Ontological overflows and the politics of absence

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Abstract

This paper suggests that STS needs to start attending to what I dub *ontological overflows*. My argument is that the methodological principle of "follow the actors" has led to STS analyses taking over the matters of concern of our interlocutors. Our informants' concerns and objects, becoming our concerns and objects.

I argue that the consequence of the methodological dictum to "follow the actors" is that we have taken for granted which objects should be attended to, cared for, and analyzed. Thus, our theories and methods have constituted a particular blindness to those objects that our informants do not care for—the objects at the edges of the network, the smooth rhizomatic spaces, the blank figures, the undiscovered continents, the plasma. The paper thus joins in the ongoing discussion about otherness, perspectivalism, and ontological politics, and asks how STS can attend to the making of the absent, weak, and invisible.

What would happen if we start paying attention to these ontological overflows in practice?

To demonstrate the usefulness of this analytical tactic the paper attends to the assembling of the absence of a pandemic at the European Disease Control and Prevention. By tracing how multiple absences are produced, the paper shows the usefulness of caring for the othered objects, of following the making of alterity and otherness. The argument is that the tracing of *ontological overflows* opens up for understanding how tangential objects are dis-assembled, and consequently for tracing how absence, alterity, and otherness is made in practice.

Introduction

This paper is about the assembling of absence. It is also about the assembling of a pandemic. And how a global snapshot of this epidemic was made in practice.[1] But more importantly it is about how the *absence of the pandemic* was assembled in parallel to its presence. By attending to absence this article aims to join the rich and insightful discussion about situated knowledges, perspectivalism, and ontological politics in STS.[2] The goal is to trouble some of the foundational tenets of STS: "follow the actor!," the telling of particular versions of construction stories, and the ontological politics of enacting objects.[3] We need to pay attention to what I call *ontological overflows* to understand the politics of science and technology.[4]

My argument is that STS' enactment stories are marked with a particular blindness.[5] We faithfully follow the actors (human and more than human) in order to tell these stories. These construction stories are powerful and productive devices for destabilizing taken for granted assumptions about nature, society, and agency—showing that it could be otherwise. But, my

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[1] This story draws on what has sometimes become labeled material-semiotic or post actor-network theory sensibilities (Latour 1999; Law 1999; Mol 1999). This means that I am dealing with the ontological enactment and rhizomatic relations that enact or assemble absence. This also means that I focus on practices, and on relations without pre-formed ideas about where agency resides (Callon and Law 1995).

[2] I refer here to the constant theoretical work in STS to understand the politics of science and technology. For instance the debates on situated knowledges and standpoint theory (Haraway 1988; Harding 1991), the work to understand how objects are multiple and fractional (Mol 1999; 2002; Law 2002), and how we can use practice oriented techniques to understand ontologies are made (Woolgar and Pawluch 1985; Lynch 2013; Mol 1999). Building on this work I analyze the assembling of a specific ontological object, a pandemic, and perhaps more importantly for this paper—its absence.

[3] In STS our analytical tools direct us to follow our actors, to analyze the assembling of objects or ontologies. A library can be made of all the objects that STS has followed. We follow the making of facts (Latour and Woolgar 1986), electric cars (Callon 1986), bush pumps (de Laet and Mol 2000), atherosclerosis (Mol 1999), or disabilities (Moser 2006). We follow actors that are made weak (Galis and Lee 2014), objects that are undone (Latour 1996), objects that don't fit (Star 1990), and objects that are kept secret (Rappert 2010). This paper seeks to caringly and lovingly trouble this inclination to follow the actors' making of objects in STS.

[4] By introducing the concept of *ontological overflows* I want to draw attention to how certain objects are omitted—in practice—from the network, the rhizome. They are made absent from the enacted, multiple and fractional objects that are our interlocutors' matters of concern (cf. Latour 2004 on matters of concern). By paying attention to overflows as objects in themselves I want to shine light on what Lee and Brown (1994) have called "the undiscovered continent." They highlight the need for attending to the making of otherness—the things outside of the network. This is related to Latour's brief comments on "plasma"—the things that remain outside the network (Latour 2012; 2005). With the concept of *ontological overflows* the focus is on the practices of excluding and omitting objects, things, and people from the network.

[5] This blindness is related to Star's critique of the managerialism of ANT, but is also dissimilar from her interest in invisible work and how weak, or non-standard actors do not fit into ready-made categories (Star 1990; 1991). My argument is not about invisible work or things that do not fit, but rather about objects that fail to emerge as objects—the things that are abandoned by us and our interlocutors. The concept of ontological overflows is perhaps most closely related to Bowker's work on the exclusion of the Other in databases. In his work he builds on Derrida (1987) and emphasizes how "things that are bundled out" of databases and discourse (Bowker 2000, 659).

argument is, our stories are marked by a blindness that stems from following the eyes, hands, and actions of our interlocutors. Following what they are enacting, constructing, assembling. Where our interlocutors bravely go—we will surely follow.[6]

One consequence of this methodological reflex—following the eyes and hands of the actors we study—is that we take over our interlocutors' objects as our own. Their matters of concern becomes our matters of concern. In our stories, the assembling of objects—be they fractional, multiple, or enacted—are the center of attention. And in these stories we treat particular objects—the ones our interlocutors care for—as unstable and assembled. We have taken to heart that nature, society, actors, and agency are all radical achievements in practice. But the objects of our attention rarely varies: our enacted objects match those of our informants.[7]

The problem with this approach is that it takes for granted the question of which objects are being enacted. Our methods are fine-tuned to destabilize and trace the multiplicity and fractionality of the things that our interlocutors enact.[8] We treat nature, society, and agency as uncertain. But not our actors' matters of concern.

There are at least three problems that stem from this approach.

The first problem is methodological. Our methods leave as naturalized and stabilized all those things that are not elevated to matters of concern by the actors that we study. When we follow the assembling of an object—a pandemic, atherosclerosis, aircraft, bush pumps, music passion, or pulsars—we co-constitute a particular blindness. A blindness to the objects that do

[6] Mol succinctly summarizes how ontological politics emphasizes following the eyes and hands of actors: "This means that it no longer follows a gaze that tries to see objects but instead follows objects while they are being enacted in practice. So, the emphasis shifts. Instead of the observer's eyes, the practitioner's hands become the focus point of theorizing." (Mol 2002, 152)

[7] For instance sometimes we take algorithms as an analytical object out there, as a stabilized object with inherent qualities (F. Lee 2021a; Muniesa 2019).

