independent, regardless of how things relate to with the world or are perceived by humans. To support this, Susanne Guerlac explains that the "mechanistic worldview was codified by Newton, who systemized the experimental method of Galileo and generated universal laws of nature" (2006, p. 18). Kepler too, provided a useful framework for the movement of the planets describing elliptical orbits around the earth.

They [Newtonism and classical mechanics] pictured a world in which every event was determined by initial conditions that were, at least in principle, determinable with precision. It was a world in which chance played no part, in which all the pieces came together like cogs in a cosmic machine (Prigogine and Stengers, 1984, p. xiii).

However, these laws and models for the Universe, while helpful, fail to encompass the material specificities and the effects of such movements. They seem to be disconnected from matter, as they are too abstract or mechanical. For example, a change in the direction in which the Earth spins would have a minimal impact on Kepler's or Newton's equations, but if the Earth spun in the opposite direction (like Venus does), the change would certainly bring novelty to our world: not only would the sun rise in the west and set in the east, but also, if the planet spun in reverse, it would have altogether different weather patterns, winds, bodies of water, and perhaps even a different continental configuration, as it is explained in a recent study by the Max Planck Institute for Meteorology (Mikolajewicz et al., 2018). In that scenario, the Amazon rainforest would be a desert while the Saharan Africa would be a humid ecosystem, among other speculations. It would not be a difference easily compensated for a minor adjustment to a mathematical statement, as is frequently done in these equations. However, in a non-linear account of the Universe, as the one that informs this research, changes can produce unexpected and indeterministic results.

A mechanistic form of movement can be observed, for example in the structuralist video works of Michael Snow, who in pursuit of a less illusionistic and non-representational filmmaking practice, incorporated mechanical artefacts, rotating arms, and remote controls as means of producing moving images, as is explained in detail by Kate Mondloch (Trodd, 2011). That is the case of the film *La Région Centrale* by Snow (1971), which a 16mm camera is controlled by mechanical arm or artefact that moves, rotates and accelerates in unexpected ways programmed by the filmmaker, turning upside down and sliding sideways or tilting. The film decenters and troubles the stability of the horizon, and that of the viewer, revealing the world in an uncanny way. Nonetheless, its movements remain mechanistic. In Snow's film, motion is autonomous and independent from world surrounding it. The moving camera shows a compelling landscape that changes, moves, and swirls but there is no active response that affects the production of those very images: it remains in the background as a



landscape. Tim Ingold talks about the concept of landscape as something which remains on the surface only to register “the contours of the land but do[es] not mingle with the earth beneath your feet or with the air you breathe” (2017, p. 31). This is also what Latour refers to as an *earthy*, a form of ‘landing’ on the Earth to negotiate and find common territories in space and time (Latour, 2018).

In Snow’s film, if the same impressive and well-designed artefact were to be installed in another mountain, it would render different results, but only inasmuch as the landscape or the instructions to move the camera changed. The differences are not a creative result from the interplay or intra-action (to use Barad’s terms) of the moving image apparatuses with other entities, namely the rocks, wind, temperature, sky, and sun.

In contrast, some of the works of Pipilotti Rist utilize non-mechanistic and spontaneous camera movements that provide a dream-like effect. This is the case in the video work *Cinquante Fifty (Installation for a Parking Lot)* (2000), where the camera flies out a building spinning and swinging rhythmically and chaotically, while occasionally focusing on two human figures inside the building who look through the windows at the camera establishing a connection. The camera does not fall endlessly but appears to bounce suspended in mid-air. As in the case of Snow’s *La Région Centrale* (1971), the horizon moves and spins in various directions and it is easy to feel vertigo when looking at the images, but the movement is not mechanical: Rist’s video seems highly specific and contingent, like it cannot be repeated. By simply looking at the images, it is not possible to discern what type of moving artefact was used to produce the work. Rist’s video work portrays a sense of movement that is complex and undetermined.

Galilean and Newtonian cosmology, while revolutionary, still insisted on a global and mechanistic view, one that can be thought of as a game of billiard ruled by a series of mathematical formulas that describe precise movements but that can be explained as the work of designer or an engineer. In this sense, it is not too different from earlier religious cosmologies in relation to

motion: if one were to remove the belief in a creator of the Universe that set everything in motion, as it is done by secular accounts of the solar system, including the Galilean and Newtonian, the Universe is still seen as a stable, mechanistic, and deterministic entity (Latour, 2018)

“— Yet it is moved,” exclaims Serres in *The Natural Contract*, echoing Galileo’s earlier ‘yet it moves’: the “immemorial, fixed Earth, which provided the conditions and foundations of our lives, is moving, the fundamental Earth is trembling” (1995, p. 86).

It is moved because it is being transformed by our doing. It trembles because of our profound impact on the Earth, which “has become –has become again! – an active, local, limited, sensitive, fragile, trembling, and easily irritated envelope” (Latour, 2014, p. 58). It is a movement that urgently points to the consideration of the impact of humans on Earth and its vulnerability; the world is moved because it is hurt. This recognition is vital as it sets the ground for the necessary thinking and action in response to the effects of the Anthropocene.

It also invokes the capacity situated in matter, for humans and nonhumans to manifest vitality, transformation, and change: the Earth is a “source of movement, emotions, effects and affects” (Latour, 2016a, p. 1). And Latour continues:

The Earth is now agitated in addition to its usual motions. Not only does it turn around the Sun (that much we knew), but it is agitated through the highly complex workings of many enmeshed living organisms, the whole of which is either called ‘Earth system science’ or more radically, Gaia” (Latour, 2014, p. 3).

Gaia is a term coined by James Lovelock and Lynn Margulis that describes the whole planet as a self-organizing productive system: “The notion of biosphere as an active adaptive control system able to maintain the Earth in homeostasis we are calling the Gaia hypothesis” (1974, p. 3).

Lovelock and Margulis pushed fiercely and creatively the idea that the Earth is not mechanistic. But rather, that movement is produced by the very things that inhabit the Earth, which means that it has been throughout time and evolution how the living organisms on Earth have enabled the conditions in the atmosphere to sustain themselves. This brings the concept of agency to the core of matter and its relationality. In the mechanistic Copernican world, things move for no reason, suspended, deprived of agency. However, according to the Gaia hypothesis, as explains Margulis, the living organisms in the atmosphere produce and regulate the conditions in the atmosphere necessary to sustain life: “the lower atmosphere is not a passive environment but is an active modulated environment for life on the surface” (1984 min. 3:14)

These ideas point to a relational ontology that recognizes the cooperation amongst organisms as the basis of life sustained by the atmosphere. But also, it introduces responsiveness at the heart of matter: “At the base of the creativity of all large familiar forms of life, symbiosis generates novelty. It brings together different life-forms, always for a reason” (Margulis, 1998). And ‘by reason’, she means responses and collaborations always in relation to other entities to do various things like survive, adapt, evolve, move and reproduce.

We have spent so long thinking of the planet from the outside, ignoring its vitality, that we have forgotten about the Earth. We are deterritorialized, explains Serres: “Delocalized too, humanity lives then, here or there in fact, but elsewhere for heads, symbols and ideals” (2012, p. 47). We have filled our collective imaginary with an image of a world devoid of movement, a globalized planet that thinks of itself from the outside, as Latour explains. It is common, he adds, to imagine the Earth as a globe seen from an outside (nowhere) position in space and time. Latour describes this place by evoking Sirius, the brightest star in the night sky, where no human has visited: to find a global image, we have zoomed out and left the planet. This *advantageous* position became the preferred site from which to understand phenomena within the domain of the ‘natural sciences’ and positivism, which depict

a mechanical view of the universe: “All other movements have become subject to suspicion” (Latour, 2018, p. 68). The laws of Newton work better when imagined from outside of the planet, undisturbed by the noise of worldly clutter (like friction and turbulence). Prigogine, explains: “We know now that the simple motions, whose descriptions still fill most textbooks of classical dynamics, correspond in fact to exceptional situations” (Griffin, 1986).

The first law of Newton, which explains that the velocity of an object will remain constant unless an ‘external’ force acts on the object and modifies it, depicts an object moving perpetually and undisturbed (by the annoyances) of friction and gravity, a situation that it is not to be found anywhere on Earth, but in the void of outer space (that is how I learnt it in high school). While imagining these conditions is helpful to understand basic motion, the first law of Newton imagines movement from the perspective of outer space, a place that few have visited but it is constantly frequented by our collective imagination: the globe imagined from an outside position as it is described by Latour.

There is no distant place anymore. And along with distance, objectivity is gone as well, or at least the older notion of objectivity that was unable to take into consideration the active subject of history (2014).

Latour refers to the distance entailed by beaming up to Sirius and imagining the world from there. We need to land, but we do not want to come crashing down. There is not enough planet, earth and soil for us to house the program of globalization (Latour, 2018). Either we deny the problem and keep on harming, escaping and imagining a stable and infinite planet where resources are inexhaustible, as Neimanis claims, when she explains that water has been rendered as placeless and infinite (2017), or else we look for shared place where to land and inhabit (Latour 2018).

## Clouds

*You are at the mountains. There is fog all around. It is cold. You feel your heart pounding in vitality: you are aware of every breath. You inhale clouds as you cannot tell the difference from the air. Oxygen diffuses into the bloodstream. The lungs warm up the air inside you. You exhale. As air leaves the mouth, its particles get colder: you see them in the form of vapour that is dispersed right away back into the clouds. But you cannot see the difference between the air you exhale and the clouds around you. You think about the boundaries of your breath. Where does it ends? At the lungs, mouth, or lips? Outside of you? You inhale clouds; you exhale clouds. You lose track of boundaries. You visualize yourself connected within the atmosphere: the thin and vulnerable space where all things live.*



Figure 1.5. Walking around the Large Millimeter Telescope at the Sierra Negra.

With no clear point of origin and always in motion, clouds are created (and dispersed) through responses to energy, heat, cold, winds, atmospheric pressure, geography, and bodies of water. As warm air moves up through the mountain and cools upon reaching higher altitudes, it creates massive banks of fog and clouds in the high parts, especially in the afternoons. It looks like they are pulled by invisible forces. But there are no intrinsic forces that attract the clouds towards the mountains: “Matter is produced and productive, generated and generative. Matter is agentive [enacts agency], not a fixed essence or property of things” (Barad, 2007).

Seen through Barad’s metaphysics, clouds are formed (and the prepositions are important here) *with* the mountains, rather than *at* the mountains. They do not move *towards* or *off* things; instead, they are created *in* entanglement with matter. Down the mountain, water evaporates once more. This process sees no interruption and cannot be fragmented. There is no intrinsic previous state that precedes or follows the forming of clouds within this continuous movement, which is constituted as an already produced and productive flow of agencies, where the “past and the present and the future are always being reworked” (Dolphijn and Tuin, 2016, p. 68).

At times, clouds are created rapidly and cover everything in a thick fog that sits at the top of the Sierra Negra. The atmosphere is almost motionless, quiet and silent. It is also possible for clouds to turn into violent storms in a matter of minutes. The weather is unstable. It can dissipate rapidly too, which at night opens an opportunity for astronomical observations. It is through precise measurements, analysis, and in close collaboration with nonhuman entities like the clouds, humidity, temperature and wind, that astronomers find moments of opportunity to observe faraway phenomena. These ‘windows’ of stable conditions can be explained in what Pickering describes as ‘islands of stability’ (2011), which are balancing acts of ‘tuning in’ with agencies at the intersections of the human and nonhuman.



Figure 1.6. Video still. Standing at the Sierra Negra looking back at the camera in the *Sierra Negra*

### **The Hidebehind**

My first visits to the Sierra Negra were full of amazement, but I felt distant. I wanted to participate. I remembered Barad's words: "Knowing is a direct material engagement" (Dolphijn and Tuin, 2016, p. 52), but things seemed unfamiliar and elusive. I thought about ways to get involved, but I did not know how to put myself out there to collaborate. How could I be affected by the mountain and the observatories? I did not want to approach matter from a distance. My aim was to be present. I wanted the 'current' to take me.

I thought about performing a series of exercises surrounded by different settings, where I would set the camera on a tripod, start the recording, and walk in front of the camera looking back to it. I would stand there without moving, just to be present. I would do these exercises regardless of the weather conditions. I performed this action several times, not knowing if it would lead me somewhere. Slowly, it helped to me get attuned to the mountain. The workers at the telescope started to recognize me, which

made my work easier. I learnt my way through the observatory and to the upper parts of the mountain, and I acclimatized faster to the high altitude (an attunement process of its own). I became comfortable with the clouds. I would observe them and record long videos, sensing and feeling their pacing. I was fascinated by fog. I still am.

It was very cold; my hands were numb. I decided to put the camera on a tripod pointing in the direction of the telescope. I imagined myself standing in front of the camera with the massive telescope in my back surrounded by rocks, hail, snow, and dense fog all around. I could not see clearly through the viewfinder, and I did not know where to focus. Nonetheless, I started recording and walked in front of the camera and stood between the telescope and the tripod. I could not see the camera obscured by the fog, nor the telescope standing at my back. I stood there without moving.

After a while, I walked back to the camera and stopped the recording. I did not view the clip right away and continued working. It was not until I was back in the studio sitting at my computer reviewing the shot that I realized that there was no sign of the telescope behind me. All I could see were clouds. However, the massive telescope slowly revealed itself behind the fog. I was standing there unaware of the ghostly appearance behind me. My presence was subtle, almost as a measuring device to provide a sense of scale. I was taking part in an uncanny situation between the camera, the clouds, and the telescope. After a few seconds, the telescope disappeared once more behind the clouds. It was overly exciting.





Video III. *The hidebehind* (2016). Duration 1:01 minutes

<https://www.emiliochapela.com/hidebehind>

To my surprise, I noticed that the image was out of focus. I was disappointed but I thought I could never repeat that again. I tried to convince myself not to be worried as the project was also about relinquishing control. But I was troubled.

It took me some days to notice that more than a ‘magic trick’ or the result of pure luck, the video constituted a form of alliance. Clouds have no clearly defined borders and do not inherently obstruct or reveal other objects. They are constantly actualizing and changing its forms.

Manuel De Landa, in his text *The New Materiality*, explains: “The state in which an organism happens to be at any one moment is actual, while all the other available states are virtual, waiting to be triggered into actuality by a catalyst” (2015, p. 20). He refers to a notion of causality (the relations between causes and effects) that entails constant change and transformation. In this context, it can be said that the clouds move from an actual state to one of many possible futures, depending on how water and vapour particles relate and respond to other intra-acting entities, like temperature, pressure, mass, humidity and so on. In clouds, past, present, and future are always entangled. That day, the telescope became obscured by the clouds in relation to the camera and me. It felt like a unique event that happened to us (camera, clouds, me, rocks, etc) and it is possible too that the massive observatory was not in fact obscured from other angles. The resulting video was the result of a particular configuration in space and time.

Jeffrey Jerome Cohen, in the introduction of the book *Prismatic Ecology*, talks about the rainbow as an alliance, which “exists as an object, but an interstitial one, at a meeting place of relations and materiality” (2013, p. xxvi). He explains that rainbows do not exist as things in the world per se, they are instead formed as phenomena in relation to the perspective of a viewer, as well as in connection to many other physical conditions. He adds: “The result of finding ourselves in the company of this rare object is wonder” (Cohen, 2013). I believe that what Cohen is trying to say is not so much that rainbows depend on the viewers to exist, which would point

to a phenomenological approach rather than a relational ontology, but that the formation of the rainbow is relative (materially) to a specific position in space and time.



Figure 1.7. Video still. Rainbow near the *Malintzin* volcano on the way back to Mexico City from the *Sierra Negra*.

The shape, size, and movement of clouds, as well as what they obscure or reveal, is the result of intra-actions with other things, and in the context of the moving image, also with the camera, lenses and other artefacts and processes like postproduction: back in the studio I managed to make contrast and brightness adjustments to enhance the ‘appearance’ and ‘disappearance’ of the telescope behind the clouds. The video that I am here describing emerged fortuitously and productively from the intra-action of various conditions and capacities like those of the camera, tripod, ideas, weather, clouds, light and postproduction techniques that allowed the video to become determined in such specific way.

In contrast to this experience, I think about James Benning's films, in which the landscape is presented as something that it is *out-there* and *over-there* (like the horizon), instead of an active place where exchanges are situated. In *Ten Skies* (2004), clouds move far away in the background. Benning explains that it is "because of the shape of the frame, it's kind of like looking at the sky through the sunroof of a car" (2004, p. 3). The frame of the movie becomes the space where things move passively, to be observed:

I'm really interested in the ways the sky changes in reaction to the landscape below – how the clouds look above the mountains, over flat lands, above a forest fire, which was kind of creating its own weather system (Benning 2004, p. 3)

While I do not believe that proximity is a condition of involvement, in Benning films, the clouds do not affect the production of the moving image. He calls them 'found paintings', and according to him, they are about enjoying beauty. Benning's clouds films are a form of contemplation of the landscape, where the role of the moving image feels passive, as no entanglement is secured.