[8] Law and Mol have also worked to trouble the stability of objects. Proposing new topologies to counter the reifying tendencies in the network metaphor (Mol and Law 1994). Also, in Law's *Aircraft Stories* he troubles the question of the absent in material semiotics. Tracing how absences are part of the present. Sometime these objects are assembled as present absences: the absent objects that actors assemble within the present objects (cf. Law 2002). In introducing ontological overflows I build on this theoretical and methodological work, but I want to push beyond the confines of the actors' matters of concern. Beyond following the hands and eyes of the actors. Ontological overflows are not about the fractional coherence or multiplicity of objects (Law 2002; Mol 2002). But about examining the omission and exclusion of objects, things, and people.

not become matters of concern for our interlocutors. Our matters of concern are constituted by the actors' matters of concern.[9]

The second problem is theoretical. In STS, we have learned to be agnostic to truth or falsity, nature and culture, as well as agency and intentionality.[10] But we are faithful in attending to our actors, to the matters of concern and enactments of our interlocutors. We do not venture in the "undiscovered continent" of action.[11] The methodological dictum to follow the actors is thus the foundation of a theoretical problem. Our analytical attention is narrowly constrained to that which the actors enact or assemble. Let the action lead the way. We follow the rails of the network, we map the territorialized spaces that our interlocutors have already colonialized. But we do not follow other lines of sight, other lines of flight.[12]

Our blindness to the things that do not become matters of concern has led to unease. We have troubled ourselves time and time again: What about the objects that do not fit in? The actors that are outside the Machiavellian networks of power? The actors and objects that are outside the confines of the network? The betrayed objects/actors? The absent presences? The plasma? The actors that are made powerless?[13] My argument is that we need to attend to these as *ontological overflows*.[14]

The third problem is empirical. In our analyses, how do we as analysts care for the many, many things that the actors do not concern themselves with, that they do not care for? The objects that remain at the edge of the actors' attention. That sometimes are not even

[9] Muniesa's (2019) incisive analysis of taking over the object-ness of algorithms from our informants is instructive in this regard. See also (F. Lee 2021a)
[10] See for instance Bloor (1976) for agnosticism to truth or falsity. Callon (1984) on nature and society, and Callon & Law (1995) for agnosticism about agency.
[11] See Lee and Brown (1994) on the undiscovered continent.
[12] Lee and Brown (1994) have discussed a related theoretical problem insightfully, in their "Otherness and the actor-network" where they discuss the relationship between actor-network theory and the smooth and striated spaces of Deleuze and Guattari's (1987) rhizomes.
[13] On Macchiavellianism see Star (1990); on betrayal and absent presences see Law (1997; 2002); on plasma see Latour (2005; 2012); on weak actors see Galis and Lee (2014).
[14] The concept of ontological overflows that I introduce here is different than Callon's (1998) work on framing and overflowing in economic negotiations. Both versions of overflow have a similar starting point: some things are outside the network, or in Callon's terms outside the "frame." Callon draws on Goffman's (1986) theatrical metaphors to discuss how frames and overflows in economic negotiations happen. However, Callon's interest in overflows lies in how "economic externalities" that are seen as being outside the market are brought into the "frame" of economics through identification and measurement of these overflows. He is thus primarily interested in the *constitution* of the network and how externalities are brought into the frame. Ontological overflows points in the other direction, where Callon seeks to highlights processes of how the excluded is brought into the fold and *stabilized*, I want to highlight how the excluded is removed from the network and *destabilized*.

assembled as objects in their own right. The things that are absent from the minds, eyes, and hands of our interlocutors. These objects are never attended to in their own right, but rather are made as *ontological overflows* from the practices of assembling the matters of concern. Our interlocutors' actions stay steadily focused on the object at hand—and consequently our analyses do too.

In this article, I want to ask what would happen if we freed our analytical gaze from the actors' eyes and hands? Looked the other way? What would happen if we started to pay attention to the ontological overflows, the objects being assembled at the edge of the rhizome? Outside the highly territorialized rails of the network. In the plasma. Would we manage to tell stories about othering and alterity? How marginalized objects or people are un-made? How things are un-made that have a tenuous grip on object-ness? Would we be able to trace a politics of the absent? What would happen if we made room for the *overflows* of our constantly ongoing ontological politics?

My overarching aim here is to join the work of decentering agency and objects in STS. In STS, we have gone from perspectivalism to ontological politics, from Machiavellian actors to hybrid collectives and modes of ordering, from stabilizing facts and artefacts to fractionalized, fluid, and multiple objects. From stabilizing facts to tracing "indeterminacy, uncertainty, and disorder."[15]

This text thus is about politics and power in science and technology. It is about tenuous objects, and the ontological politics on the sidelines of enactment. It is about ontological overflows.

The story begins: the Zika pandemic, the Rio Olympic Games, and the ECDC

This article tells a story about the assembling of a pandemic (cf. also F. Lee 2021a; 2021b). It is a story about how the Zika pandemic of the mid 2010s was assembled; and in particular how the *absence-of-Zika* was composed in various situations. Our object of interest is the *ontological overflows* from producing a pandemic. Thus, it is a story about how *absence-of-*

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[15] On ontological politics: (Strathern 1992; Mol 1999); On Machiavellianism, hybrid collectives, and modes of ordering: (Star 1990; Law 1994; Callon and Law 1995); on the move from stabilizing facts to fractionality, fluidity, and multiplicity: (Latour and Woolgar 1986; Mol and Law 1994; de Laet and Mol 2000; Law 2002); On indeterminacy, uncertainty and disorder: (Vogel et al. 2021, 4).

Zika was put together in various practices, in various places and times, through various human and more-than-human actors. It is also a story about the multiple practices and multiple versions of absence. And in these multiple practices, the absence of Zika was performed by an assemblage of humas, algorithms, databases, satellites, climate data, signal processing and computational models. *This is a story that traces the multiple versions of absence that are assembled into a coherence.*

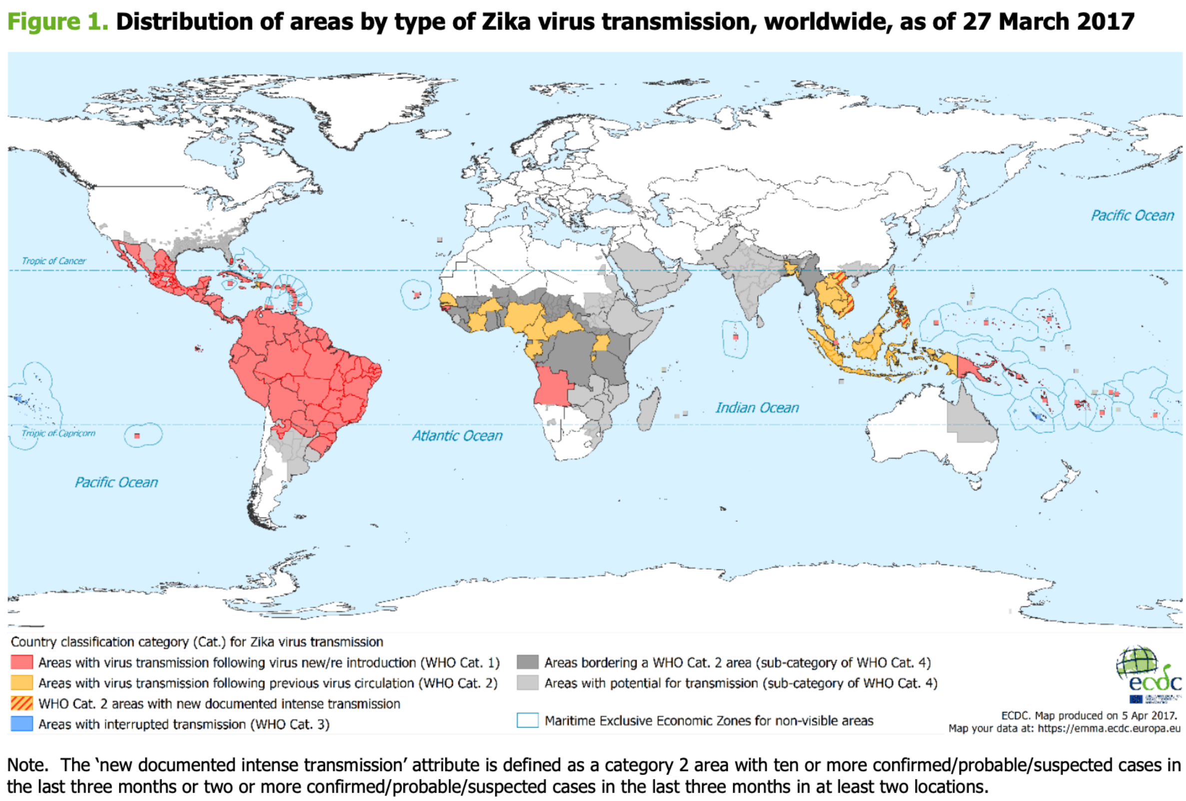

Figure 1. Worldwid Zika Virus Transmission 27 March 2017 (European Centre for Disease Prevention and Control 2017)

In the case of a pandemic, the presence of disease is the main matter of concern: counting cases, making maps of the disease, making epidemic curves, assessing risks (F. Lee 2021a). But in all this making of presence, there are a multitude of ontological overflows. Here we attend to some of these overflows by tracing the making of a multiplicity of absences. There are multiple, perhaps even innumerable versions of absence at play in assembling absence-of-Zika: absence of cases, absence of data, absence of Zika transmission risk, absence of the disease vector—the *Aedes aegypti* mosquito—and absence of prediction. As I show below, all of these absences are assembled into a coherence in practice: absence-of-Zika.

This story starts at the European Centre for Disease Control and Prevention, the ECDC, in January 2017. During this time period the fear of widespread Zika transmission in Europe was still tangible (see figure 2 below). The ECDC published weekly updates about the number of cases, and there was a palpable fear that the ongoing Zika epidemic would become a pandemic following the Olympic Summer Games in Rio de Janeiro in August of 2016.

The number of Zika cases in the EU peaked in conjunction with the Olympic games. During the peak, the number of cases in the EU were counted in the hundreds. The fear was that the disease would become locally spread in the EU and not just transmitted in conjunction with travel to countries where Zika was already endemic, like Brazil. The fear was that Zika would become widespread in Europe—transmitting sexually, from mother to child, and via mosquitos. This was partly due to the fact that Zika is transmitted by the mosquito *Aedes aegypti,* also known as the Yellow Fever Mosquito, whose range is limited in Europe, but also an increasing fear that the Zika could be transmitted by the related Asian Tiger Mosquito—the *Aedes albopictus*—whose range extends over much of Mediterranean Europe.

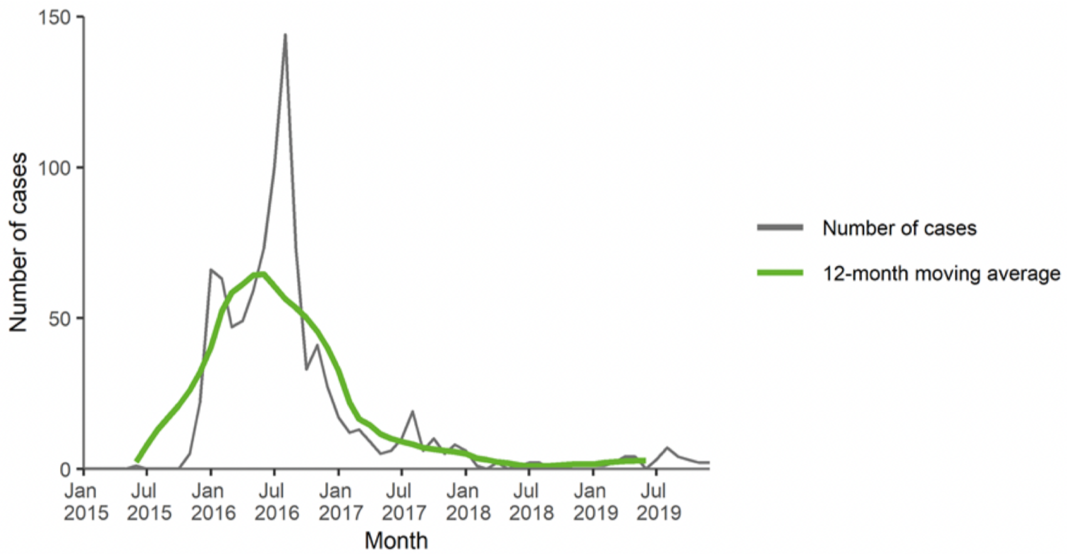

Figure 2. Zika virus cases by month in the EU from 2015 to 2019 (European Centre for Disease Prevention and Control 2021, 3).