In contrast to Benning's work, and in relation to the video I made in collaboration with the clouds and the telescope: can agential realism challenge assumptions of the moving image like that of subject matter, objects, and artefacts? It is worth questioning here, for example, who is the object of inquiry? Is it the telescope, the clouds, or me? As an artist, I participated in the recording with the intention to produce a work of art, but my role in the video functions mainly as a tool to provide a sense of scale, as the camera was standing on a tripod without no direct influence of the cinematographer: "The camera has presence", explains Jamie Lorimer, and can explore more-than-human geographies through the moving image by engaging in affective entanglements (2010). In this case the image was not in focus, which was something that I did not want. It was clear that the camera, as well as the telescope and the clouds were active participants in the moving image forming alliances, or entanglements (to use Barad's words).

I will refer to the work of artist Simon Faithfull to problematize this further. As part of a commission, Faithfull traveled to a technological observatory in northern Finland inside the polar circle to try to see the auroras borealis. After not being able to see the auroras due to overcast skies, he produced the work *Aurora Borealis (unseen)* (2008), which consists of a close-up video of his own eye reflecting both the massive antennas and the auroras documented with the specialized artefacts that he visited. The eye of the artist (not used here metaphorically) served as a meeting point, where various landscapes converged. In the video, the eye moves impatiently, as if waiting, while the iris functions as a reflecting tool that shows various levels of observational intricacies created between the observatories and the auroras. To some degree, Faithfull is able to show the entanglements and difficulties of astronomical observations and the moving image, however, it seems like the artist decided to hide or ‘camouflage’ the presence of the camera reflected on his eye, missing an opportunity to recognize its presence and its capacity to affect, as the camera cannot be suppressed, as the eye has no option but to reflect it.

Another example to review using a strategy opposing the interests of this research, is the work of Lois Patiño, *En el movimiento del paisaje* (2012). While the video is interesting and compelling, it reveals a division between the human subject and landscape: we see the artist recorded from behind facing various remote and beautiful spaces like a waterfall, a desert, or a tundra. The silhouette, however small, is always visible and maintains a clear visual contrast with the landscape, in part because of the black clothes that he is wearing. One thing is never confused for the other. This configuration encourages a separateness, or a rendering of nature as something that surrounds the human presence. In relation to this work, Patiño explains in his artist webpage that the human figure “is situated within a landscape that develops facing towards him, surrounding.” (loispatino.es, 2021) His intention is to underscore the vastness of the world by standing still (as well as keeping the camera still) while watching the world move. I subscribe to a view of a world that is in constant change; nonetheless, and unlike Patiño’s work, this research is constituted on the effort to move along with it.

That is the case of Tacita Dean's film portrait of apple grower and poet Michael Hamburger (2007), in which there is a close agential relationship established between the camera, the film and the weather, which is open to change and transformation: in the film, we see the light constantly changing because of the fast-moving clouds that reveal and obstruct the sun alternatively. The apple trees react to the intense winds too. However, the camera operator does make an effort to compensate for changes in the light. The image gets darker and lighter as the clouds move above. Even though they are not seen frequently on the film, they participate actively showing the vitality of the world and its movements. The world is alive. Inside the house, the light is dark (a little under-exposed) as it is filmed directly against the light coming from the garden. This is not an annoyance, but an affirmation of agency. While Hamburger speaks about the apples, he evokes stories and metaphors: the film is not only an interesting portrait of the poet, but it also presents a coordination of atmospheres that includes the weather, the clouds, the film, camera and the film projector used to reproduce it. This film has been an inspiration to my research, and I see it enacting a New Materialist moving image practice, even if Dean, as far as I know, has not been explicitly influenced by it.

## The Hidebehind II

I became comfortable with the ‘out-of-focus’ video, in which I collaborated with the clouds and the telescope that I described earlier (*The Hidebehind*). I was already using it to talk about this research, as it served as a good example of the kind of collaborations I wanted to develop, and as a suggestion for how to resist the habit to exert control over the camera and the ‘environment’. Following Dean’s film about the orchard, I stopped looking for ‘ideal’ situations that served to my advantage. In my trips to the observatories, I would record as much as I could regardless of the weather conditions, or how I had imagined them beforehand.

Nonetheless, I wanted to try to record the video again, but this time in focus, knowing that I was probably going to fail, as it would be hard to know the exact moment when the telescope would be revealed and obscured once more behind the fog. I wanted to be ready and react if I saw an opportunity. I was curious to see how rare those conditions were and how different the resulting video would be from the first time: the particularities of the entanglement had to bring different results as diffraction is about emerging differences and not sameness. (Barad, 2007).

One goal of this research has been the exploration of methods and ideas that can nurture collaborations by means of experimenting: trying things out, failing and ‘tuning in’, both in the way that is described by Pickering, as a performative form of ‘finding out’ (2011); but also as an attunement, as it described by Stewart: a process of dwelling in spaces (and in time, I would add), in which “things matter not because how they are represented but because they have qualities, rhythms, forces, relations, and movements” (2011, p. 445).

Musicians tune their instruments through listening and calibrating to a sound, which is a direct and performative form of relating to the world’s atmospheric pressure and its vibrations. Attunement is also the process of sensing and adapting, which Stewart describes as “rhythms, valences,

moods, sensations, tempos and lifespans” (2011, p. 445), for which considering time is essence. Anyone that has driven on the opposite side of the road has noticed that thinking about it, is not too helpful, and that attunement to the road is a matter of time and practice.

‘Tuning in’ is also used to describe the action of moving a notch on an old radio to find a particular station to synchronize the voltage to a desired radio signal. This process is similar to how radio-telescopes are calibrated to ‘tune in’ to various wavelengths of light that in some cases, like in the Sierra Negra millimetric telescope, come from millions of years away in time and space. Attuning is not a passive attitude: it always entails doing something. It is a performative task: “Take the example of microscopy. In [Ian] Hacking’s account, ‘seeing’ atoms or other entities with the aid of a microscope is not a matter of simply looking—of passively gazing on something as a spectator—but an achievement that requires a complex set of practices to accomplish” (Barad, 2007, p. 51). To ‘see’ one must actively intervene.

The process of acclimatization when hiking a mountain is also an attunement process. By spending time at a high altitude, the body synchronizes and learns to negotiate better with the material conditions that affect it.

In relation to attunement, Stewart is interested in a form of agency that is subtle and atmospheric. She refers to everyday sensibilities, shifting rhythms and background noises that might, or might not, emerge given certain circumstances (Stewart, 2011). And although, the conditions at the mountain are somewhat extraordinary, fog and clouds (which are atmospheric in a very literal sense) have emerging qualities and productive capabilities. They are emergent systems that bring novelty, in the sense described by DeLanda (2012). They resist the assurances associated with linear causality that affirm that same causes bring the same consequences.

About two years later after I recorded the *The Hidebehind*, I took the opportunity to try to record the telescope disappearing behind the clouds once again. The fog was dense. The workers at the telescope were expecting



a storm and I was asked to take cover inside the telescope room or go down the mountain if I heard a thunderstorm. But I saw a few workers carry on with their jobs outside, completely covered in fog. I decided to continue, and try to make the artwork again, just to see what happened.

I already knew my way around the telescope, which was completely covered by clouds. I tried to remember the exact place where I had placed the camera the last time. Things looked different. The landscape seemed changed. I found the spot and I made sure that the image was in focus before starting the recording. Like the first time, I walked away from the camera and stood looking back at it. I decided to stay there as long as I could. Time was an ally. It increased the possibilities for the clouds to reveal the telescope. But I could not see the artefact standing at my back. The hail intensified as the storm started. I stood up there without moving for around ten minutes and decided to return to the car before leaving the mountain. I was getting wet and cold. To my surprise when going down the mountain, there had been a massive storm in the towns beneath me. Roads were completely flooded.

Back in my studio, I saw the footage, and the telescope looked completely covered in clouds throughout the entirety of the video, with the exception of just a couple of seconds where it was barely visible: “There’s a pause, a temporal suspension animated by the sense that something is coming to existence” (Stewart, 2011, p. 446), explains Stewart describing when something is about to emerge. The telescope was hard to see, and it was by no means as clear as the first time. I took me sometime to decide if I could work with the clip. I made some brightness and contrast adjustments to the image and the telescope appeared with more clarity. Postproduction (colour correction techniques) played an important part on the ongoing configurations of the moving image. I was fortunate to achieve these images, it entailed attention and attunement that resulted in establishing a productive alliance with the clouds, but it was clear that I had not produced the same image as the first time at the mountain, and that each video is ‘imprinted’ with the particularities of the entanglements that produce it. It was an alliance, but it was by no means the same one. In the mechanistic world of Newton, the same cause will lead to the same result, always, while in a New Materialist account, agency and movement are always singular.



Video IV. *The Hidebehind II*. (2018). Duration 3:11 minutes

<https://www.emiliochapela.com/hidebehind2>

## Earthly Astronomy

Inspired by an image of the Earth taken by the *Voyager 1* spacecraft in 1990, Carl Sagan described the world seen from a distance as ‘the pale blue dot’. Here is a fragment of what he wrote:

It has been said that astronomy is a humbling and character-building experience. There is perhaps no better demonstration of the folly of human conceits than this distant image of our tiny world. To me, it underscores our responsibility to deal more kindly with one another, and to preserve and cherish the pale blue dot, the only home we’ve ever known. (Sagan, 1994, p. 7)

The incommensurable vastness of the universe in relation to the ‘pale blue dot’ in which we inhabit provokes a humbling, if not demeaning experience. But it also points out to the folly of our narcissism in sending a spaceship to explore the solar system and beyond. The *Voyager 1* is today the farthest human-made object from the Earth, and it has barely left the solar system.

I feel challenged, or even troubled, when thinking about astronomical observatories as apparatuses designed to explore the farthest regions of the Universe, even after recognizing their active and agential capacities: I have wondered about the anthropocentric and colonialist implications that might be associated, however implicitly, with these machines. I do not mean this as a literal colonization of outer space, although the mining and exploitation of space resources might soon become a threat, but in the sense described by Latour, as means to help us escape the planet because we no longer have a land to inhabit (Latour, 2020). We stand here on the Earth but live somewhere else in our heads. And it is from there, in our ideals that we think about science, explains Latour. It is also the place that Stengers refers to the ivory tower from where what she calls fast science is produced, a scientific practice associated, among other things, with industrial developments that isolates the objects of study from the context in which they act, which include, sometimes, the ethical considerations of its consequences (2018).

Can astronomy be a practice that can help us land in the sense proposed by Latour? A practice that considers its *milieu*, understood here as the surroundings or the habitat with which it acts (Stengers, 2013). Is it possible for astronomy to explore the cosmos by looking far away while attending to its relations with this planet? I believe it can, but I will leave this enquiry open since it lies beyond the scope of this research. I bring up this idea, however, to explain that the moving image practice here developed was motivated precisely by forming entanglements here within the Earth, especially in the remote places like observatories, where humans are looking out. Perhaps others will be keen to inquire if collaboration amongst disciplines can open up distributed forms of knowledge that can attend to the cosmos while looking at Earth, or reconcile the micro with the macro, nature and culture, and so on. Artistic practices could play an important role in the movement described by Boaventura de Sousa Santos, who suggest “replacing the monoculture of scientific knowledge by an ecology of knowledges” (2008, p. xx), which aligns with Stengers’s ecologies of practices, discussed in more detail in this research.

I have thought that one aim of this research is to ‘throw myself in the middle’ of things in order to get entangled with the world. However, I wonder if that is not the manifestation of another anthropocentric habit. Being in the middle requires first and foremost the identification of a centre, one which might be problematic to find as it implies the delimitation of its spatial boundaries, as well as fixing time to a specific moment. Defining a center is troubling because it relegates other entities to the surroundings, producing distance. Perhaps, an important correction is needed here: instead of ‘throwing myself in the middle’, it is preferable to think about enabling forms of participation to get close to the world, even from a distance. To do it, I use Barad’s ideas on touching (2015), a form of material entanglement that suggest something more than the physical act of touching, a way of becoming together that entails a response to that what is touched. Similarly, and from the perspective of the art practices, Marhöfer’s offers ways to think about the environment through relational practices: “Filming enacts as an immediate relation with a territory [...] marked by transversal interactions” (2015, p. 50).

Barad also suggests agential realism as a way to destabilize the idea of centre/surroundings (as boundaries are determined through intra-actions) providing an alternative to the pervasive imagination, over-exploited by literature, that puts humans at the centre looking at nature relegated to the background (Morton, 2009).

The artist Francis Alÿs is successful in enabling close relations with the territory. In his film *Tornado* from 2010, where we see the artist running dangerously towards a tornado in a dirt field with the clear intention to get into its path. As the small human silhouette disappears inside the phenomenon, the video cuts to the images recorded with a camera in his hand from inside the tornado: the lens is covered in dust and the result is chaotic and disorienting. He succeeds in showing the irony, and perhaps the futility to position oneself in the middle of things (seen from an anthropocentric perspective). Nonetheless, he shows value in *touching*, or ‘getting dirty’, so to speak, by engaging in close contact with the tornado. The effort to dissipate the fixed boundaries between background and foreground, is also echoed by Morton, who highlights the importance of discussing the environment, because “when you mention the environment, you bring it to the foreground” (Morton, 2009), helping to challenge the categories that designate the divisions.

There is some danger in portraying natural phenomena as events that are unconnected to our daily lives, as if they only happened in the background. The Earth beyond our feet is shaking, roaring, and trembling, warns Serres in *Biogea* (2012). Our rivers are dying. The atmosphere is endangered. The soil that we ought to be sharing “is contaminated, eroded, drained, burnt, exploded, flooded and impoverished on a worldwide scale” (Gray and Malins, 2004, p. 163). Denying a response is pernicious. Furthermore, while we recur to an imaginary that does violence by pushing nature to the background obstructing a sense of ‘response-ability’ to other *earthly* creatures, the damage is frequently directed at them: “Landscape and vegetation are not simply the backdrop against which violence and dispossession unfold, but are mobilized as the very medium of violence” (Gray and Malins, 2004, p. 164).

## Emergent Atmospheres

Since the beginning of this project, clouds have been my companions. I would record them moving slowly up the Sierra Negra through its ridges: changing, expanding, contracting, and unravelling. I made images while completely immersed in fog, standing inside of them, as they discharged. I fantasized about seeing a drop of water growing into ice as it dropped to the lower parts of the mountain. I would also turn the camera to the neighboring *Citlaltépetl* volcano and wait as clouds obscured or revealed parts of it. I learnt to be patient and record long sequences before moving to the next one. These shots resulted in well-composed images, at times pristine. It became an intimate form of observation and contemplation. But I wondered if I was producing distance by displacing the clouds to the background or relegating them as landscapes, as in Benning's films. I reassured myself that this was not the case. I did not know exactly why. It troubles me still.



Figure 1.8. Video still. Clouds surrounding the *Citlaltépetl* taken from the Sierra Negra

One summer night at the top of the Sierra Negra, it began to snow while I was recording. I was surprised. I felt like I was witnessing the exact moment when it started to snow but not knowing if a snowstorm was about to form. The wind and the turbulences of the air made the snowflakes move in various directions. Emergent systems, like storms, atmospheric phenomena, symbiotic relations and the evolution of the species, are as much about novelty as heterogeneity, explains DeLanda (2012). “Its lines of force propel forward, spread laterally, and diverge into distinct trajectories” (Stewart, 2014, p. 550); they are systems with agential capacities to move, change, affect and be affected, or cease to exist. “It is inherently impossible to determine in advance which direction change will take: whether the system will disintegrate into ‘chaos’ or leap to a new, more differentiated, higher level of ‘order’” (Prigogine and Stengers, 1984, p. xv). The reason is that past, present and future are a continuous movement, where “possibilities are being turned into actualities while other possibilities are being excluded from actualization” (Griffin, 1986, p. 2). Without the indeterminacy of non-linear causality, DeLanda says, “there is no novelty in the universe” (2015, p. 17).

As I stood there by myself, I felt that I was seeing the emergence of something, but it was not clear if it was an orderly or chaotic state of matter; or if the event was strengthening or about to disappear. There is no way to tell: “at uncertain times and places, the eternal, universal fall of atoms is disturbed by a very slight deviation—the ‘clinamen’” (Prigogine and Stengers, 1984, p. 144). The clinamen, a spontaneous and unpredictable deviation (an inclination that would provoke atoms to swerve), explained Lucretius, is what gives rise to the world and all natural things (1984). While Lucretius’s words might not be precise in the context of contemporary physics, the clinamen, explain Prigogine and Stengers, can provide a good explanation of the perturbation experienced in water when becoming turbulent or the exact moment when a vortex is created. It is a moment of transformation.