Tracing the assembling of a pandemic

We enter this story during my fieldwork at the ECDC. The story then branches out into relations to algorithms, computations and infrastructures that stretches out in faraway times and places: into scientific laboratories, into jungle expeditions, even leaving earth to journey into satellites in space.

My fieldwork was part of a larger project which examined how new information infrastructures become part of disease surveillance. The project started in 2015 with a preliminary study into so-called infodemiology, the use of various information infrastructures to track disease, but the fieldwork that this article draws on started in 2017 at the ECDC, and continued with various degrees of intensity until 2021, with the aim of investigating the use of information infrastructures in disease surveillance. An important point of departure being that a pandemic is assembled in many ways, using various infrastructures and tools, and many different types of data.

Accordingly, tracing disease implicates an abundance of human and non-human actors: such as experts on epidemiology, virology, or medicine. Technologies of disease tracking, such as pathogens, viruses, and bacteria. Animal disease vectors such as mosquitoes, bats, birds, or livestock. Tracing disease through these more than human relations fosters a practice of constant and eclectic experimentation in the practices of disease surveillance. Any conceivable resource available is harnessed to track down pathogens, disease vectors, and bring outbreaks under control. The work of disease surveillance is truly wide-ranging drawing on any available resources that to attempt to trace the sources of an outbreak.

As a consequence of the rhizomatic characteristic of disease surveillance, the fieldwork strategy was by necessity one of multi-sited ethnography. This strategy puts the objects of investigation in focus over the site of fieldwork, tracing the action into the world system (Marcus 1995). This strategy meant that I shadowed the making of various disease outbreaks through practices and infrastructures, as well as human and more-than-human actors (Latour 1987).

My fieldwork pursued an array of information infrastructures that were harnessed to surveil the world for disease outbreaks. It came to explore news surveillance, genetic tracking of disease, algorithms for visualizing pandemics, and the use of social media, such as Twitter or TripAdvisor to find sources of disease. Where my informants and the infrastructural assemblage led, I followed—like a faithful material semiotician. But, during the fieldwork I came to increasingly ask, what happens at the edge of the pandemic, outside of the web of established practices, matters of concern, and taken-for-granted objects? What about the *ontological overflows*?

As a consequence the materials collected were heterogeneous and included fieldwork observations, document analysis, and interviews. In engaging with the enactment of disease outbreaks I came to follow these assemblages through a variety of places, situations, and materials.

The starting point for the fieldwork at the ECDC was three weeks of participant observation, and six months of less intense meeting participation, interviews, and document studies. During the three-week startup period I worked in the epidemic intelligence team. This team was tasked with surveilling the informational world for new disease outbreaks, and used various informational resources to scour the news media, twitter, and reports from other disease surveillance organizations. All with the intent to find the next disease outbreak. After my period in the epidemic intelligence team, I studied the work of the genetics team and genetic disease surveillance (F. Lee 2021b). In sum I followed the assembling of disease outbreaks through interviews, in meetings, by participating in staff training, as well as by studying reports, publications, and news of different disease outbreaks.

Consequently, the fieldwork at the ECDC only provided a starting point for understanding the assembling of disease outbreaks. To understand the infrastructural rhizome and the infrastructural work that was being done, it was necessary to follow the assemblage to other places and times. For instance, the analysis of models led to different research institutions to follow how the models harnessed particular mathematical models, satellite imagery, and climate models, and so on. This work continued after the fieldwork proper, with additional document studies being done as late as 2021. In sum, I traced the assembling of disease outbreaks through a multiplicity of places branching out from particular rooms in the global disease surveillance apparatus to infrastructures stretching far away and back in time: into satellites in space, into 19th century climate classifications, and into jungle expeditions to capture the infamous *Aedes aegypti* mosquito.

This article drills down in a small subset of these branchings, to highlight how the absence-of-Zika, the white area on the global Zika map, was enacted. Our story starts at a meeting at the

ECDC and branches out into an analysis of various infrastructures, to understand how the absence of Zika was assembled as a coherence.

Multiplicities of absence: the real, the vacant, the virtual, the fake, and the blank

In assembling a disease outbreak, the absence of disease is produced at the same time as its presence. This does not mean that absence is a mirror image, and it does not mean that absence is relational to presence in any straightforward way. The making of the absence-of-Zika is both parallel and not parallel to the making of presence-of-Zika. Absence is its own relational object—assembled through its own multitude of relations. Thus, absence and presence of an epidemic, or potentially any object, are not two sides of a coin but are produced as a series of rhizomatic human and more-than-human relations. Sometimes versions of absence create boundaries around the Zika outbreak and sometimes versions of absence are folded into the presence of the outbreak (cf. Law 2002).

Below we follow how absence-of-Zika is assembled by tacking together several different versions of absence.

The first version of absence is assembled by counting confirmed cases—"zero confirmed cases of disease"—which is perhaps the mode of enacting the absence of a disease outbreak that is most common. The second version of absence is "no data," and encompasses those times and places where no data is available; not an unusual state of the world when you are tracking a pandemic. The third version is about calculating the risk of transmission, and deals with the practices of computer modelling to predict the risk of the disease vector: "the risk models show no potential for Zika transmission here." The fourth version is absence of prediction. And the fifth enactment deals with the simulation of the absence of the disease vector that is then used as an input to the risk model, what the actors call "simulated pseudo absence."

Consequently, when tracing the making of absence in practice, the absence-of-Zika multiplies into a multitude. Different things, different absences, are lumped together with the consequence of creating new zones of Zika risk. These absences have many different qualities, which are amalgamated in practice. Below we follow a number of empirical moments where the-absence-of-Zika is enacted in different manners.

The real: cases—confirmed, suspected, and otherwise

Counting disease cases in space and time is completely central to disease surveillance. A large amount of work goes into finding and counting cases at the ECDC. During my period of fieldwork in the epidemic intelligence team, each morning started with the team updating the case counts of the diseases that we were currently tracking: Zika, Yellow Fever, and Chikungunya in Brazil. The Plague in Madagascar. Legionella in Dubai. Salmonella in Europe. The mundane work entailed checking the published number of laboratory confirmed cases on the websites of different CDC organizations around the globe. It also entailed scouring news reports, databases, and epidemiological email lists connecting various actors in disease surveillance for emerging disease outbreaks. The number of cases of Zika both in the EU and globally were treated with solemn importance (see fig. 3).

However, my informants' minds and hands—and therefore my eyes and hands—were focused on enacting the *presence* of a Zika outbreak. My informants attention and work, the searching eyes and hands of disease surveillance globally, were trained on the presence of cases. And my attention, alongside theirs was likewise focused on the same thing.

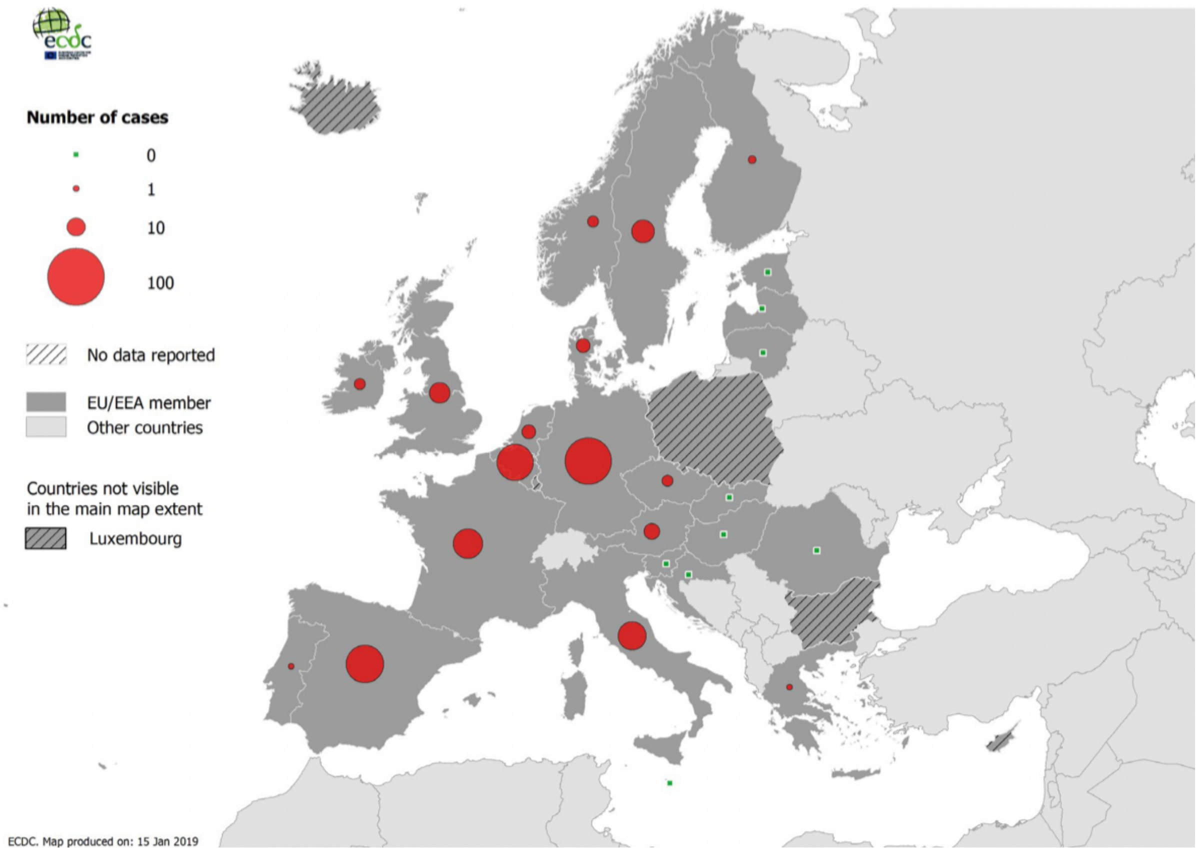

Figure 3. Zika virus cases in the EU in 2017 (European Centre for Disease Prevention and Control 2019, 3)

However, in order to be counted as a disease case, the case in question needed to become a confirmed case. Either by the epidemic intelligence team using websites that were deemed trustworthy, such as the Brazilian CDC—which was seen as a high quality source, or the case needed to be ascertained by communication with relevant authorities. This could entail checking uncertain case numbers by following up with emails or calls to confirm their laboratory status. A confirmed case was a number that was constructed by lots of work in laboratories, clinics, government agencies. For a case to become counted—a certified case of Zika—it needed to become confirmed. If it had not been confirmed yet it was put in a different category, and instead joined the group of suspected, but unconfirmed, cases. At the ECDC, the unconfirmed cases were sometimes counted in the assessments of the development of disease, but always with an eye toward answering the question: "Is it *confirmed"* (cf. Martin and Lynch 2009)?

Thus, confirming a Zika case demanded work. To produce a confirmed case of Zika meant confirming the disease in bodily fluids, rather than just relying on a symptomatic diagnosis. Making a confirmed case built on detecting the disease by different methods in different body fluids—in serum or plasma, in saliva, in urine, or in semen. The timing of the tests was also important. In the beginning of the onset of Zika symptoms certain methods were seen as reliable, while later on in the disease onset, other types of tests were seen as effective (see Fig 4 below). For example, in the acute phase of Zika, during the first five days of symptoms, PCR tests using genetic technologies were seen as dependable, while during the convalescent phase serology using antibodies were seen as more optimal.