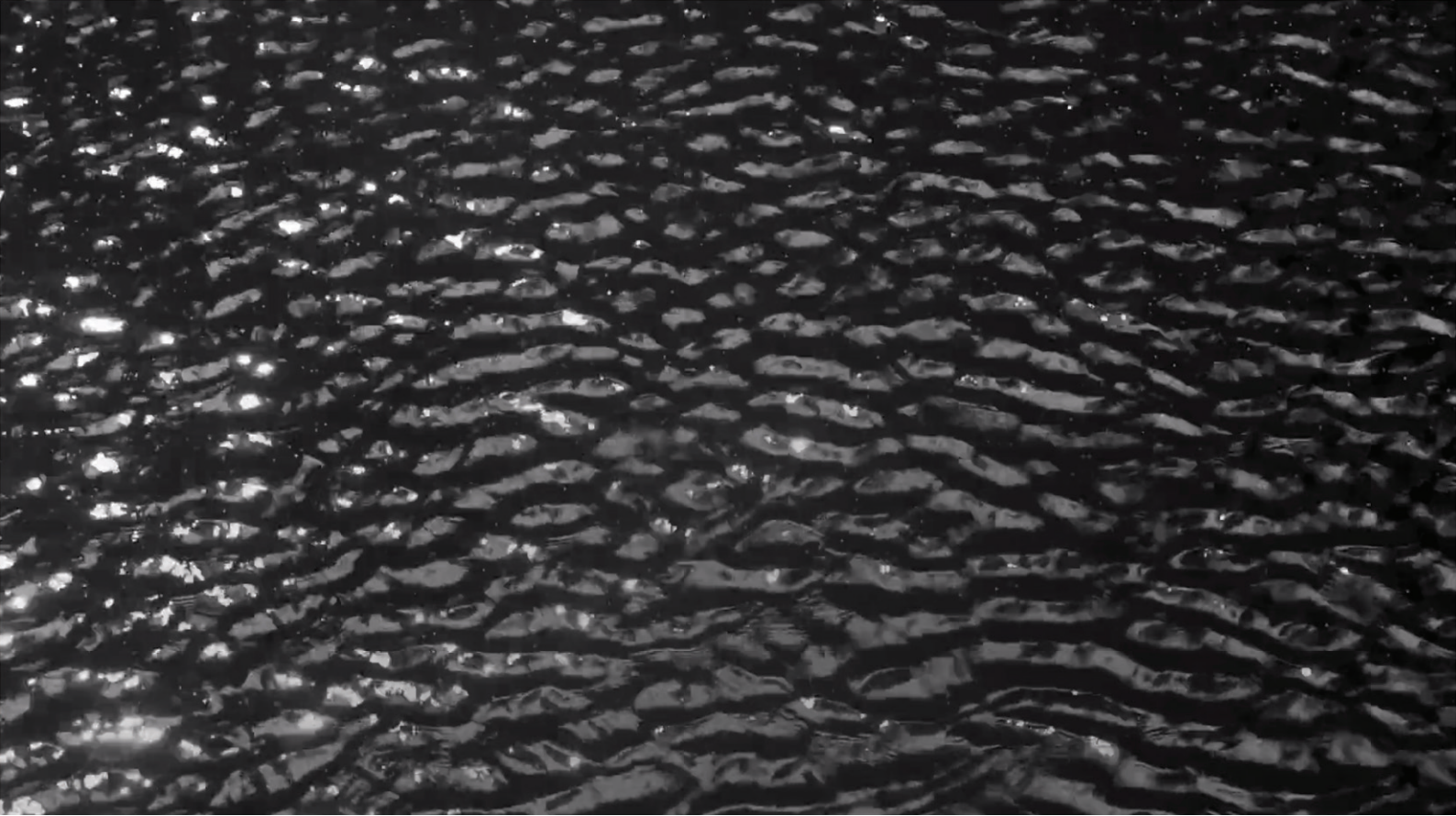


Video V. *The Clinamen* (2019). Duration 11:00 minutes

<https://www.emiliochapela.com/clinamen>

I started to think about other emergent situations or atmospheres, where movement was nondeterministic and complex and continued to approach the mountain using that same strategy, recording single-take sequences, and observing movements that interested me. I also noticed that I started to make comparable videos in other situations directly unrelated with the Sierra Negra or this research (or so I thought), which was the case of a trip I made to a lake called Santa Helena in the state of Hidalgo about 200km from the Sierra Negra observatories. I took my camera on a hike and climbed to the top of a small dam on the reservoir. Looking down to the water, I spotted hundreds of small insects moving fast on the surface of the lake. I felt inclined to record them. I started the camera right away without setting up the tripod. To my surprise several small waves appeared inside the frame, vibrating and producing diffraction patterns. I knew how to recognize them as I had been reading extensively about them in the work of Barad. Diffraction patterns form by the overlapping of disturbances caused on the water that produce unique interferences and differences (Barad, 2007).





Video VI. *Diffraction - Santa Helena*. 2019. Duration 4:00 minutes.

<https://www.emiliochapela.com/santahelena>

Consider a familiar example. If two stones are dropped into a calm pond simultaneously, the disturbances in the water caused by each stone propagate outward and overlap with each other, producing a pattern that results from the relative differences (in amplitude and phase) between the overlapping wave components. The waves are said to interfere with each other, and the pattern created is called an interference or diffraction pattern (Barad, 2007, p. 76)

That day at the lake in Santa Helena where I recorded the diffraction patterns in the water, I did not know how long I was going to continue. Stopping the recording meant ending the video, as if I were already editing with the camera. But the rhythms of the water kept changing and I was curious to see what could happen next. I did not move the camera and decided not to stop until the phenomenon itself gave me a cue, perhaps until I noticed a repetition on the patterns, or the water became calmer.

I continued working in a similar way as that day at the lake in Santa Helena: I would concentrate on things and movements that interested me staying curious and engaged, which materialized in the form of single-take videos, in which an event unfolded in time, like an emerging atmosphere where agency is both latent and manifested. Among these atmospheres of sorts, I recorded things like a setting of the sun on the top of the Sierra Negra, the falling of hail, and the movements of clouds reflected on a lake, where the shapes of the clouds expand, and contract, affected by a reflection on the water and the diffraction patterns caused by falling objects and the winds.



Video VII. *Diffraction - Brück (2017)*. Duration 2:34 minutes

<https://www.emiliochapela.com/diffraction>

To produce the videos, I did not cut or use techniques like ellipsis, montage, and other structures related to the syntax of cinema: the images respond to a phenomenon's entire cycle, or concentrate on specific movements until they cease, change their qualities, disappear or something is revealed. It can also be the case that I lost interest in the action or ran out of battery. I see these works as indivisible movements that are experienced as intensities, in the sense described by Bergson:

Think of what you experience on suddenly perceiving a shooting star: in this extremely rapid motion there is a natural and instinctive separation between the space traversed, which appears to you under the form of a line of fire, and the absolutely indivisible sensation of motion or mobility (Bergson, 1910, p. 65)

For Bergson, time cannot be discretely separated, and needs to be experienced, and not measured in minutes, seconds, or hours (Bergson, 1911). In consequence, time becomes an experience, in which "each image contains its own unique duration, its own capacity for change (Herzog, 2000, p. 6)". This notion of duration is what drives how I approach these experiments. However, it is important to acknowledge that Bergson believed that film had no access to the experience of duration, as he said it was comprised of individual frames or photographs reproduced mechanically at a constant rate, which fragmented the experience of movement only to be reanimated mechanically with the projector, and this produced impersonal and simple movements (Bergson, 1911). However, for Herzog, it is possible to reconcile Bergson's ideas of time with the moving image. She emphasizes that representation is the cause of the immobility, not the sequencing of frames: "representation operates through immobilization, spatialization" (2000, p. 7). Bergson's theory of matter, she adds, allows us to see film not as a fixed representation, but as an aggregate of images in flux with the world.

These emergent video atmospheres are not intended for the viewer to simply perceive a situation as it happened in front of the artist as a representation. Each of these videos is seen as an event in itself that produces "an image

on its own right, with its own duration and axes of movement” (Herzog, 2000). A movement that is not simply represented (Bergson argues that representations convey no movement), but it is activated via the experience of the artwork and “through the collision of affective images” (2000, p. 7). That way, Herzog adds, “what is conveyed becomes less significant than what is not revealed”. I take that as an invitation to look past the perception of movement (the things that move inside the frame) and experience what emerges from movement, intellectually and affectively.



Video VIII. *Sunset*. Duration 1:25 minutes

<https://www.emiliochapela.com/sunset>

## Emergent Atmospheres II

### The void

As a vital materialist associated with New Materialism, Bennett explains a world which is “populated by animate things rather than passive objects” (2010, p. vii). She shares the view with Spinoza that everything is made of the same substance that flows through and around us, which she calls vibrant matter (2010). Through this force, she explains, both humans and nonhumans exert affective capacities that participate, intertwine, block, or enable other bodies. She exemplifies these vital interactions in things as food, metal and electrical grids that form assemblages (entanglements for Barad) of profound interconnectedness, where small variations within the assemblages can cause dramatic, minor or antagonist effects. It is hard to tell which.

Bennett’s gives voice to a relational vitalism that is material and non-mechanical, “in the process of absolving matter from its long history of attachment to automatism or mechanism” (2010, p. 3), which is associated with the Galilean and Newtonian worlds. In this she echoes Bergson, who was also skeptical about sustaining a mechanistic model of nature. The resistance to acknowledging the vibrance of matter, explains Bennett, derives from the numbness of “detecting (seeing, hearing, smelling, tasting, feeling) a fuller range of the nonhuman powers circulating around and within human bodies” (2010, p. ix). Bennett’s ideas invite us to move away from anthropocentrism, when she poignantly asks: ‘Why advocate for the vitality of matter?’ The image of dead matter, she explains, can feed anthropocentric attitudes of domination and consumption: it is more challenging to conceive of matter as lively and self-organizing rather than passive (2010)

Quantum field theory, explained through the work of Barad, also provides convincing arguments in favour of the world’s vitality, precisely at the very place that we assume to be completely empty: “Quantum field theory tells us that the void is an endless exploration of all possible couplings of virtual particles” (2019, p. 519). This introduces a radical idea that presents

nothingness as an entity that is not empty. Barad explains that the void is material too in its non-presence: matter is entangled with the virtual configurations of the void. In other words, and this lies at the heart of causality (how things come to be), virtuality is described as an experiment that the world performs on its own, testing all possible paths (2019), paths which might —or might not— become determinate as qualities, events, possibilities, and further intra-actions with the void. At the risk of simplifying things, the void is not an empty space but an active participant in the world's becomings: the void is relational. This challenges the more widely accepted view of the void as total nothingness and absence of matter, like in Newtonian physics where it is no more than an empty receptacle, a stage, or a place with no life of its own (Wilczek, 2020).

Absence and presence are not only a matter of physics and philosophy, but also a matter of politics: the notion of the void, as explains Barad, has been a valuable apparatus of colonialism, used for example, as a rhetorical device in favour of claiming ownership of land, as well as to install politics of extractivism (Barad, 2019). As Barad explains, that is case of the Marshall Islands where several atomic bombs were detonated causing widespread human and nonhuman tragedy, under the argument that they were 'virgin' territories. This reasoning is already charged with violence. However plentiful these territories are, colonialism portrays them as inhospitable, non-civilized and empty (Barad, 2019). These arguments, are also used frequently to colonize space; legitimize mining, fracking and oil industry practices; or to justify the construction of hydroelectrical plants and other infrastructural works. Paradoxically, it is the abundance and richness of matter and movement in these allegedly empty spaces that draws the interests of industries in the first place. I bring this here not only to support the vitality of matter, even in things that we take as inert, but also to present the void as a productive and creative entity and to challenge the anthropocentric assumptions that artificially separate absence and presence.

By diffracting these ideas to the context of the moving image, one can think of the Newtonian void as an empty stage, or a background where the objects

of the world move as if performing for the camera to fill the emptiness of the moving image. I explicitly associate this strategy with the films of early cinema like the work of Charles Chaplin or George Méliès (to bring the dialogue close to astronomy) which are notably theatrical, and where the foreground action is accentuated in the frame over a motionless background. An analogous situation is experienced in the context of artists using the video camera as a tool for documenting ephemeral works, where the action is the most crucial element, and not necessarily the background in front of which it is performed, like in the early works of Marina Abramović or Vito Acconci. In this context, Bruce Nauman began to challenge the emptiness of the artist studio by engaging in creative dialogues with the space itself and the video camera by walking, dancing, and exercising around the empty space.

Under the optics of the Newtonian void, the frame is rendered as an empty container that can be later ‘filled’ with discretely defined objects and landscapes that manifest, withdraw, enter, exit, interact, or crash. Such forms of aloof interactions makes me think about the non-relational objects described by Graham Harman that exist ontologically prior to interactions, and to which Jane Bennett strongly opposes (2012). I will not go into detail on the work of Harman or the kind of moving images that could emerge from object-oriented philosophies; although I would be curious to see that research. However, I bring it up here to establish that I follow the relation ontologies of Bennett and Barad, whose entities, although they sometimes resist it, have the tendency to form networks and dynamic systems, which is contrary to Harman’s objects which remain mysteriously hidden and inaccessible (Bennett, 2012).

The ‘Newtonian’ empty frame serves as a spatial reference in which things happen, but nothing emerges from it. It is not agential. For some, that is also the case for the white box of the gallery, frequented by the artists associated with modernism and minimalism, and widely used in museum spaces to put forward and isolate the objects of art (O’Doherty, 1986). Nonetheless, neither the world, nor the moving image frame are really empty. They

just happen to be portrayed that way. Agency is made invisible or denied. Challenging such conceptions is how John Cage arrived at the conclusive affirmation that silence does not exist, which is also the case for stillness (De Bellis, 2020). Similarly, explains James Turrel, there is always light, even when we cannot see it (Kahn, 2013). Emptiness, silence and void, add up to immobility as recurrent ideals that present the image of a world derived from movement that it is easier control (Guerlac, 2006).



## Infrared

Observatories and telescopes, like the ones at the Sierra Negra capture and process light that humans cannot see, but that nevertheless intra-acts with the world in various ways, which is the case of ultraviolet emissions that are felt on the skin and can cause sunburns. Infrared light too, which heats the Earth and helps to sustain life, is only visible to humans through specialized cameras.

Thinking about the importance and agential capacities of these invisible forms of energy that are frequently overlooked, I had my video camera modified to sense infrared light. Jean Painlevé argues that filmmaking techniques like slow motion, reverse playback and infrared film sensibility could lead to interesting discoveries, which he explored by filming animals and octopuses on the laboratory. He explains: “And with infrared film, one can film phenomena not visible to the human eye, to see beneath skin, to peek through veils of fog, to detect the roundness of the earth from high in the atmosphere” (2000, p. 155).

Apart from the visible spectrum, the sensors on digital cameras (CCD) have the capacity to register near-infrared and –ultraviolet wavelengths, but they have built-in filters that block them. In an infrared modified camera, the filter is removed or replaced by another one that blocks all light apart from infrared. The resulting images are rendered in hues of red and magenta, but the extraordinary part is not the colour of the images but the emergence of things that otherwise we could not see before: clouds are seen in more detail, optical flares appear more frequently (and more noticeably) healthy plants are seen as bright white (like snow) since they absorb most visible wavelengths, except for green, which in this case is filtered out by the camera.

These emerging qualities are the result of replacing a filter that leads to different things (and not others) becoming determinate. The green in plants, like the perceived colour of any object, is not an inherent quality that it

is possessed by the object (things do not have colour intrinsically) but a relational capacity dependent on incident and reflected light, as well as the artefact that gathers the information, whether it is the camera or the human eye. Colour, flares, and haze in clouds are the results of particular entanglements that can form alliances. The camera is not an entity with inherent qualities, but an active participant that relates with other entities always through particular entanglements.

I became interested in optical flares because they serve as notable examples of emerging entanglements or alliances where things participate in various forms: incident and reflecting light, the lens of the camera, the infrared sensor, the angle of the shot and the movement introduced when holding the camera trying to produce them.

I made a trip to the Sierra Negra with the intention of experimenting with an infrared camera: I wanted to record flares, which are often described as optical aberrations of light scattered across the lens caused by framing the camera directly toward a light source. I spend some time aiming at the sun while moving the camera, zooming in and out, and moving the exposure and shutter dial to see how I could produce or amplify them. For brief moments, I moved the camera to hide the sun behind a hill or a mountain: flares would appear and disappear, as if they insisted on their emerging qualities. I could see them being created, moving around and changing size and shape ranging from over-exposed bright white patches to irregular patterns, 'half-moons', arcs, circles and other geometrical shapes. I am interested in flares because they seem to form within the interstices of the moving image. They are not representations but trapped light; suspended and intricately. They are neither background nor foreground, but entanglements, always intra-related, touching and being touched.



Video IX. *Infrared* (2019). Duration 3:12 minutes

<https://www.emiliochapela.com/infrared>

I kept recording. I wanted to extend the duration of the flare by prolonging the alliance. I was concentrating on the phenomenon. I became fixated on the light flares and forgot about the wider context of the image, which made me think of the structuralist-materialist films of Peter Gidal in particular films like *Room film* (1973), a close-up exploration of a small room recorded with one light that resulted in an abstract piece, as if the light source, the camera, and the film were the only things in this world. It is an interesting work, however, I realized that this form of material isolation is not what drives my interest. Once more, I regained a comprehensive view of the image and saw the flare superimposed on the clouds and mountains. Playfully, I moved the camera until I could align a small circular flare on the sky to resemble a star or a planet. It trembled. I enjoyed that moment. I kept on trying to produce more flares, by tuning in, adjusting, and experimenting.