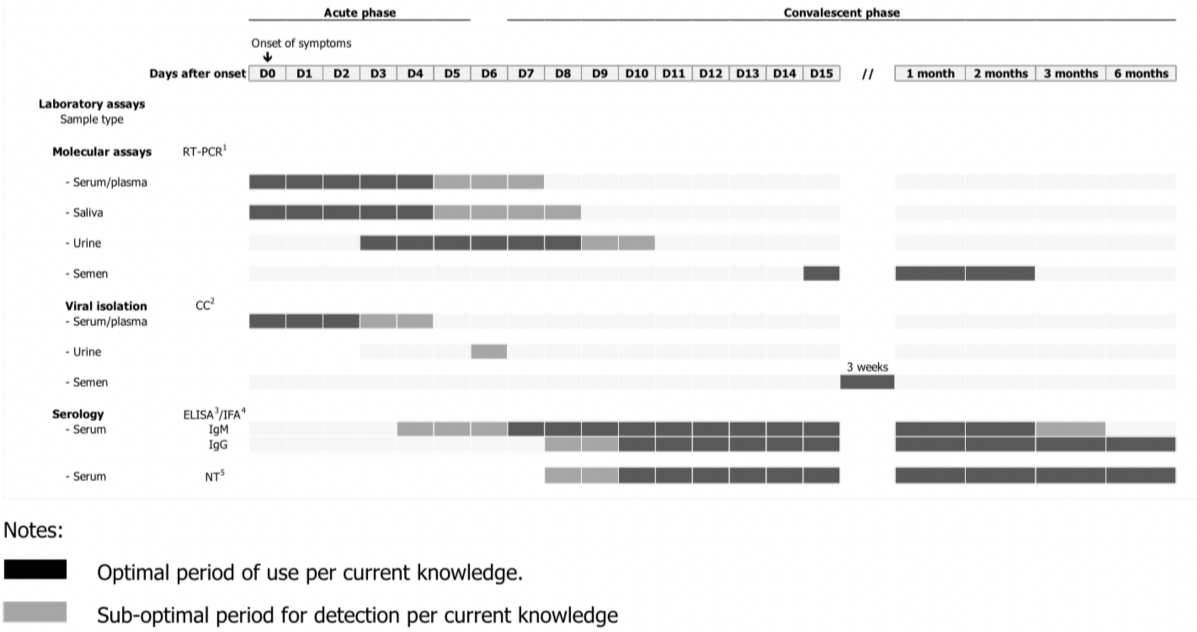

Fig. 4. Timeline of the optimal periods of use for different test types. (European Centre for Disease Prevention and Control 2016, 4)

If we return to absence, the absence of cases was produced in parallel to the confirmed and suspected case numbers. Sometimes the unconfirmed cases were counted as "zero cases"—they were folded into absence-of-Zika. That is, sometimes suspected cases were included in absence-of-Zika, but sometimes they were counted as a case. The inclusion or exclusion of a case in Zika-presence or Zika-absence depended on the situation and how the numbers were to be used. The number of non-confirmed cases in the steady stream of information that entered the ECDC were discussed and tracked, they were the source of questions and worries, but it was the confirmed cases that were most often enacted as real cases, while suspected and unconfirmed cases became part of Zika-absence. When the cases became classified as ∅, as not-case, they thus became part of the *ontological overflow*, where my interlocutors' and my hands and eyes were not trained.

However, even confirmed cases were enacted as not-cases at certain points in time. For instance, when so-called travel-related cases of Zika —when someone had contracted the disease outside their home country—were counted they were sometimes argued to be more appropriately seen as non-cases—as they weren't seen as showing *endemic*—local—spread of Zika. This was for instance the case in an instance when cases were to be counted in Pakistan: Actors in the WHO argued that two travel related cases of Zika were to be counted as cases, and therefore they would show active spread of Zika in Pakistan on the Zika world map.

While actors in the ECDC argued that it was absurd to count two travel-related cases toward "active spread" in that region (cf. F. Lee 2021a).

The status of the cases, and their counting constantly being negotiated and decided in practice.

As a consequence, the counting of cases, and the enactment of presence and absence of Zika was not straightforward, and multiple versions of presence or absence of cases a were constantly negotiated. Was it a suspected case? Was it laboratory confirmed? Was it travel related? Should it count in assembling the outbreak? Or was it a non-case? These questions were constantly navigated by the actors at the ECDC. There was always room for negotiation, doubt, and assessment of trust (cf. Garfinkel 1963). The presence or absence of Zika cases always needing to be enacted in practice.

The vacant: absence of data

This brings us to another absence: the absence of data. If you revisit figure 3, you will see that certain countries on the map are striped, which denotes "no data reported." Another absence of Zika. We start tracing the making of this version of absence at a meeting that occurred during my fieldwork at the ECDC. I joined my informants Thomas and Bertrand in a meeting where they were discussing what they had dubbed "the Zika algorithm" (See F. Lee 2021a). Thomas and Bertrand had been discussing how to construct an algorithm to automate the production of the global map of the Zika pandemic. At the time, the ECDC published the Zika map on a weekly basis. And it took time and resources for the epidemic intelligence team to update it. So for Bertrand and Thomas the algorithmic automation made sense in the long term, but it also led to a lot of challenges.

At the time of the meeting, Bertrand had been working for months to create the Zika algorithm, and different CDC organizations around the world had expressed interest in implementing this new algorithmic methodology. It would be a load off the epidemic intelligence team to automate the process. Assembling an outbreak takes a lot of work.

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Thomas and me are looking at the large wall screen where Bertrand is displaying several excel tables of cases and flowcharts of the Zika algorithms. He clicks between the tabs in the excel database. Thomas and Bertrand are discussing how to automate the global Zika map. They are in agreement, and seem to think almost everything about the automation is straightforward. I'm trying to keep up. However, at one point in going through the database, Thomas brings up the example of Chad, one of the poorest countries in the world.

"There is no data from Chad." Thomas tells me.

What Thomas is pointing out is that the absence of data creates a blind spot in the surveillance system. Chad is said to be such an epidemiological blind spot. Regardless of the quality of the Zika algorithm, the rigor of case definitions, and the depth of expert judgment—certain places don't have good disease surveillance data. (Fieldnotes from the ECDC)

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Our second version of absence thus concerns data absences. Another challenge in surveilling the world for disease. How to deal with those areas of the world—like Chad—that don't have data? As we can see in the map below (See Fig. 5), northern Chad was classified as having no Zika risk. White, just as, for instance, southern France. However, in contrast to Chad, France is seen as having good surveillance data. But they are still both white spots on the map. They both show an absence of Zika.

Fig. 5. Crop of the Current Zika State as published on the website of the European Center for Disease Control and Prevention on 29 Aug 2017

Thus, Chad and France are both classified as having no Zika risk. White denoting "Zika absence." The algorithm that Bertrand and Thomas are constructing lumps together a literal white spot on the map—"no data"—with countries that report zero cases. "No data" is thus classified in the same category as "zero confirmed cases of Zika." Absence of data about Zika becomes equated with no confirmed disease cases.

Two absences coalesce into one. Data absence becoming an ontological overflow which disappears from this enactment of the Zika pandemic.

The virtual: modelling absence of Zika risk

But more intricacies in the assembling of the absence-of-Zika emerge here. If we return to the map in Figure 5, we can note that southern Chad—which has no surveillance data—is tinted grey by the Zika algorithm, nevertheless indicating that there is a risk of transmission of Zika. However, the grey color, rather than being based on counting confirmed cases in time and space, is based on several different resources: statistical modelling of the disease vector's habitat, the spread of the dengue disease, a world climate classification born in 1884, satellite climate imaging, entomological literature about mosquito presence, and mosquito traps around the world (cf. F. Lee 2021a).