Like infrared light, radioactivity too, provides a good example of a kind of energy that we cannot see but has a significant impact on humans and non-humans alike. It has both beneficial applications (in the medical field) and detrimental outcomes: Barad describes the violent destructive force of nuclear bombs as the crossroad of “nuclear colonialism and the climate crisis” (2019, p. 524). In fact, there is some debate whether the beginning of the so-called Anthropocene epoch, is defined by the first evidence of radioactive material on the Earth (Barad, 2017). For Barad, the atomic age is “fixed and fixated on the event horizon of total annihilation”(2017, p. 52). Barad discusses the material connections of the atomic bombs released in various sites like the Marshall Islands to discuss the political implications of nuclear colonialism not only on the land, but on matter and time themselves.

For the survivors of Hiroshima, time is troubled (Barad, 2017). Radioactivity introduces time as an entity where past, present and future are already entangled. The survivors of the atomic bombs carry the memory of the trauma, not only as remembrance that hunts them into the present, but also as a constant risk of sickness caused by the exposure to radioactivity. It is unclear when the radiation will cause them physical problems.

## **Totality**

On August 21, 2017 I took an opportunity to travel to witness and record a total eclipse of the sun in the USA. I joined an interesting group of people, whom I had never met before to make a road trip from Los Angeles all the way to Idaho to see the eclipse. We spent time talking, learning, researching and getting to know each other around the astronomical event, which was my first clue that eclipses are not only planetary events, but an intricate coordinations of matter. We speculated about the 'ideal' site to experience it, which is a narrow area of around 160 kilometers that falls in total darkness for over two minutes (a period called totality). We chose to climb one of the two small, extinct volcanos called the Menan Buttes, from which I wanted to make a film about the eclipse.



Figure 1.9. Video still. The Menan Buttes in Idaho moments before the total eclipse of the sun in 2017.

At that moment, my practice was already influenced by New Materialism: I saw the eclipse as a more-than-human entanglement, through which I could coordinate with the planet, the moon, the sun and the clouds that threatened to obscure the view, as well as the many visitors that were traveling from different places, to stand below the shadow of the moon cast over the Earth to make a film. The entanglement extended also to the precise calculations and the science used to predict eclipses, to my expectations and those of the group, and to my fond memories from a childhood experience of a total eclipse that I witnessed in Mexico in 1991. The memory was uncluttered by professional expectations. It was intense and continuous, unfragmented; fed by curiosity and awe. That memory was my only experience of an eclipse, and it became my bearing. We know from Barad, that Neils Bohr insisted that “the concepts used to describe a phenomena are not ideations but specific material arrangements.” (2007, p. 144) Ideas are matter too, which might also be the case for affects, memories, expectations and perhaps even dreams and magic.

Even when it was my intention to record the eclipse on video to produce an artwork afterward, I did not see the expedition as part of my research. It was because, at the moment, I wanted to maintain a connection to the spatial specificities of the observatories and the volcano in the Sierra Negra. You cannot “disentangle something from its particular surroundings” (2013, p. 187), writes Stengers, to explain that there is no sense, to give an example, in understanding an animal without considering its food or its predators. My practice at the Sierra Negra was tied up (but not artificially fixed) to the specificities of the observatories and the volcano. However, as I will explain further along in this text, my relation to the mountain changed in response to the material conditions that emerged from my entanglement with the mountains, and with this I mean not only the light, clouds, rain, fog, cameras, and telescopes, but also other things like regulations, permits, politics, logistics, crime, etc. All these things need to be accounted for too. Bennett makes a case for recognizing the vitality and agency in things as diverse as electricity, food, trash, metals and other nonhumans. (2010).

The relations to these varied things guided me into new territories. As if a sudden storm had taken me adrift, I had to adapt to other ecologies, which made the research more receptive to change, less static, more permeable and adaptable. That movement also gave me the tools to include and discuss other works that are also relevant to this project, like the total eclipse videos. Thinking about New Materialism was already transforming my practice, and not only the projects at the Sierra Negra.

Hours before the eclipse and not knowing yet what to do, the light seemed strange and beautiful. I started recording the partial eclipse with a telephoto lens and solar filter knowing that I could have access to better and more 'professional' footage. I left the camera standing on the tripod recording while I prepared the rest of the equipment. Minutes later, I would look again through the viewfinder to see that the sun had shifted and left the frame. It was because of the rotation of the Earth.



Video X. *Totality - Introduction* (2021) Duration 01:05 minutes

<https://www.emiliochapela.com/totalityintro>

There were many things around me that incited my interest apart from the planetary phenomena: the volcano, the snakes hiding in the rocks, human mobility and the saturated highways, the rituals, the telescopes, the re-tracing of my memories and the winding of the Snake River in the plains below the mountain. I was amazed by the scale of such more-than-human coordination. However, I wondered if there were people living in the USA within the strip of totality who had no idea of what was about to occur, and to whom the event would come as a total surprise. What if the event did not happen at all? Why was I so sure? These questions made me realize the trust I put into science, and the sense of agency and material importance that such calculations and preparations have on events like this.

I started recoding on all cameras. Suddenly, it was dark. The light changed incredibly fast during totality. I managed to see the shadow of the moon arriving with great speeds. I heard a plane flying and people screaming. I wanted to record everything, so I kept on moving from one camera to the next trying to record something interesting, or take a picture with my mobile phone. I wanted to enjoy it too. I thought about the strange need to document everything with a camera. I felt confused. Daylight returned. It was overwhelming. The world truly exceeds us, “we are in a world of immeasurable results” (Haraway, 1997, p. xi).

Hours later, I saw the images I recorded with a handheld camera. It showed my confusion and anxiety. I thought it was terrible. I had failed.

However, the videos that I recorded that day underscored the incommensurability of the phenomenon: its complexity, movement, vitality, and the lack of attunement and synchronization when trying to control it. In the context of non-representational theory Boyd and Edwards explain: “There is more to the world than what we can consciously know or represent in language” (2019). The video reveals a hectic situation where various manifestations and movements are involved. I wanted to record a close-up of the eclipse and decided to leave the camera lying on the floor, which caused a malfunction on the stabilizer, making the image tremble. In the video, we see confusion and chaos, but also excitement and wonder.





Video XI. *Totality - Part 1* (2021). Duration 3:46 minutes

<https://www.emiliochapela.com/totalitypart1>

In preparation to record the total eclipse, I stayed up late inside my tent making drawings and designing what I wanted to record and where I could put the cameras. I had some ideas from previous days, but I did not manage to conceive a work of art beforehand. I devised strategies to record the event from various angles as I had five small cameras that could be put in different places. We were warned that there were many rattle snakes in the mountain and that we had to be careful. I thought about the snakes and the disorientation an eclipse might have on them. I came up with the idea of putting a camera inside a hole looking out to resemble the vision of a snake, but later back in my studio, I did not find the moving images to be interesting. I realized that it was because I was aiming to produce an effect or an illusion that presupposed something about the subject matter, instead of engaging in a collaboration. By representing, we create more distance, that is what representations do (Haraway, 1997). It would have been different to strap a camera to a snake, if one could only bypass the danger and the ethical implications of doing that. I thought about the impact on the snakes, not only because the eclipse might cause them confusion but also

because of the unexpected visit of hundreds of people to their habitat. We did not see or hear any. I think the snakes were hidden; terrified.

However, there was something interesting about the image recorded by the camera hidden in the volcanic rocks: it was possible to see the blinking red light that indicates when the camera is recording, as it illuminated inside the little volcanic chamber. The shot became interesting to me only after recognizing the camera as an active entity ‘noticing’ itself in relation to other things instead of a passive apparatus taking part in an illusion, designed by the artist, in the likeness of a snake.

An opposition to that kind of illusionism is what drove the structuralist/materialist filmmakers to move away from representing or documenting and, by demystifying narrative and illusion, to deal with the matter of film itself. (Gidal, 1978). I am inclined to ask, however, if moving images can completely escape representationalism and if it is possible, as Gidal proposed, to make a film that in fact does not represent something. A materialist film “does not *represent*, or *document* anything” (Gidal, 1978, p. 1). It is a troublesome problem to which I cannot give a definite answer, but one that has been of interest to cultural geographers that speak of non-representational theory as the ‘geography of what happens’, an affective, ‘pre-cognitive’ mode of understanding, which follows life’s movements, intensities and encounters (Thrift, 2008):

Non-representational theory is an attempt to embrace life’s messiness without the need to contain or reduce it to a set of social constructions. (Boyd and Edwardes, 2019).

Boyd and Edwardes propose similarities between non-representational theory and creative practices, by recognizing the potential in art to ‘make sense’ through the world’s contingency (2019). This research is interested in actions aimed at attuning and relating with the world movements and intensities (including its representations), but not in presenting images in representation and likeness of the world, like in the example of the snake.



Video XII. *Totality - Part 2* (2021). Duration 3:02 minutes

<https://www.emiliochapela.com/totalitypart2>

I knew the exact duration of the eclipse (a bit more than 2:18 seconds). But Bergson sees time as a force, not as a reference of time that can be understood, compared, and discretely separated: whereas we can “map out the successive positions of the trajectory — the mobility itself is felt as intensity” (2006, p. 68), explains Guerlac, referencing the example of the shooting star recounted by Bergson (1910).

In trying to calculate and operate all cameras at once, I had experienced a sense of failure. However, I was ecstatic. I could feel the intensity of the event. That day, I learnt that our expectations and plans can be incommensurable with the world. Nonetheless, it was equally clear that it was possible to approach the world and touch it. And I am here referring to a form of touch that is material, intimate and more-than-human. A way of ‘meeting the Universe halfway’ (Barad, 2007) that is not about controlling, categorizing, or representing but about sensing, reworking and moving along with the world.

The images of the eclipse are fixed into my mind as is the feeling in my body: “the ability to apprehend the non-representational is made possible by a sensing body in relation” (Boyd and Edwardes, 2019, p. 3), a body where forces and intensities are felt. That is how I remember the eclipse from my childhood memory. Events connect actively with the past and linger into the future. The body remembers, assures Serres, describing his experience after an earthquake (2012). I think he is right. I went through a major devastating earthquake in Mexico City on September 19, 2017, only a few weeks after the total eclipse of the sun in Idaho. At that moment, my memory of another deadly earthquake that happened 22 years before, came rushing into the present. The body/mind responds automatically. Earthquakes (like eclipses) form *naturecultures*: they are more-than-geological (more-than-oscillatory) movements, as they can bring countless human tragedies and material damage too. They can also uncover systemic acts of corruption, which adds to the reasons why many buildings can come toppling down. Are these kinds of disasters the work of ‘geos or anthropos’ (Tsing *et al.*, 2017)? Artificially separating nature and culture, carries the risk of obstructing responses, rather than enabling them.



Video XIII. *Totality - Part 3* (2021). Duration 3:06 minutes

<https://www.emiliochapela.com/totalitypart3>

## The Black Hole

During the development of this research in March 2017, I had the opportunity to witness, explore and record in video the observations performed within the context of a project called the *Event Horizon Telescope* at the Sierra Negra observatory that in coordination with several other telescopes around the world produced the first image of a black hole. The collaboration consists of expanding the capacity of each individual telescope by building an array of collaborating artefacts that spans across the globe. Their efforts were concentrated on two different massive black holes: one sitting at the centre of our galaxy, around which all celestial bodies in the Milky Way move, and a massive black hole at the heart of the distant galaxy Messier 87, which they succeeded in capturing. The image produced by the telescopes shows the black hole as a dark circle surrounded by a glowing aura (Akiyama *et al.*, 2019). They have not managed, still, to produce a similar image of the black hole at the centre of our galaxy, but the accomplishment was a major milestone on the history of astronomy.

The whole thing intrigues me, which is why I had so many questions during the nights I spend at the telescope at the Sierra Negra during these observations. I was amazed by the coordinated efforts that make possible for all telescopes (Spain, Hawaii, Chile, Mexico, Antarctica, and others) to move and point out to the exact same locations on the sky simultaneously, a movement they had to perform with exactitude. The telescopes moved at the exact same time, focusing on various objects and alternating their observations between the two black holes. To help them do that, they installed an atomic clock at every participating telescope synchronized to the Universal Time Coordinated (UTC), which is the prime meridian that crosses Greenwich (a colonialist remnant in itself), and also an artefact that Barad identifies with globalization, militarism and capitalism. The atomic clock, explains Barad, is the global, cosmic, and Universal time of “total colonization of spacetime synchronized to the heartbeat of an atom” (2017, p. 59). In this case, however, it is the cosmic simultaneity of the clock that enables the collaboration between the telescopes.

I am also curious about the black hole itself as an object that cannot be seen, as light cannot escape its gravity. At best, with this experiment, it is possible to ‘see’ what astronomers call the shadow of the black hole (Akiyama *et al.*, 2019) as it was millions of years in the past when the light reaches the Earth. Even if we could travel or send a probe to explore it, it would be impossible to get close and escape its gravity or send back information about the findings. Unknowable and ungraspable, I have always thought about black holes in terms of death itself.

And I wonder if we live with the anthropocentric anxiety of not knowing, or not being able to see, what it is there, in the middle of ‘our’ galaxy. There might be some importance for humankind in trying to know what lies at the centre of the galaxy, simply because it is in the centre. The Galilean revolution moved the centre outside the Earth, and it did not take long to discover that the sun was not that centre, either. And then, we “placed our galaxy at the middle of the universe, to satisfy our narcissism” (Serres and Latour, 1995, p. 48). Today, to my knowledge, science has abandoned the idea of the universe having a centre. Everything seems to be expanding away from every point of the Universe, which can carry both a feeling of despair and humility.

I had the chance to ask Dr. Gopal Narayanan, one of the lead astronomers on the project *Event Horizon Telescope* from the University of Massachusetts Amherst, if he believed humans had a special need to find a centre and if that was something that motivated him. He told me that it was not a question about astronomy, but he was nonetheless intrigued. He answered me from the perspective of science and explained that there is conclusive evidence that show that the stars and planets in the Milky Way (as it is the case for other galaxies) rotate around a single point, and the reason they do that is because there is an object with a mass so large that pulls everything towards it. That object is a black hole, Narayan explained to me. He insisted that his interest was not in the centre, *per se*, but in the black hole, which happens to be there. In other words, the condition of a centre is a designation based on the observations of gravity in the galaxy. For astronomers, the urgency is

to study the black hole at the centre of the Milky Way, and not so much to think about the meaning of a centre as a social construct. For an artist, both things can be interesting as they unveil a form of alliance between the social and the natural.

It was important for me to work with this idea, but I did not know how. I could not easily introduce a camera in the middle of the process without interrupting, staging, or representing the observations. I did not know how to participate. I could not access, process the data, or see the results of the observations. There was nothing for me to record, which I found frustrating. Perhaps, it was the frustration that comes from my inability to position myself in the middle of things. I had to look from a distance too.

However, I kept thinking about how all the telescopes moved and aimed at the same target simultaneously, and how the effort was not exclusively a human endeavour, but a coordination of humans, machines, clocks, and weather. The act of measurement explains Barad, “is an instance where matter and meaning meet in a very literal sense” (2007, p. 67). Moving together, focusing, calibrating, and gathering information are all form of attunements that I find interesting.

When focusing on a celestial object, the massive observatory moves very slowly to compensate for the rotation of the earth, but that is not possible to see or feel: movement can convey a sense of paradox, like when travelling on a moving plane, where it is not possible to feel the velocity, a theme explored in the exhibition *The Paradox of Stillness* curated by Vincenzo de Bellis in the Walker Art Center (2020) and exemplified in the video work *Wall-Floor Positions* by Bruce Nauman that shows him performing a series of physical poses trying to stay still and without moving in his studio. The subtle movement of the body is noticeable as the muscles get tired, his body shakes, and he transitions from one position to the next. Nauman is well known for bringing attention to the artist’s studio as an active space of physical and conceptual experimentation, instead of an inert, empty place. That same night during the black hole observations in 2017, I wanted to

see if I could document the telescope as it moved by recording a time-lapse sequence. It was around 2:00AM when I went outside and climbed to the very top of the mountain through a path that I knew by memory: it is only a 20- or 30-meters hike, but it is physically demanding because of the altitude. I set the camera on a tripod and started the recording to see if I could detect the telescope moving when compensating the Earth's rotation. I made sure I had enough battery to last for a couple of hours and left the camera and went back inside as it was freezing outside.

In trying to remain steady to its objective (the black hole), the telescope was coordinating with the Earth's rotation forming an alliance: if I could show the telescope moving, I was in fact, in some sense, showing the Earth's spin. I succeed, in the short video, it is possible to see the telescope moving when compensating for the rotation of the Earth.