But that also means that the white category—the-absence-of-Zika—includes all those resources to produce the absence of Zika risk. The absence of Zika not only contains absence of laboratory confirmed cases or the absence of disease surveillance data. The absence-of-Zika also encompasses modelled Zika absence.

Absence of Zika multiplies again.

This version of absence builds on the modelled "absence of Zika risk" which draws in a multitude of computational and classificatory resources. The Zika map is assembled based on a model of the *Aedes aegypti* mosquito, on a model of the transmission of dengue fever, as well as a global climate classification. Here, the Zika algorithm pulls in other computations, models, classifications, and datasets—to model the absence of Zika risk.

My informants' understanding of mosquitos, and particularly the *Aedes aegypti* species, is key to understanding this flurry of risk computation (see fig 6 below). Apart from sexual transmission and transmission from mother to child, Zika is understood to be transmitted by the *Aedes aegypti*.[16] The risk for disease transmission—or the absence of transmission—is built on this assumption.

[16] At the time, there was some doubt if its cousin, the *Aedes albopictus* mosquito, was a competent vector.

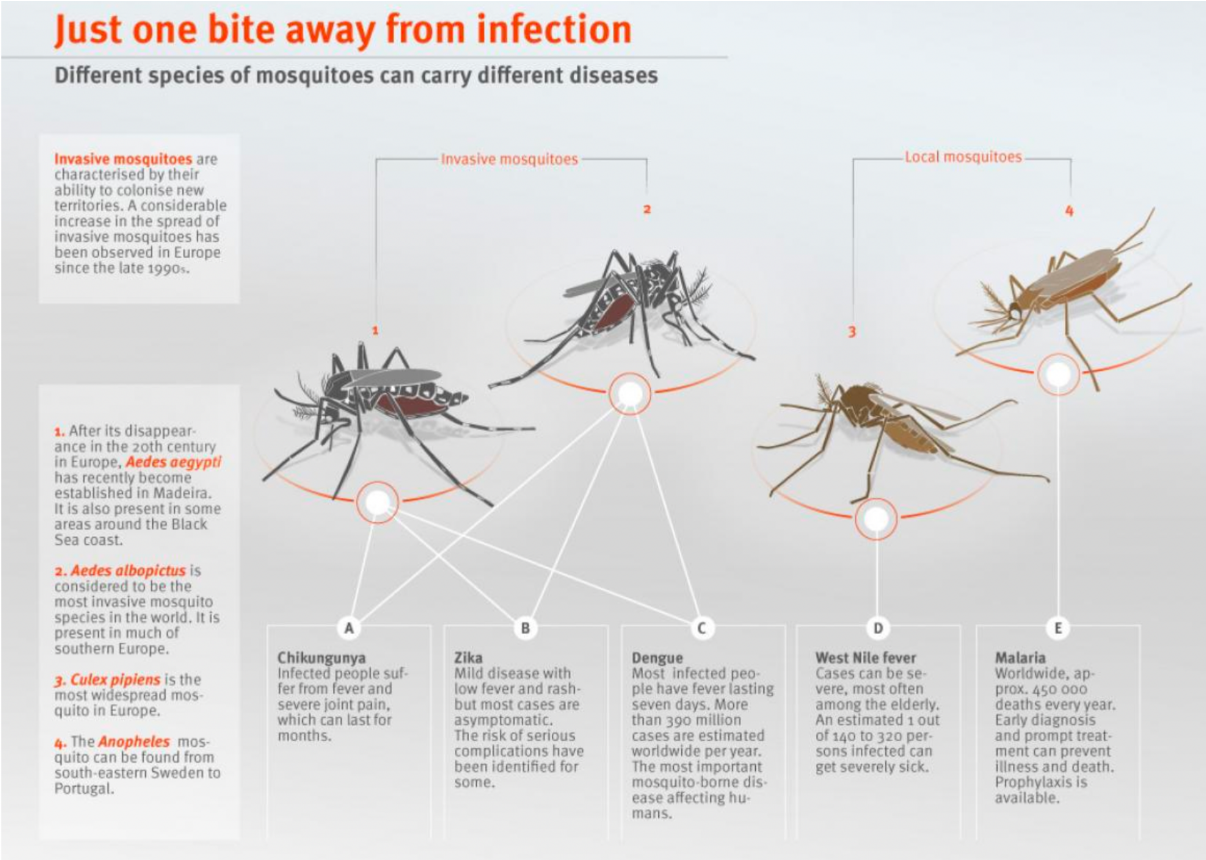

Fig 6. Infographic from the ECDC ("Mosquito-Borne Diseases: An Emerging Threat" 2014).

One layer of the mosquito risk modelling that is included in the Zika map, is the so-called Köppen-Geiger global climate classification map, which was first created in 1884, and has been updated over the years. The version used in assembling the Zika map was updated in 2007 (Peel, Finlayson, and McMahon 2007). The Köppen-Geiger classification divides the world into climate zones (see fig. 7) based on for example temperature and rainfall. And by drawing in the Köppen-Geiger map, the assembled ECDC Zika risk map includes assumptions about mosquitos thriving in certain climate zones. The assumption is that Zika risk exists where the climate zones are amenable for certain types of mosquitos.

On the map of Zika risk in figure 5, we can observe that the risk for Zika in Chad follows the boundary between the red and orange climate zones in the Köppen-Geiger map below (figure 7). The absence of Zika risk thus includes a particular climate classification.