Figure XIV. *Sagittarius A\** (2016). Duration 00:44 minutes

<https://www.emiliochapela.com/sagittarius>



## Touch

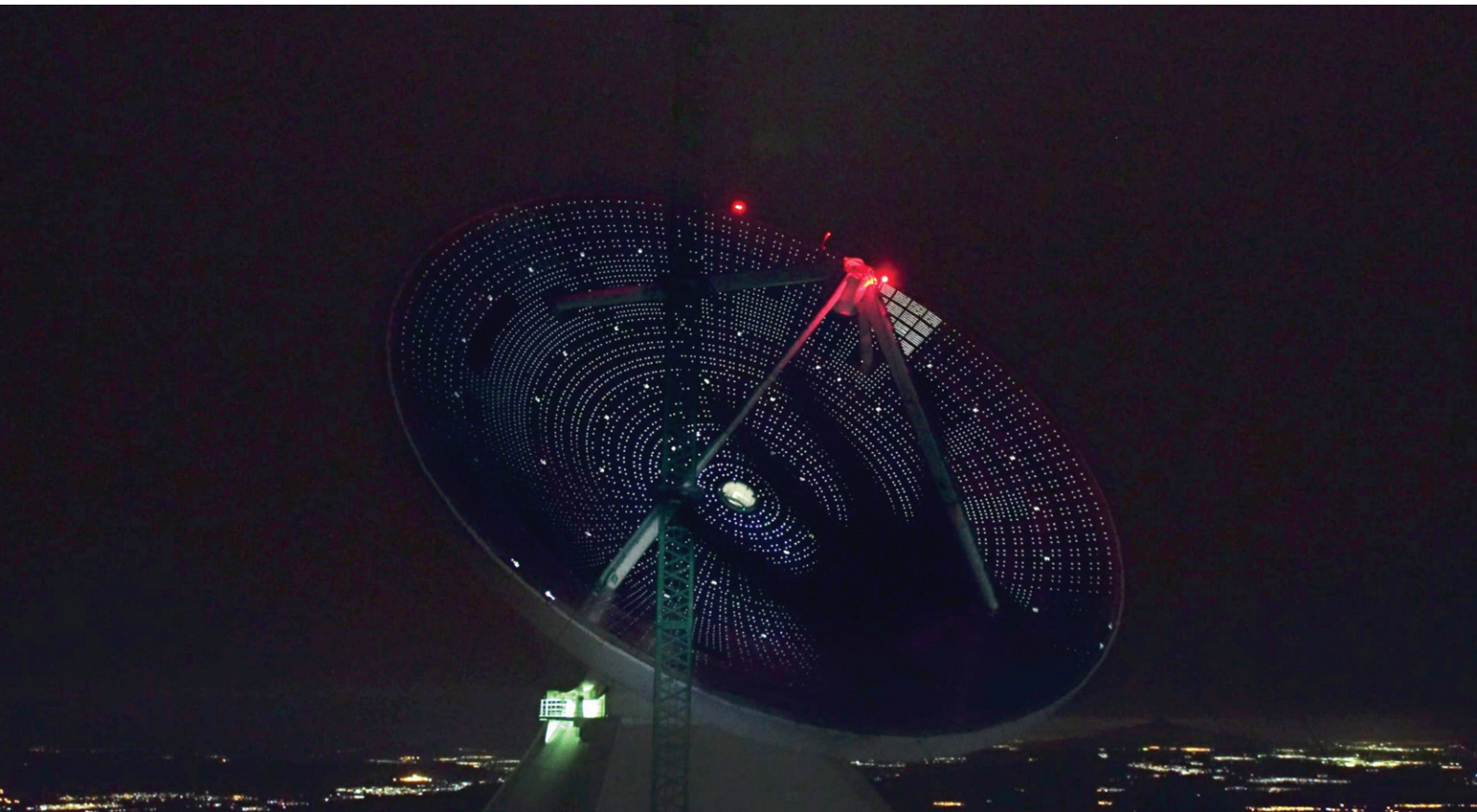
On every visit to the observatories, I tried to get closer to the work of the astronomers by asking questions: I was curious about the artefacts and the apparatuses used during their observations, and I wanted to understand more about the kind of images they made. But things felt distant. The observatories like the ones at the Sierra Negra are designed to capture non-visible electromagnetic energy that is processed as data and visualized in various ways. There is no eye piece or monitor which you can see through like in a traditional telescope. The control room is an enclosed office with two or three computers that show numbers, positions, weather status, humidity and other things used to operate the telescope, but not much about the actual observations. The rest of the machinery is comprised of state-of-the-art apparatuses, hard drives, sensors and the gigantic engines and wheels that move the antenna. It is not easy to relate to what astronomers are doing.

Nonetheless, it was very clear to me that the light, a tiny speck of energy coming from millions of light years away, was reaching the massive antenna and directed inside the telescope building only to reach a sensor, not too different, in the way it operates from those on a conventional digital camera. In a quite literal way, the light coming from outer space touches the sensor by establishing a material connection to a faraway object as it looked in the past, when the energy was emitted. It is a distant touch: the entanglement is captivating.

In an important sense, touch is the primary concern of physics. Its entire history can be understood as a struggle to articulate what touch entails. How do particles sense one another? Through direct contact, an ether, action-at-a-distance forces, fields, the exchange of virtual particles? (Barad, 2007, p. 155).

I abandoned the idea of participating directly in the observations to concentrate on what was happening in front of me, and to explore forms of touching from the perspective of the artistic practices: what could I learn from the telescope's captivating touch?

During a visit to the Sierra Negra, some months after the black hole observations in 2017, I climbed from the observatory building to the top of the mountain wearing a light on my head which allowed me to better operate the camera. I thought about projecting a shadow at the telescope as a way to relate with it. I started recording and pointed the light at the telescope: everything flared up. It looked so bright and beautiful. I was recording with a highly-sensitive digital camera and there were no obstacles to the telescope's antenna. I decided to introduce my hand in the way of the headlight to cast a shadow on the antenna and move it slowly as if I could touch it. Perhaps the exercise seems too literal, but I realized that the touching was not related to my hand in the form of a representation. Instead, it was the light that was touching. A touch at distance, or perhaps, a touch despite the distance. I spent several minutes moving my hand as slow as I could. Months later, in 2019 I showed this work in the exhibition described in the introduction at the Laboratorio Arte Alameda in Mexico City.



Video XV. *Touch* (2018). Duration 05:53 minutes

<https://www.emiliochapela.com/touch>

What does it mean to touch? The question is core to Barad's idea of entanglements and to this research. To be entangled does not mean to be in the center, but to be capable of enabling responses, which is a form to 'becoming with', even and despite distance: "Touching is a matter of response. Each of 'us' is constituted in response-ability." (Barad, 2015, p. 161). When touching, we become responsible to others, whom we are entangled with; and here Barad refers to a notion of a radical alterity that not only welcomes the more-than-human, but that challenges the idea of the self by exploring the polymorphous capacity of matter and how it intra-acts with more matter: "In an important sense, in a breathtakingly intimate sense, touching, sensing, is what matter does, or rather, what matter is: matter is condensations of response-ability" (Barad, 2015, p. 161)

## **Irruption**

The videos of the flares were not the only recordings I did with an infrared camera. I was intrigued to see how the observatories and their surroundings looked, which is why I decided to document the towns at the lower part of the mountain on my way back to Mexico City. I stopped the car on the side of the road near *Atzizintla*, a nearby town at the base of the mountain to record the observatory from a distance using the infrared modified camera. There were no clouds on the top of the mountain, which was rare. As I was aiming at the telescope, I noticed a couple of pickup trucks driving slowly in front of me. I did not stop recording. I was waiting for them to pass when I saw (through the viewfinder) a man standing on the back of a pickup holding a machine gun. I decided to continue recording for a couple of seconds as I did not want to draw too much attention by leaving immediately. I was quite nervous. I got into the car discretely and drove away. I saw the pickups taking the road that leads to the town of *Atzizintla*.

Minutes later, those men killed; or died. It is hard to know the details, but there was an armed confrontation between criminals and police forces in which they participated. I saw it on the news hours later. The nearby areas are known for their violence and organized crime, especially related to gasoline theft. Allegedly, the incident led to the arrest of more than 70 people including members of the local authorities who might have been involved in criminal activities. I do not know exactly what happened, but I am telling this story because it led to a political instability and further violence, which made the area more dangerous.

I was advised not to go to the observatories or explore the mountain while things settled. The astronomers had to postpone their work for months if not years, as it is an ongoing problem. This incident, apparently related to drug trafficking, and the illegal extraction of fuel from gasoline pipes, affected the development of my project. Violence forced my project to change. I was angry. I wanted to continue, and I felt victim to an imposition.

It surely came as an irruption, but it took me sometime to understand that the violence was an integral part of the material conditions of my entanglement with the observatories: corruption, crime, regulations, beliefs, discourses, law, as well as sciences statements, and art practices, can constitute what Michel Foucault describes as heterogenous ensembles called 'dispositifs' (Foucault, 1980). Barad, builds on Foucault, to recognize that these ensembles, which she calls apparatuses, participate materially in the reconfiguring of the world. Also, and considering the agential capacity of matter in the sense described by Bennett that recognizes the vitality of edible matter, debris and metals, it is possible to describe the agency of gasoline, pipes and guns in a similar manner, and always in relation other entities. In this sense, Yusoff, invites to a narrative of the Anthropocene that seriously considers our "geological (or geopolitical) life and its forms of differentiation" (2013, p. 779). What other alternatives can we find to fossil fuels? This question needs the careful consideration of our corporeal and shared relations to fossil fuels, explains Yusoff. And not only the consideration of their advantages and shortcomings. We give them shape, and we are shaped by them. Similarly, I realized that there is no way to easily separate the practice of astronomy at the Sierra Negra and the illegal activities related to gasoline that are deeply entangled with the material conditions of the region.

In consequence, and by considering the agential capacity of matter (and discourses) affecting this research, ignoring the criminal activities at the mountain not only represented a threat to my safety, but it carried the negligence of not responding to others whom I was entangled with. To maintain a dialogue with New Materialism and its potentiality within the moving image, I decided to explore other territories. I was interested in the neighbouring glaciers at the Pico de Orizaba that helped form the Jamapa River.

This man...



...has a gun.



Video XVI. *This Man has a Gun* (2018). Duration 01:59 minutes

<https://www.emiliochapela.com/gun>

**II**

## Jamapa River

After spending some time exploring the Sierra Negra and its observatories, I became interested in the neighbouring glaciers of the Pico de Orizaba, the highest mountain in Mexico. I had heard that the Jamapa River was formed high in the Pico de Orizaba from the melting of the glacier near its base. I felt there was a connection to be explored related to the deep time of astronomy, geology and the time of glaciers. I wanted to expand my project to incorporate the Pico de Orizaba glaciers and its river.

The Jamapa River gathers its waters from the Pico de Orizaba glaciers but also from a massive mountain range called the *Sierra madre oriental* (which translates into English as Mother Oriental Range). The humidity from the Gulf of Mexico reaches the mountains and precipitates into the basin adding water into the river.

However, before embarking on a trip to the mountain and to the tropical forest in Veracruz, I asked the advice of Yosú Rodríguez, a geographer in Mexico, who holds a comprehensive view that extends to ecology, sociology, politics, immigration, etc.

He advised me to get in touch with a colleague who knew more about the Jamapa River, but he told me that the river was highly contaminated from human and industrial waste and that there was a lot of criminal activity in the area, a situation that I wanted to avoid, especially after the events at the Sierra Negra. However, he said, if I became interested in making an artwork about the Usumacinta River in the south of Mexico, he could help me—it is the only living river in Mexico, he said, as it has no industrial discharges or dams along its course.

Hearing that description got my attention right away. He explained to me that when he said that the river was living, he did not only refer only to the health of animals and plants, and the quality of the water, but to the health of the entire river basin: a complex temporal and spatial system of interactions and



exchanges, like precipitation, wind, tides, vegetation, climate, pollution and various human endeavors and economies. It aligned with New Materialism and the ecological thinking that could provide me with the opportunity to experiment and develop my moving image practice further at a different location.

Referring to a wider scheme of things including the Earth, the stars, the galaxies and all the things in the universe, Serres recognizes that we share a common origin, a great narrative that goes back beyond human history: in his literature, that narrative frequently takes the form of a river (2018b). Every body of water is unique, but the rivers are comprehensive entities that expand inside, around and beyond the basin. I have always been intrigued by rivers, but reading Serres, a son of a bargeman, heightened my interest, specially, especially his ideas about time and rivers.

## Flow

‘Everything flows’ writes Lucretius, as is referenced through the work of Serres in the book *The Birth of Physics* (2018a), which follows the origins of physics back to the Greek philosophers by opening a rich and difficult discussion on flow and its relationship with atomism in the work of Lucretius, for whom movement is equated with flow and turbulence. In contrast with classical mechanics, for Lucretius, “bodies do not have to await the action of an external force before undergoing a deviation from their path” (Serres, 2018a, p. 5). Deviation is spontaneous. It is a source of creative order, like that of turbulence or a vortex. Serres is interested in how things flow, particularly in how (and when) a flow becomes turbulent departing from a state of stability: that exact moment in which a vortex is formed, or when a flow is agitated, compressed, accelerated, or heated (like when water starts to boil).

Turbulence, more than disorganization, entails a close coordination of various superimposed orders associated with a chaos, as it is explained by Serres (2018), and also by Ilya Prigogine and Isabelle Stengers in *Order out of chaos* (1984). The title of the book already suggests an apparent contradiction: “viewed in this way, the transition from laminar flow to turbulence is a process of self-organization” (1984, p. 141). Turbulent flow can be thought of as crowds moving through narrow spaces, where a parallel alignment of people is hardly possible. Crowds self-organize through spontaneous responses. Most of us have experienced something similar when walking along with a large crowd of people and reaching a bottleneck: our bodies become tightly fit against others as if trying to fill the voids. We must renounce control and move into a coordinated order keeping the rhythm and direction imposed by the group. In consequence, we flow.

This is echoed by Serres when he explains “how an order, or several orders, emerge from disorder. And it is turbulence that secures that transition” (2018a, p. 37). It appears contradictory, but turbulence is found more frequently than we tend to imagine. According to Prigogine and Stengers,

turbulence has been identified with disorder and noise, but that is no longer the case: “The multiple space and time scales involved in turbulence, correspond to the coherent behaviour of millions and millions of molecules” (1984, p. 141), which emerges in cascades, streams, rivers, winds, in the blood inside our veins, in airplane turbines, flows of lava, hurricanes, vortexes and even when we open the water tap.

In contrast, laminar flow is a form of movement associated with dispersion and stability, where particles move loosely in parallel without mixing or sticking together. To depict this, it is helpful to imagine athletes running on a track constrained to parallel lanes. Runners can achieve that willingly and with intention, but according to Lucretius, that is a rare behaviour for matter, which tends to deviate from stability to find other forms of turbulent order, as it is explained by Lucretius (Serres, 2018a).

Examples of laminar and stable flow are difficult to encounter as ‘turbulence soon appears’, explains Serres. In fact, as he declares, laminar flow is a theoretical and ideal state of flow, especially when sustained in time (2018a). While the exact reasons why water becomes turbulent escape the aims of this research, Benedetto Castelli in conversation with Galileo in 1625, observed that the speed of a river increases (becoming turbulent) when the riverbank is smaller or narrower, and the water slows down if the river becomes wider and deeper (Levi, 2016). Hence the saying that warns us of the danger of crossing a river when the water seems calmer, because it is then when it can be deeper and more dangerous.

Newton’s equations, as well as the basic laws of thermodynamics, presuppose stable and closed systems that are unlikely for us to encounter in the world. Like movement without friction, as I explained before, laminarity, stability and stillness are not norms, but exceptions. Nonetheless, we insist on imagining the world as immobile: so we can master it, as Guerlac explains through the work of Bergson (Guerlac, 2006).

Whether in the form of text or moving images, this project entails recognizing its open-endedness and mobility. Both the writing and practice aim to attune to a world in movement experienced through time in the sense described by Bergson, who insisted on the effort to experience time as a form of undivided movement, instead of fragmented in spatial qualities or measurements that can be split into parts (Guerlac, 2006). That is the case, for example, of the total eclipse of the sun that I reviewed earlier, a phenomenon that cannot be split into temporal or spatial sections, and that unfolds in various open sensations, experiences and thoughts. Ingold reinforces this by explaining that matter is not made up of discrete particles that make up the world, but it is in the “variation and flux of materials: in the running waters of the river, the flickering flames of fire, the turbulence of wind and the heaving of the earth” (2017, p. 30). In a flowing river, where turbulence is agential: a flow that appears and recedes; that increases its speed or slows down depending on the material conditions of the riverbed, the rocks, the inclination of the terrain, the narrowing of the river, etc. None of these things can be isolated. And the complex coordination and indeterminacy of these entities, which are determinant for water dynamics, was one of the motivations behind doing *Usumacinta* (2019), a video work made with the effort to ‘become with’ the river by means of the moving image: that is, to flow along, submerged, traversing and ‘diffracting’ through the river flow. The moving images produced, as I will describe next, respond to the emerging qualities of the river.

## Usumacinta

The work *Usumacinta* (2019), presented at the Laboratorio Arte Alameda in the exhibition *En el tiempo de la rosa no envejece el jardinero* in 2019, is a five-channel immersive video installation that deals with the forces of turbulence and other forms of agential and non-mechanic movements in the Usumacinta River in Chiapas, Mexico. I decided to submerge several cameras in the river to enable a collaboration with the river's various velocities, currents, sediments, vortices (the Usumacinta is well-known for its whirls and water rapids), vegetation and so on.

To do the work, I attached five cameras along a flexible plastic tube articulated in resemblance of a snake and developed exclusively for the purpose of the production of this work. With the help of artist Alejandro Mejía, it was possible to adapt the artefact for the currents to take it, using floating materials and other aids for movement.



Figure 2.1. Video still. Five submersible cameras are attached to an artefact that flows through the river.

The cameras, which were also equipped with underwater microphones, picked up video and sound as they moved in coordination with the river: it is possible to see and hear, for example, the flow of water or when the cameras bumped into a branch or hit a rock or when turbulence increased. The sound design was made by musician Esteban Chapela, who enhanced it through filters to make the underwater recordings sound crisper. He also designed the multi-speaker spatialization, which makes the work immersive: it created a sort of tunnel of sound that echoed the shape of the snake-looking artefact in the exhibition space. The video-installation spans across five screens which lay on the floor looking up, where images and sounds are closely synchronized in such a way that the continuity of movement experienced by the artefact is maintained throughout the screens.

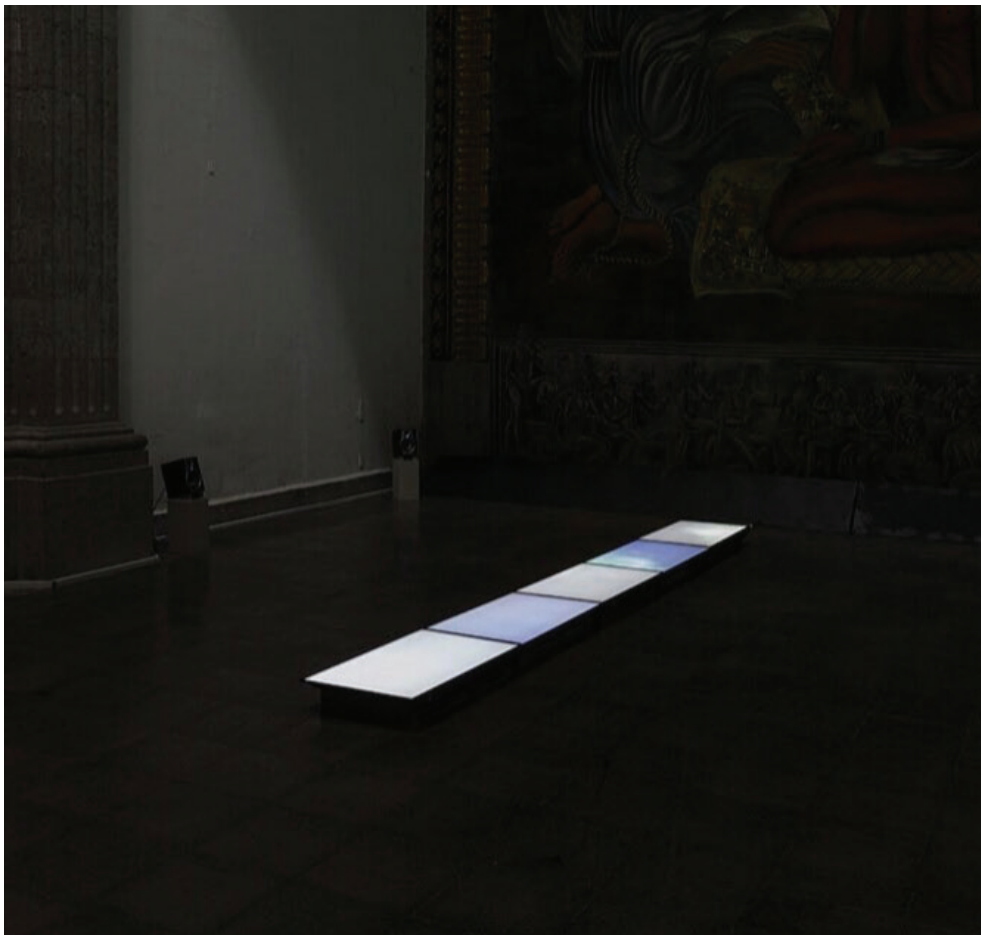


Figure 2.2. The immersive five-channel installation *Usumacinta* (2019) as it was installed in the *Laboratorio Arte Alameda* in 2019.

I wanted to explore the river as a continuous flow bound to be experienced in time and space as it is traversed, maintaining an effort not to simply float or get carried away encapsulated, like when riding a boat, where a subject-matter observes and reflects on the things around him, to provide critical statements about the world, usually in the form of representations. In contrast, the experiment that I wanted to perform was about entanglement and being in touch with the river through immersion. Other scholars associated with multispecies studies (van Dooren, Kirksey and Münster, 2016), also use the idea of immersion as a means for curiosity and entanglement, and as an invitation to leave behind the pervasive inertia to view “other creatures [in this case the river] as mere symbols, resources, or background for the lives of humans” (2016, p. 6). It is in that sense that I wanted to get immersed, not only metaphorically but quite literally. I wanted to perform an experiment that allowed me to see the emerging qualities of the collaboration. What moving images emerge from such entangled collaboration? What kind of images do turbulent waters create?

I did not know what to expect, as I had never been in the Usumacinta River before. I was lucky enough to be introduced to David López, a local boat pilot who was instrumental in the development of this work, and to whom I am very thankful. He guided us (with artist Alejandro Mejía and musician Esteban Chapela) up the river to a suitable place where we could throw the cameras. David suggested that we could record the artwork in a small tributary river that moved across a complicated geography of stones and vegetation for a few kilometres before reaching the Usumacinta, a strong and powerful river that brings a lot of sediments from Chiapas and Guatemala, making the water muddy during the rainy season in the summer, when we visited.

The river was high, which can be dangerous, especially when crossing the rapids upstream. Nonetheless, David mentioned that it was safe to release the cameras in the small stream just a few hundred metres before it reached the river in a place where we could swim behind the cameras in case they got stuck or lost when reaching the river, but where we were also guaranteed

to see how the pristine water from the small river got mixed up with the brown waters of the Usumacinta. That is what we did.

We put on life vests and started recording with all five cameras before submerging them into the water and releasing the artefact. Although the river was not too deep, we floated calmly behind the cameras until the force of the water felt strong. I remembered Castelli's mathematical conjectures on the speed of a flowing river, as well as Prigogine's ideas related to turbulence that I described before: when the riverbed becomes narrower, the somewhat dispersed and disordered molecules of water are forced to increase their speed and arrange in an orderly but turbulent manner. The water is changed by the topography of the river into a turbulent flow. When looking at the video, it is possible to see the water particles as they change speed and suffer the pressure when the river is narrowed. I could feel the pressure in my body too.

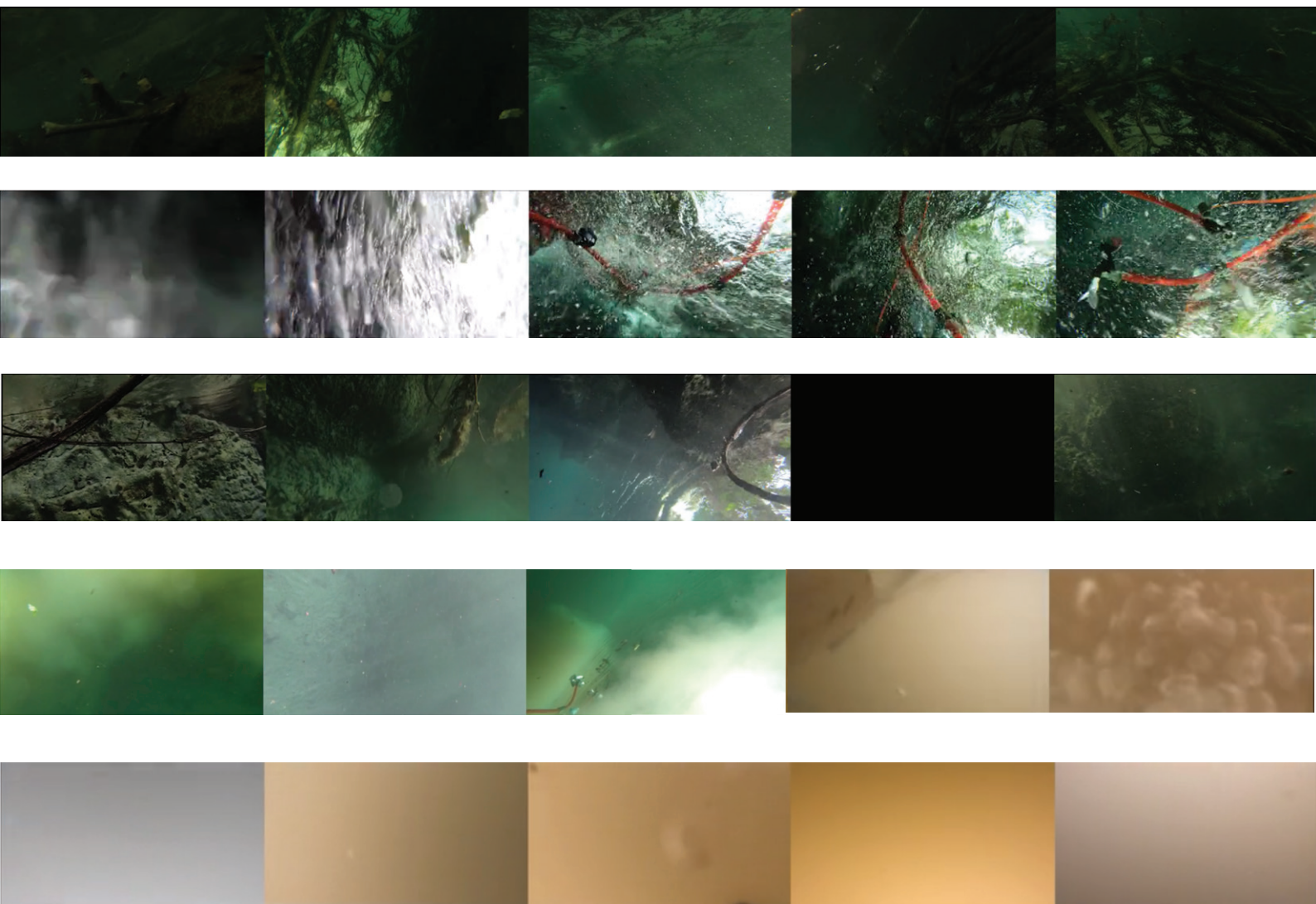
The river pulled me. I felt my body resisting the turbulence, almost like an instinct of survival. I was tense. I heard David saying that I had to let myself go: you must flow, he said. I thought about giving up and accelerating; about becoming liquid and turbulent; or permeable. "Our bodies are mostly water" (Neimanis, 2017, p. 41). Neimanis brings this forward to decenter matter from the human body, and to recognize, in water, common spaces and shared matter where agency is distributed. We tend to think of water as something strange and independent: 'modern' water, explains Neimandis, referring to the idea of water understood under the lens of progress, is seen as something abstracted from bodies — it is 'out there', in the same way that modernity portrays nature as something relegated to the surroundings. In contrast through recognizing our commonalities (hydrocommons as Neimandis calls it), we can enable the capacity to respond and relate to others. And by 'others' I not only mean water but also a multitude of micro-organisms and other companion species (Haraway, 2008) with which we form alliances. Relation ontologies like New Materialism, multispecies studies and other posthumanist philosophies, trouble the notions of alterity by recognizing commonalities, *naturecultures*, atmospheres and shared territories; and by mapping the differences that matter, as in the case of Barad's diffractive processes.



It took us around 20 minutes of swimming and recording to reach the end of the small river, where a boat was waiting for us. I had to recover the cameras just before reaching the strong currents in the main river. However, my initial plan was to submerge the cameras in the Usumacinta River as well. So, I suggested throwing the cameras in rapid waters or vortexes, where we could not swim along. David agreed to take us further upriver and try that. I thought about attaching a cable (like a fishing line) to the snake-looking artefact in case we lost it. But David stopped me right away and explained to me that if I used the cable, the cameras would submerge to the bottom of the river due to its tension, putting them at risk of tangling with something. It is a similar situation to what makes a kite fly.

Instead, he suggested letting the cameras flow freely in the river and assured me that we could fasten a buoy (a plastic bottle) to the artefact and we could follow the cameras with the boat. I was afraid to throw five cameras into the rapids of a river, but I decided to trust him. Once more, to collaborate, I was asked to renounce control of the situation. I needed to better understand the river, to be attentive and attune to the situation. But that comes with time and experience, which was something that David was willing to share with us. In making this artwork, I also learnt about how trust can be distributed in more-than human entanglements with water, the river, the cameras and the small production team— and David, who was already attuned with the Usumacinta: collaborations are about listening and being attentive and responsive. We followed the cameras as they moved rapidly down the river.

Later in the postproduction studio, I decided to transition from the sequence recorded at the small tributary river, to the images recorded inside the rapids of the Usumacinta: to my surprise, the brown coloured images from the river looked more abstract, even when the cameras were carried with more strength. The sediments of the river made the images look homogenous. And paradoxically, they appear quieter than the turbulent streams produced in the tributary river. The artwork transits from clear, varied and multicolored images, to more abstract ones, changing velocities, accelerating, slowing down, rotating, jumping and crashing.



Video XVII. *Usumacinta* (2019) . Duration 16:47

<https://www.emiliochapela.com/usumacinta>

*Usumacinta* is a work that deals with the turbulences and densities of the river: the cameras respond to the dynamics of water, but they are not simply carried away as passive objects. Instead, cameras are performing bodies, which is what Barad means when she explains that “bodies are not situated in the world, but they are of the world” (2014b, p. 218). And that is the case of the camera too: “even the camera itself is enthusiastic and endowed with an agential capacity of its own. It breathes rhythm. It never keeps one pace or one affect throughout” (Marhöfer, 2016). The cameras are immersed and performing bodies; not bystanders, as they have been when used by some artists, like in the work of Patiño that I described before, or like in the work of some early conceptualist artists in the 70’s for whom “video functioned as a vehicle for ideas” (London, 2020) or as a tool for documenting performances.

Other filmmaking practices related to environmental issues were already exploring and incorporating complex movements into their films, like in *Streamline* (1976) a work by Chris Welsby that follows the changes and movement of a stream of water from outside the river with the help of a motorized carriage mounted on a steel cable which allowed the camera to film the water vertically. The work establishes a dialogue that contrasts the fluidity and capacity of the stream’s transformation with the constant speed and rigidity of the technological device. As Welsby, explains, this structural approach to movement responds to complex systems (or structures) that carry information, like the wind, water, the movement of the sun and the passing of time (2015). I find Welsby’s work inspiring, and it is worth using it as departure point to accomplish a more comprehensive integration of the material entities participating in an ecology: instead of producing films that carry the complexity of a given phenomenon, I aim at making films by engaging with the world, which is complex.

By letting the cameras flow free along with other non-passive entities like water, vortexes, turbulence, rocks and sediments that collaborate productively to make the images, the river becomes both the subject-matter and the instrument which generates the movement at the same time. The

cameras participate actively within the flow to challenge (or expand) the role of the apparatus when seen reductively from a Cartesian perspective. Here, the fixed notions of subject-camera-object are reworked, with altogether different results from those when recording the river from outside, driven by a form of movement that is unresponsive to the agential forces of the river, like in the work of Welsby that I just described.

In the work *Usumacinta*, at times, the cameras record each other as if the apparatus or the artefact could turn on itself and see its 'tail', 'head' or 'body' (I use singular quotes because the categories in this case are conventions that can be interchangeable). The confusion is a manifestation of the inseparability and entanglement of matter: for most parts of the video, there are no clear references that provide a sense of orientation, and it is hard distinguish the direction of the water or that of gravity, a force that almost universally, and automatically, provides a sense of grounding. The film does not have clearly defined subject matter. It does not attempt to construct boundaries that differentiate background from foreground, technology from nature, outside and inside, and so on. Already ridden of these binary constructions, the work aims instead, to produce a 'direct image of time', as it is encouraged by Amy Herzog (2000).

Amazed by the capacities of brittle stars, an organism that has no brain or eyes, but a multitude of crystals which function as micro lenses and cover their entire body and limbs, Barad explains that "brittlestars don't *have* eyes, they *are* eyes" (2014b, p. 225). Similarly, in this artwork, the artefact more than carrying the cameras, is made of cameras. Consequently, I argue that not only is this sort of 'organism' moved by the water on the river, but also the river is both the 'organism' and the cameras. In that capacity, and in total immersion, everything moves together, producing moving images that respond to the velocities and transformation of the river. The moving images are the river too.

## **The Tiber**

In 1598, Rome suffered a great flood caused by the Tiber River (Levi, 2016). In response, and to avoid further accidents, the authorities decided set up to widen the riverbed, but they did not know how much it should be increased. Benedetto Castelli found that to solve the flooding problems it was necessary to measure the width and the depth of the riverbed, as well as the length of a segment of the river, which he could approximate using various tools. However, to measure the velocity of the water (a temporal quality), it is necessary to find a way to segment (spatially) the flow of the river. Castelli had to consider time as a spatial dimension by measuring the inches, feet, metres or miles that water traverses in a minute. To do so, it was necessary to throw in a buoy to measure the time that it takes it to travel from a given point to another. Castelli, with the help of Galileo, solved the mathematical problem to widen the river, but to achieve it, he had to subordinate time into space, a translation that had no consequence on Castelli's mission, but considering the thinking of Bergson (and pertaining to the relevance of this research) it denies the possibility of experiencing events in their undivided intensity.

However, the impossibility does not come from the act of measuring time itself, but from the reduction of time to its spatial qualities, as it is suggested by Bergson (Guerlac, 2006). Similarly, Barad denounces the fragmentation of time as “a succession of discrete moments, where a moment is understood as a thin slice of time where each successive moment replaces the one before it” (2017, p. 60), which is a notion of time that is supported by progress. Seen that way, it is easy to explain the violence embodied in the program of modernity that tends to separate those who can keep up with progress from whoever is left behind. To dismantle this view, Barad (2017) insists that time is not universal. And although, Indigenous traditions have long resisted a homogenous idea of time and history, its peoples have suffered a form of ‘epistemicide’, manifested in the lack of recognition of the diversity of systems of knowledge around the world (De Sousa Santos, Nunes and Meneses, 2008). Nonetheless, explains Demos, post-anthropocentric

philosophies in scholarly research, like the ones that inspire this project, have started to relate and connect with the “long-standing Indigenous views of nature as a pluriverse of agents” (2016, p. 23).

In this context, and considering various and heterogenous temporal coordinations, Elaine Gan follows the practice of rice cultivation manifested through histories of more-than-human attunements. She denounces the temporal logic of modernism and capitalism that has erased difference and temporalities embedded in rice by re-engineering grains into high-yielding crops that are quick to harvest in response to a temporal system of domestication, efficiency, acceleration and profit (Gan, 2018, p. 88). As she explains, these actions have already resulted in rice grain extinctions and ecological damage in Southeast Asia. Furthermore, the degradation, damage and dispossession of soil and plants is of a global scale (Gray and Sheikh, 2018). And so is the erasure of myriad and varied temporalities and rhythms (associated with epistemological diversity) that have been moulded as *naturecultures* through a long history of human and nonhuman collaborations, and that have been mostly replaced by the prevalence of a homogenous time associated with progress:

Understanding the sequences, rhythms, and patterns of shared more-than-human existence is one of the most crucial aims in studies of continuity and change throughout the arts, sciences, and humanities (Gan, 2018, p. 100)

Then, how can the moving image (a time-based practice) challenge the prevalence of a single homogenous time?

I have showed before how I collaborated with the movements and rhythms of the Usumacinta River to rework some of the anthropocentric habits related to preconceived notions of time, objects, apparatuses and subject matters. But I am also interested in responding to more-than-human temporalities through the temporal qualities of the moving image, like velocity and reproduction speed (frames per second) that can be reworked and expressed in pulses, rhythms, heartbeats and moving images running at various velocities.

Bergson criticizes cinema for having a regulated frame rate that fragments the experience of time (Bergson, 1911). He explains that no real movement emerges from the mechanical pace of the cinematograph, and that it is through the unfolding of images or photos that the illusion of movement is restored, which is a form of representation. However, Herzog (2000) argues that the moving images are not reduced to the contrivances described by Bergson, and that it is possible that he had overlooked the affective potential of films. Film was still latent when Bergson denounced its limitations, and the image of the Muybridge's horses and the Lumiere brothers (an illusion of movement) was still very latent. Cinema, as Herzog (2000) assures, through Bergson's ideas, is capable of creating new movements and images of thought because of its capacity to distribute movements and intensities in an ecology of ideas, things, people and affects. The artwork *En la memoria del volcán nunca mueren las estrellas* (2019), which I will describe in the next section, and that relates to the entanglement of my heartbeat with the running speed of the moving images, shows how matter can be distributed in an ecology of forces and movements while challenging the temporal conventions of moving images where speed and framerate are left constant.

There are various examples of artists who have experimented with altering the temporal conventions of the moving image usually identified with real-time (which is when the time of the filming coincides with the time it takes to project it) like Bill Viola, who has experimented extensively with slow motion not only to show things in a novel way, but also as an emotional and affective instrument. I have also discussed the work of Pipilotti Rist, which uses slow motion as an evocative oneiric element. Science also, has pioneered into altering time parameters both in video and film to show phenomena in different ways that will help research or reveal something that was not otherwise perceived:

What difference does time make in experimentation? There is the time of the experiment, the time of the recording, and the time of demonstration, and these parameters can be manipulated in relation to one another in order to see new phenomena or to see well-known phenomena in a new way (Landecker, 2006, p. 123)

The possibility to alter the temporal qualities of the moving image are key questions in the context of this research: can a temporal reworking of the moving image produce differences in how we relate to the world's various rhythms and temporalities?

Some of the narrations in the films of Painlevé, an experimental artist interested in scientific recordings, like in *Pigeons of the Square* from 1982, argue explicitly in favour of slow-motion as a tool to observe in detail and discover things that we would not notice otherwise at regular speed. He uses slow motion and backward playing (he calls it forward-reverse) to study the way pigeons walk. Pigeons he notes, bend their legs to the front as opposed to humans. In this humorous movie, Painlevé shows two girls struggling to mimic the distinctive bird walk as they try to move their heads back and forward. By altering speed and reversing movement, he shows us something about birds and humans, while opening a door to curiosity, humour, and affective connection (Painlevé, 2000).



## Heartbeat

My heart was pounding fast and loud on my first visit to the observatory. I think I could hear it. That was also my first time in a high mountain environment more than 5,000 metres above the sea level. The heart beats harder and faster to compensate when the body is deprived of oxygen. It is an automatic response.

It is only after a few hours have passed that the body starts to acclimatize, a mechanism in which the body learns to coordinate and attune to a new environment. It is a response that requires time and a process of adaptation that I find both fascinating and relevant to this research.

In all my visits to the observatory, even after being acclimatized I would pay attention to my heart, which was always present: pounding and keeping various rhythms. It felt like a clock, but not the universal homogenous kind of clock that Barad associates with capitalism and colonialism (Barad, 2017). Instead, I refer to a collectively produced, non-mechanical and dynamic timekeeper that manifests through my beating heart. When I say, 'my heart', it is only because it is inside me and keeps me alive, but it is not mine alone: always intra-related, it responds to various stimuli by 'becoming with' in coordination with other things that I do not control. My heart, like my blood, acts automatically and "without the intervention of intention, which is subjective and cognitive" (Serres, 2018b, p. 37). That is also the case of the oxygen at the mountain, the terrain and the rocks, which also act automatically, and in relation to each other. My stamina, too, which is an aggregate of material responses determined by past actions (or inactions), participates in the dynamic flow kept by my heart's emerging temporalities. Working out or eating healthy can translate into future capacities that makes you stronger. You can struggle too. It is common to see strong and healthy people suffering from headaches and confusion on the mountain. There is always the risk of feeling bad at high altitudes, no matter the experience of the climber. There is no linear causality. The response is always differentiated. The heartbeat is a heterogenous clock, an agential clock in relation to a plethora of moving things and complex responses. I wanted to work with that clock.

I wanted to avoid the ultra-precise atomic clock that astronomers use to coordinate their observations and the monotonous standardized velocities of the moving image that maintain 24, 30, 60 or 120 frames per second (fps). I follow Gan when she explains that “human clocks and calendars are insufficient apparatuses for more-than-human dynamics” (2018, p. 100).

How could I use my heart to run the camera? How could I make a work where the time of the video would emerge from my heart frequency responding to manifold relations? I decided to map the beating of my heart to the speed of the video. For this first experiment, I would attach a camera to my head and register my heartbeat while hiking the mountain. Later, in the postproduction studio, I would modify the velocity of the clip in response to the heartbeat. I imagined the video speeding up or down depending on the effort made while climbing to produce a unique work that responded to the material conditions, capacities and histories of the various shared bodies participating in determining the beating of my heart.

But to do the work, I needed to try out the heartbeat sensor and scout the mountain. I made a trial run on the Sierra Negra volcano just before the incident with the criminals. I invited a friend to climb with me. It took us around four hours. We were both in good shape and wearing heartbeat sensors, but my friend is an active marathon runner: we compared our readings while climbing and found them to be quite different. The movies produced by each of us, would have been noticeably different. And that is a key point to diffraction: differences are crucial when mapping the effects that cause such differences. In this case, the accumulated stamina of my companion was having an effect in the present and future of the climb. In this exercise, past, present and future are clearly entangled.

I was also able to experiment and program the post-production software to convert my heart’s beats-per-minute equitable to frames-per-second. The velocity of the video is modified in such a way that an increase in effort would speed up the video, while a decrease on heart activity, would translate into a slower image.

This first attempt also led me to realize that I needed a high resolution 360-degree camera, as I wanted the video to show my feet walking, the path in front of me and the sky above my head at the same time. I wanted the experience to be geological, atmospheric and astronomical, in accordance with a comprehensive New Materialist approach. I was interested in enabling an immersive experience that placed the viewer within the world that we inhabit, as suggested by Latour, who calls us to revise the narratives that reconstruct the globe from an outside position (Latour, 2016b), and to explore other forms of knowledge that can resist the alienation caused by a visual imaginary that portrays a planet from a ‘nowhere’ position. This work is an attempt to land in this world (Latour, 2020), not through representing, but through a form of *earthly* touching that meets in concrete temporalities and spaces, even if the connections are not readily visible, like the intra-relation between my heartbeat and the available oxygen.

We managed to perform the first experiment just before the violent incident at the Sierra Negra, when I was advised not to return until things had settled down. The Sierra Negra was of great importance to me, but the research had already drifted into new territories and temporalities: I decided to produce the work at another extinct volcano at a similar altitude, called *Iztaccíhuatl* (white dormant woman), where I had been hiking regularly. I scouted the site and programmed the recording. However, in repeating the experiment, I expected different results to emerge.

I was accompanied to the *Iztaccíhuatl* by a small team of people: my friend Maria Paula Martínez who led the expedition and Eric Romero the camera operator who helped me out with the technical aspects, as I had to carry the spherical camera myself with the help of a rig which I carried on my back to position it above, and in front of my head, to free my hands.



Figure 2.3. Hiking in the *Iztaccihuatl* volcano while recording *En la memoria del volcán no envejecen las estrellas* (2019) with a 360 degree camera.

The effort to walk was so arduous that my heartbeat increased constantly without stabilizing until I could not climb any further and stopped the video. The resulting video, mapped to the heartbeat in postproduction, decreased its velocity almost to a stop. The viewers who stood in front of the video installation projected onto a ten-metre wall inside the Laboratorio Arte Alameda Museum, could hear my heartbeat accelerating as a low-pitched reverberation, while at the same time experiencing the effort produced while climbing, as time appears to stretch because of the burden of every step. It is not my intention, however, to solely represent or mimic the experience of hiking in the mountain, but to explore the various rhythms and temporalities manifested through my pulse. The work is about the emergence of a more-than-human temporality of the moving image, when diffracted through geographies and atmospheres. I did not intend to produce an immersive installation to attain more credibility when depicting or representing what it feels like to hike a mountain (or to be inside a river in the case of the Usumacinta), but to encourage further inter-connection by inviting the public to participate and reconcile with other forms of temporalities.

Taking a walk is to become a landscape. It excites the molecules of the body, initiates a connection between breath, pulse and the sounds, gestures and pulse of a city, a street, a forest, a desert. It helps to be attentive to the rhythm of a territory. (Marhöfer, 2015, p. 50)

Marhöfer is talking here about her own films as she explores the emergent material relations of a given place. In the case of this artwork, the territory creates a rhythm. Time is not universally given, it is “articulated and re-synchronized through various material practices” (Dolphijn and Tuin, 2016, p. 66), explains Barad, which is an idea that resonates with Bergson: “Time enters into the very substance of matter, it becomes concrete and mobile” (Guerlac, 2006).

My heartbeat became an apparatus of time, the clock from which time emerges. By accommodating this new temporal condition that uses my heartbeat as an heterogenous metronome, a hybrid *medianature* emerged. Measurement entails a meeting between the natural and the social: ‘Measuring is a form of touching’ (2015), explains Barad before continuing with a powerful idea that is pertinent to this research: “physicists are actually making time in marking time” (Dolphijn and Tuin, 2016). I believe that is also the case for the moving image: not only do moving images happen in time, but also time is created through the moving image.

In this work, the software, an apparatus of postproduction, plays an active role in how the work is experienced. That was the case also of the scale of the work, as I learned in the exhibition space: the bigger the image the more vertiginous the movement would become, almost to the point of making the viewer nauseous. With this, I found an interesting correlation between space and time. In immersive installations movement becomes more noticeable, in such a way that as the image increases, it enables unfamiliar sensations on the body and mind. Scaling up or down, could present an opportunity to discover something that otherwise was difficult to perceive in the sense described by Painlevé (2000).



Video XVIII. *En la memoria del volcán no envejecen las estrellas* (2019) .

Duration 3:28 minutes

<https://www.emiliochapela.com/volcan>

Talking about hillwalking, Ingold describes how “the corrugations [of the terrain] are felt in the muscles, whether straining with or against the force of gravity” (2021, p. 65). That is also the case of the heart: I wanted to create a vital connection with the terrain, the architecture of the museum in dialogue with the sound of my heart, and the bodies visiting the exhibition. The work is about inhabiting spaces (the terrain and the museum) by seeing, feeling and hearing pulses and rhythms that coordinate in correspondence. It is a ‘multisensory encounter’, as in Rist’s installations, which enables us to “pour our bodies out” (Mondloch 2017, pag. 3) and share an embodied experience in connection to other bodies and matter.

Ingold differentiates between the climber who approaches a mountain peak with the objective of reaching a summit (a practice associated with the goal of conquering it) and the traveller or shepherd who visits the mountain to make their way through the geography, grounding and relating on every step. For the climber “it is the summit that counts, not the great, heaving mass of rock of which the summit just happens to be the high point” (2021, p. 65). While I believe that Ingold might be overlooking the fact that some athletes go to great lengths to know and acclimatize to the mountain, which requires close coordination with other human and nonhuman entities before and during the effort to climb, he has a point insisting that we should inhabit the mountains and listen to their stories instead of seeing them from afar as peaks with the potential to be conquered. My goal with this work was not to reach the summit of the *Iztaccihuatl*. I decided to work in a part of a mountain I knew well from past projects. I already had established a dialogue with the space. This work is an effort to get closer and inhabit, and in doing so, allowing moving images to emerge from that entanglement.

**III**



## Diffractions

This research offers my account and process of how I diffracted New Materialism through moving images when looking at *earthly* movements. The contribution is not only situated in the artworks that emerge when looking at the world as emergent, agential, and contingent, but it provides clues, through the specificities of this project, to how diffraction can be adapted to other locations, temporalities, and art practices.

I decided to embark on a PhD project because I felt that I was somehow doing things automatically, and without a sense of movement. I felt stagnated. I wanted to read more, learn, and reanimate my work and ideas. In that sense, I am satisfied with this doctoral project, which has been transformative on various levels and has led to the emergence of different contributions. I recognize that the artworks I produced during this research reveal a world that is complex and unpredictable, where matter is taken as vital and intra-connected. I see these artworks as more-than-human collaborations that pay attention to what happens in the world, as it is manifested in its movements and intensities, instead of as mechanisms of containment, control, or division, like the Newtonian and Galilean interpretations of mechanics that tend to simplify and depict movement as stable, as well as the Cartesian epistemologies that categorize, separate, and take matter as inert. New Materialism is helpful to challenge these views, as it introduces ideas and methods, like diffraction, that allow one to read and experience the world attentively, mapping its mobility and differences as they emerge in relation to other entities like mountains, clouds, and rivers, but also the video camera, tripod, and other artefacts of the moving image.

The videos presented here, which aim to coordinate with various temporalities and forms of movement, will become part of future exhibitions, presented in various contexts, and in relation to other artworks, people, and curatorial projects. In that capacity, I hope they can animate affectivities and pose further questions in connection to this research as they collaborate both in a discussion of movement by means of the moving image and in relation to other artistic practices looking at New Materialism as a methodological approach.

This research contributes to the discussion that utilizes New Materialism as a tool of diffraction to respond to the world's agential and non-mechanical movements. I do so through the work of Barad and her notions of intra-action and agential realism, which provided me with the framework to approach the astronomical observatories in the Sierra Negra, and other sites where my practice has drifted as ecologies not where entities precede their interactions, but where qualities and capacities are created and determined in response to other entangled entities. This project sees the world as emergent and in constant transformation, which demands a redefinition of the mechanistic cosmologies of the Universe (like Newtonian physics) that aim to secure the formula *same cause, same effect, always*, by opening to other forms of nonlinear causality and movement in which things happen always in relation to the specificity and agential capacity of other participants. Agency is constantly moving and distributed across various things that cause different effects and outcomes that bring novelty. As an artist, I have made the effort to work in agreement with such unpredictability and susceptibility to change, like when collaborating with the weather and clouds, or by trying to attune to the precise moment when a storm forms (or fails to do so), or by working with the complex turbulences that affect the flow of water in a river. I have also discovered that if I were to repeat this research, other results might emerge. Here, repeatability cannot be embodied in the outcomes. However, I have learnt that there are methods like Barad's and Haraway's diffraction (Barad, 2007), Stewart's attunements (2011) and Stengers' ecologies of practices (2013), which are all used in this research, and can be adapted by other artists, practitioners or scholars outside the art practices including scientists, interested in diffraction as tool for learning and creativity. The project adds to a discussion in the context of the ecological relational field and in connection to contemporary feminism, as New Materialism can be a useful tool for mapping how differences emerge from material entanglements and ecologies: "feminist are not trained to look or take pleasure in everything being the same, but to think about differences" (Barad in Dolphijn and Tuin, 2016, p. 51).

According to Stengers, ecologies of practices are ‘tools for thinking’ through what is happening, and that is why they are never neutral, as they are affected by the specificities of their surroundings. (Stengers, 2013, p. 185). In consequence, she makes a call to resist the habit and predisposition to find recognizable and generic tools that impede us from thinking creatively. The relevant tools, she explains, are the ones that makes us think and adapt, not recognize. This research aligns with that effort (which comes with a sense of uneasiness), but it does it through the art practice. These artworks are tools that avoid the habit to take movement and matter as stable or fixed. Instead, they pay attention to what happens in relation to other entities and how movement is being created. That is why experimenting is so important to this research: The moving images that emerge from this research are tools to ‘meet the Universe halfway’ (taking the invitation posed by Barad) through a form of ‘tuning in’ (Pickering, 2016), responding, calibrating and sensing. Each time I would visit the sites where I recorded these images, I would pay attention to how things moved and changed, so I could attune to their motions and rhythms. Back in the studio, I would see the materials, make notes, and write about the images in relation to New Materialism (I stayed close to its literature throughout this research). This creative entanglement of ideas and moving images with the spaces where I worked, is what I understand as diffraction, a process of feedback in response to the world’s movements, in which ideas motivate the practice, and the practice affects back the thinking. This text accounts for that process of transformation, which is why it is written in the form of as story, lived by me but in collaboration with other entities and the movement produced from our entanglement.

This research flows. It advances and stagnates. It is turbulent. It deviates from a constant path. As Pope explains, contributions are not discrete objects of study that can be easily picked-up and handled, like “adding a ‘brick’ to a pre-existing ‘wall’ of knowledge” (2017). This research does not follow a linear path that leads to discrete contributions, nor does it move inertially (a state of things characterized by its resistance to change). It gathers (like a river) from various sources and ‘disperses’ in practices,

artworks, images and texts. Flow is about traversing and experiencing material exchanges and velocities, sensing its forces, resisting, and letting go. However, more than using metaphors to orient to images or representations, this project attunes to “rhythms, forces, relations, and movements” (Stewart, 2011, p. 445)

Although, I have explained that ecologies of practices and diffraction are non-neutral tools that are used to ‘work-things-through’ in the particularities of this research, they can be adapted (or actualized) to other ecologies, temporalities, ideas, and artistic practices. However, the gesture of taking these tools ‘in hand’ will be each time, a particular one (Stengers, 2013, p. 185). By adapting them, is how others can use this research as a means of creating and animating tools and responses when looking to their own questions and practices.

Diffractioning New Materialism through this practice has also been helpful as a tool to resist the Cartesian notions that artificially separate subject, object, and camera; background and foreground; nature and culture, and so on. It is also useful as a philosophy of reconciliation that can bring these things together by forming (or reforming) *naturecultures*, or by challenging anthropocentric views that categorize spaces as empty or remote and make agency and movement invisible. For example, this research approaches the video cameras (or the reproduction speed of a video) as things endowed with agency and capacity to affect and be affected through entanglements and collaborations. In the work *Usumacinta* (pag. 114), for example, the flow of the river generates movement in coordination with the cameras, which are carried by the current, participating actively in the formation of the images: predefining, and fixing the role of the camera, or the river, is a habit (of control) that becomes futile and unnecessary. Similarly, in the work *En la memoria del volcán nunca mueren las estrellas* (pag.126), the speed of the film changes accordingly to my beating heart that in turns responds to a series of material conditions like the geography of the mountain and my strength and stamina. That way, speed is not seen as a predefined quality of the moving image, but an emergent temporal condition that produces particular and unique images.

This research opens to an interconnected and relational world through New Materialism, but in doing that, it carries the risk of getting lost in its (intricated) connections. The Galilean revolution displaced the Earth out of the centre of the Universe, but humans stayed, in their minds, in the centre, carrying a false sense of pride. Today, as we make the effort to move away from the centre and situate ourselves within a wider ecology, like the one this research aims to provide, it is easy to feel lost. Recognizing a world full of movement with myriad interconnections can be challenging. It can bring despair. If suddenly, the world feels too big and complex, it might be helpful, not to depict it as stable, nor to go back to the reassurance to consider ourselves humans in the middle of all things, but to think about the immediate, close, and concrete intra-relations that we can affect and that affect us, and that we can cherish; to consider the space, time and movements of those things, environments and peoples with whom we share, live and participate.

This research also adds to the call made by Latour in his book *Down to Earth: Politics in the New Climate Regimen* when he asks anyone willing to share their personal ideas on where to land, and how to share this Earth: “tell us a little about where you would like to land and with whom you agree to share a dwelling place” (Latour, 2018, p. 106). This project is a response to that pressing invitation. It provides tools to attune to the world’s agential movements, renouncing control and avoiding separating (nature and culture) or relegating things to the background (by positioning humans in the foreground). To land, one must also resist thinking about the world in terms of ideals and stability. I approach this from the moving images. But I extend Latour’s invitation to other practitioners: what modes of landing can be enabled from the arts? Or the sciences? How can we sense the world’s changing atmospheres through writing, sculpture, or installations? I have already started to use other media with these purposes. And, although, the aim of this research is limited to the moving image, the impact of New Materialist thinking and relational ecologies, has already transformed me both as artist and as a person. I am making moving images, but I have learnt through this project not only as a moving image artist.

While it might be hard to account for all the discoveries I have made through this doctoral project, it is important to recognize the personal changes that this research has brought for me. I am referring, for example, to the relationship to my immediate surroundings. And I do not speak of the things that I see positioned around me (from an anthropocentric view) but to the human and nonhuman entities with which I am entangled with, and to which I have a relation of response-ability. For example, I have been increasingly aware of our relationships to the bodies of water around us (or the absence of them), their state of health and the quality of our relations. Do we drink from their water? Are they polluted, dry, intubated? Where does the electricity that that powers the computer where I am writing comes? Or the display which you are reading? Computers are powered by lithium, silicon and other minerals. What is our participation in that long history of materials and their relations? How do collaborate positively towards improving our living conditions amongst them? These are questions that I do not know how to answer, but I leave them here with the hope to stir up some trouble.

Attending to various forms of movements, and responding to the thinking of Serres (2012, 2018a), I have revised my ways of resisting the habit of understanding the world in terms of ideals that treat matter as homogenous. I have also acquired a suspicious attitude towards anthropocentric art practices that take the world as static or mechanical. A world without movement is easier to master, explains Bergson (in Guerlac, 2006). However, “in ignoring messiness, and dreaming of its eradication, we discovered that we have messed up our world” (Stengers, 2018). The world is moved because of our doing (Serres, 1995), but we have neglected movement (and its effects) by making it invisible, which carries an undeniable violence. We have separated nature from culture, while making time homogenous by wiping out other more-than-human temporalities (see Gan, 2018). Our capacity to respond is not well calibrated, as we tend to misunderstand, reduce or minimize the world’s movements. Constant and stable movements, as well as clear-defined boundaries, are exceptions

(if not only human constructs) like Newtonian laws of physics, which describe motions only after eradicating some of their intra-acting capacities and effects that we take as disturbances and alterations, like friction or turbulence, which paradoxically, more than annoyances, are the emerging forces that result from inhabiting the planet. For these laws to function correctly, we must, literally, leave the planet, and not only in our heads.

In opposition, and in an effort to negotiate with *earthly* movements, this practice is open to form collaborations with humans and nonhumans alike, which makes us rethink our ideas of authorship: “culture is not our own making, infused as it is by biological, geological and climatic forces” (Bennett, 2010, p. 114). However, enabling these collaborations can be troubling, as there is no way to erase the fact that we approach the collaboration with the intention to produce an artwork, unlike the clouds, the sun or the wind, which function automatically, that is without the intervention of intention (Serres, 2018b). Then, it is worth to ask what the role of the art practice is in enabling such collaborations. Pickering suggests moving away from representations to a “worldview which sees humanity not in a position of cognitive control” (2016, p. 4) and that is open to experimentation (a process of finding out), instead of domination.

Moving away from the centre, and embracing more vital, and less mechanistic and anthropocentric forms of movement, can bring angst and vertigo. In response, Haraway suggests ‘stay with the trouble’, which is a phrase that she uses frequently as an invitation to form entwined collaborations with other companion species and ‘mortal critters’ that form of entanglements with animals, people and all kinds of matter and meaning (Haraway, 2016). She describes these combinations as string figures, referring to the game performed by manipulating a string with one’s fingers or between the hands and feet of other people to form intricate (or entangled) shapes and designs. Staying with the trouble, as I understand it from Haraway, is not about dreaming of a less precarious present, or about projecting ourselves outside the planet to leave the Earth expecting to find a world that we can easily manage and control, an attitude criticized by

Latour (2018); nor is it about disentangling the strings and undoing the twists and turns, which would make the figures disappear (and with them the collaborations). It is about being present and responding to unfinished configurations of matter, space and time. “Our task is to make trouble, to stir potent responses to devastating events, as well as to settle troubled waters and rebuild quiet places,” (2016, p. 1) explains Haraway, before adding: It is about finding a “timeplace for learning to stay with the trouble of living and dying in response-ability on a damaged earth” (2016, p. 1).

Doing this project has not been easy: I have experienced moments that have seemed to me to be failures (when thinking about success as a capacity to control the outcomes), like the videos ‘failed’ videos I recorded during the total eclipse of the sun in Idaho in 2017. I have struggled to relate and think about my practice in comparison to the immeasurability of astronomy: time and light are elusive entities that are hard to grasp. My visits to the Sierra Negra observatories were cut short because criminal activities. I experienced a major earthquake in Mexico City. And of course, as we all did, I had to deal with and navigate this research through the COVID-19 pandemic along with the material, affective and emotional impact that brought to us all. However, all these things are only reminders of the world’s movements, its susceptibility for change and its precariousness. The Earth is trembling because of our actions (Serres, 1995). I here make the effort to accommodate that trouble, which Anna Tsing calls the ‘unplanned nature of time’, by acknowledging that even if it is frightening, indeterminacy is what makes life possible. She asks us to relinquish to the perceived fantasies portrayed by the lack of movement that insists that precarity (animal extinctions, drought, climate change) is the exception. But it is not: “precarity is the condition of our time” (Tsing, 2015). Everything is flux; we are vulnerable to others, she adds.

In the context of science, Stengers invites us to abandon the benchmark-driven research associated with industry and progress, where knowledge is an end of itself and not a process. She does that by introducing ‘slow science’, a form of knowledge that seeks to reclaim science’s autonomy,



and which requires attention and openness to be transformed by what is learnt. She insists (also from the perspective of activism) on the practice of reclaiming as a form of reinventing or recovering what a separation has destroyed (like Cartesian categories), or what has been abandoned and neglected, in this case movement: “reclaiming means first recognizing that we are sick and need to heal. Slow science does not provide a ready-made answer; it is not a pill” (Stengers, 2018, p. 124). Similarly, the artistic practices discussed here, are concerned with processes and transformation, instead of discrete findings, which are not to be understood as ends on themselves, and that cannot be taken as ‘pills’ either. The works presented in this doctoral project are open and susceptible to further transformation. I am too.

Following Stengers, I wonder if it is relevant to explore a practice of ‘slow art’? What would that practice look like? This poses a series of questions (also related with time) that might be interesting to explore beyond this research, where diffraction could provide a useful tool to read Stengers’s ideas through the art practice in resistance to the mobilization of progress, and in the service of the “creation of a future worth living” (Stengers, 2018). Or perhaps, I would say, other possible sustainable futures that can be suggested through art practice. There is much to do and think about this, for example, in relation to the wellbeing of rivers, which have been subject to pervasive practices caused by anthropocentric endeavours. How can art practices participate in the reclaiming of its *naturecultures*?

Stengers explains that the humanities (she is both a scientist and a philosopher) have managed to maintain a critical reflexivity, which has provided a resistance to the fast and controlled production of fast science (2018). But she explains that it is not enough, and invites us to go past reflexivity, by stressing the need to develop tools that can reclaim our attention and capacity to learn, like diffraction, which according to Barad, provides an alternative to critical reflexivity (Dolphijn and Tuin, 2016, p. 49). Diffraction is a form of situated knowledge where the effects of change are singular and interconnected with the problem they seek to

explore. It is not a way of thinking and doing things that can be repeated in hopes of obtaining the same results — first, because diffraction is not result-driven like the ‘fast science’ that Stengers denounces, and second, because diffractions are imprinted, so to speak, by the temporal and spatial specificities to which they respond— that is, the ecology in which they act: diffraction is not a tool of recognition, but adaptation. It is a methodology that entails spending time with other things with which you are entangled with. It is not something that happens once and for all, like when you cross a tunnel that you leave behind. It is a continued process of reconfiguration and change. It is open and unfinished.

## The fall

Towards the end of this research, I dreamt about the Salto del Tequendama, a massive but highly polluted waterfall in Colombia, a place that was once known for its magnificence but where I have never been before. I know the cascade only through photographs and stories told by my colleagues that got entangled within my dreams. In the dream, I dropped a video camera down the waterfall to make an artwork by recording the fall: the camera stirred and became immersed in the polluted waters of the Bogotá River. What I do not remember is that if I saw the camera falling from a distance, standing still and immobile, or if I saw it through the viewfinder while falling along with it, or if I was myself the camera, immersed in fog, obnubilated and implicated in the dirty waters of the river. The discrepancy is not minor, and it reveals the difference between moving along with the world even if troubled and imagining it still and from a distance, ignoring its movements, and my own.

I woke up restless. I thought about how to protect the camera. Will it survive the fall? I thought about the contamination and smell of the water. I imagined the danger involved in climbing down to rescue it. I thought I could let the camera shred to pieces and transmit the images remotely, but somehow, I knew that this dream was about hope. The camera had to survive, even if it meant dealing with the trouble of getting entangled with the precarious and polluted waters of the river. What does it mean to fall down the cascade? We are headed for a crash, warns Latour, before inquiring: “How is it down there? ‘Is it habitable?’ ‘Will I survive there?’” (Latour, 2020). For me, it depends on the capacity to learn how to inhabit a world in motion, to attune to the act of falling, and responding to those others who you are falling with. Art, for me, is one way to do that. It is how I chose to land.

“Why are we so afraid of falling when fall is all we’ve ever done?” asks the Indigenous leader and thinker Ailton Krenak (2020, p. 61) as a provocation not to be afraid and to turn the act of falling into something exciting and

edifying, perhaps even as an act of healing. In his book, *Ideas to Postpone the End of the World*, he insists on the need to build ‘colourful parachutes’ that help us slow down and allow our dreams and imaginations to inform our actions. One day, I might go to the Salto del Tequendama and throw a video camera down the waterfall to record the fall. I will invite colleagues, and anyone interested, to make sure the camera survives the fall, submerged and in collaboration with the polluted waters of the river.

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Submitted videos by Emilio Chapela

Please refer to the following webpage for accompanying artworks.

<https://vimeo.com/showcase/9000695>

I. *Position and Momentum are Mutually Exclusive* (2017). HD Video. Duration 3:01 minutes.

II. *The Alpine Tree Line is not a Line but a Gradient*. (2016). HD Video. Duration 3:07 minutes.

III. *The Hidebehind* (2016). HD Video. Duration 1:01 minutes.

IV. *The Hidebehind II* (2018). 4K Video. Duration 3:11 minutes.

V. *The Clinamen* (2019). HD Video. Duration 11:00 minutes.

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VIII. *Sunset* (2016). 4K Video. Duration 1:25 minutes.

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X. *Totality – Introduction* (2021). HD Video. Duration 01:05 minutes.

XI. *Totality – Part 1* (2021). HD Video. Duration 3:45 minutes.

XII. *Totality – Part 2* (2021). HD Video. Duration 3:02 minutes.

XIII. *Totality – Part 3* (2021). HD Video. Duration 3:06 minutes.

XIV. *Sagittarius A\** (2016). HD Video. Duration 00:44 minutes.

XV. *Touch* (2018). HD Video. Duration 05:53 minutes.

XVI. *This Man has a Gun* (2018). HD video. Duration 01:59 minutes.

XVII. *Usumacinta* (2019). 5 channel video installation. Immersive sound. Duration 16:47 minutes.

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Figure 1.7. Video still. Rainbow near the Malintzin volcano on the way back to Mexico City from the Sierra Negra.

Figure 1.8. Video still. Clouds surrounding the Citlaltépetl taken from the Sierra Negra. Credit: Emilio Chapela.

Figure 1.9. Video still. The Menan Buttes in Idaho moments before the total eclipse of the sun in 2017. Credit: Emilio Chapela.

Figure 2.1. Video still. Five submersible cameras are attached to an artefact that flows through the river. Credit: Emilio Chapela.

Figure 2.2. The immersive five-channel installation Usumacinta (2019) as it was installed in the Laboratorio Arte Alameda in 2019. Credit: Emilio Chapela.

Figure 2.3. Hiking in the Iztaccíhuatl volcano while recording *En la memoria del volcán no envejecen las estrellas* (2019) with a 360 degree camera.