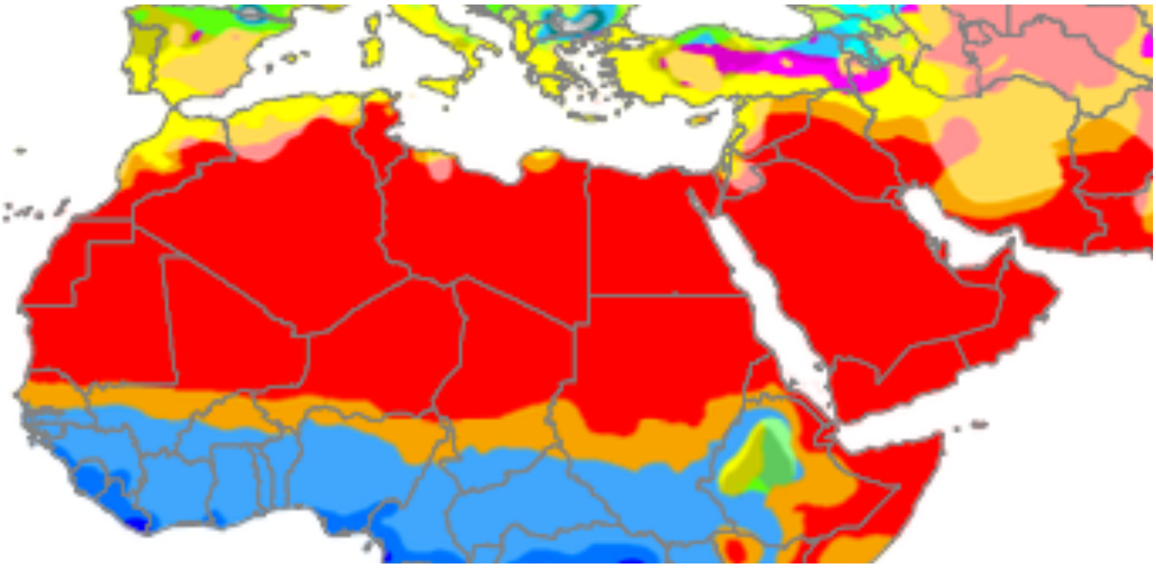

Fig 7. Köppen Geiger map updated by Peel

But the multiplicity of absence of Zika risk does not end there, the modelled risk of Zika transmission—and its absence—also includes two computational models.

Bertrand and Thomas had decided to include 1) a model of the geographical range of the *Aedes aegypti* and 2) a model of Dengue fever risk in the Zika risk computation. The first model aimed to compute the presence of the *Aedes aegypti* mosquito, and the second attempted to compute the risk of Dengue fever, which is transmitted by the same mosquitos as Zika. These two maps were layered with the Köppen-Geiger map to produce the map of Zika risk. But then also of absence of Zika risk. In Figure 8 we can see the *Aedes aegypti* model in action (on the left), and the overlaying of the Köppen-Geiger map with the *Aedes aegypti* model (on the right).

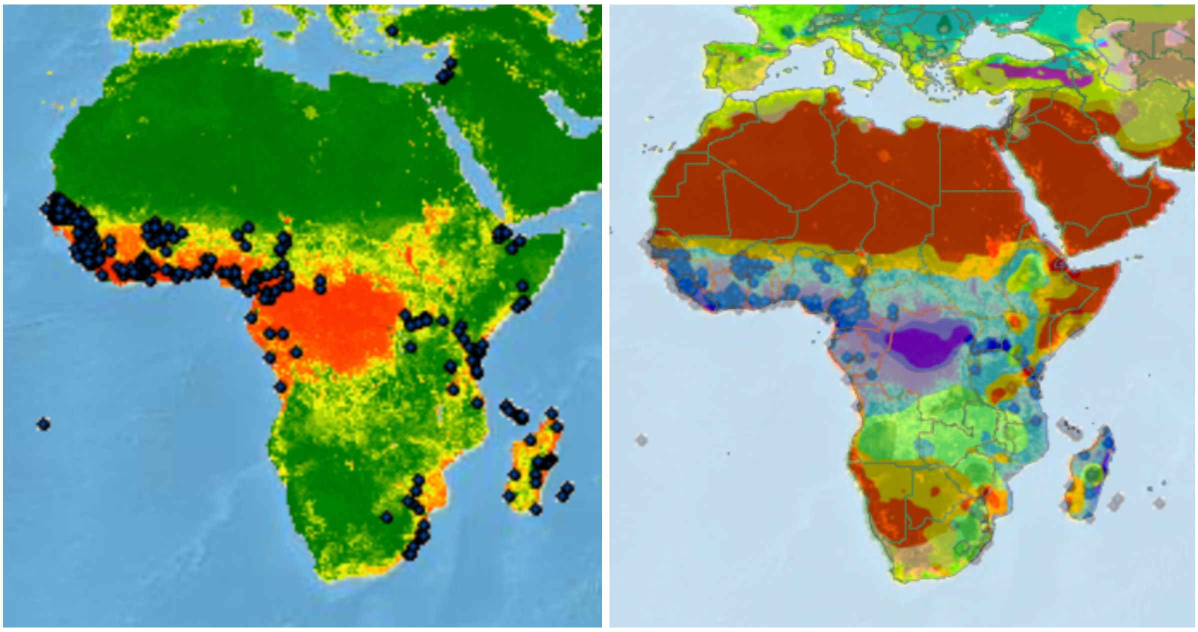

Fig 8. Aedes model 2017-09-21 kl. 10.51.39

The two risk models were produced by a group of geographical risk modelers at Oxford university. These modelers combined climate data with mosquito sightings in order to model risk. Thus, they used mathematical and statistical methods to predict for example where the *Aedes aegypti* roams, where the *Aedes albopictus* thrives, and, in line with how the transmission risk was understood, where the risk of Dengue and Zika transmission existed.

The *Aedes aegypti* model and Dengue model were closely intertwined with each other, and built on the same type of modelling and drew on the same sets of data. The two different maps were produced using the same general methodology and data sources.

First, produced datasets on the presence of the mosquitos by compiling the geographical locations where they had been found. In the case of the *Aedes aegypti* maps the modelers used several strategies. One strategy was to create a bespoke database using published literature in PubMed, Web of Science, and Promed. The literature was used to produce presence points and areas: "5 467 geo-located point records and 571 geo-located polygon records were obtained" (Hay and Rogers 2012, 5). The modelers also used older databases and maps produced by the ECDC, the US CDC, as well as the modelers private records.[17]

[17] These different data sets were produced in various times and places, by various actors: The publications that were harvested were published between 1960 and 2009, one of *Aedes aegypti* maps was from 1965, and another one was from 2008. In the case of Dengue the team used a pre-existing Dengue database of points and polygons made from published literature, which they complemented with new literature searches.

The modelers also drew on geographical data about environment, climate, geography, and population. They pulled in data from the so-called MODIS instrument, the Moderate Resolution Imaging Spectroradiometer, from a satellite called Terra, meteorological data from meteorological stations contained in the WORLDCLIM database; climate models from the Hadley Centre, called HADCM3 and a global climate model GCM, which is used by the IPCC; also a dataset of population density was used from the Global Rural-Urban Mapping Project. The data was mathematically transformed, using Fourier transformation, into cyclical wave forms that could be correlated with the presence of the mosquitos.

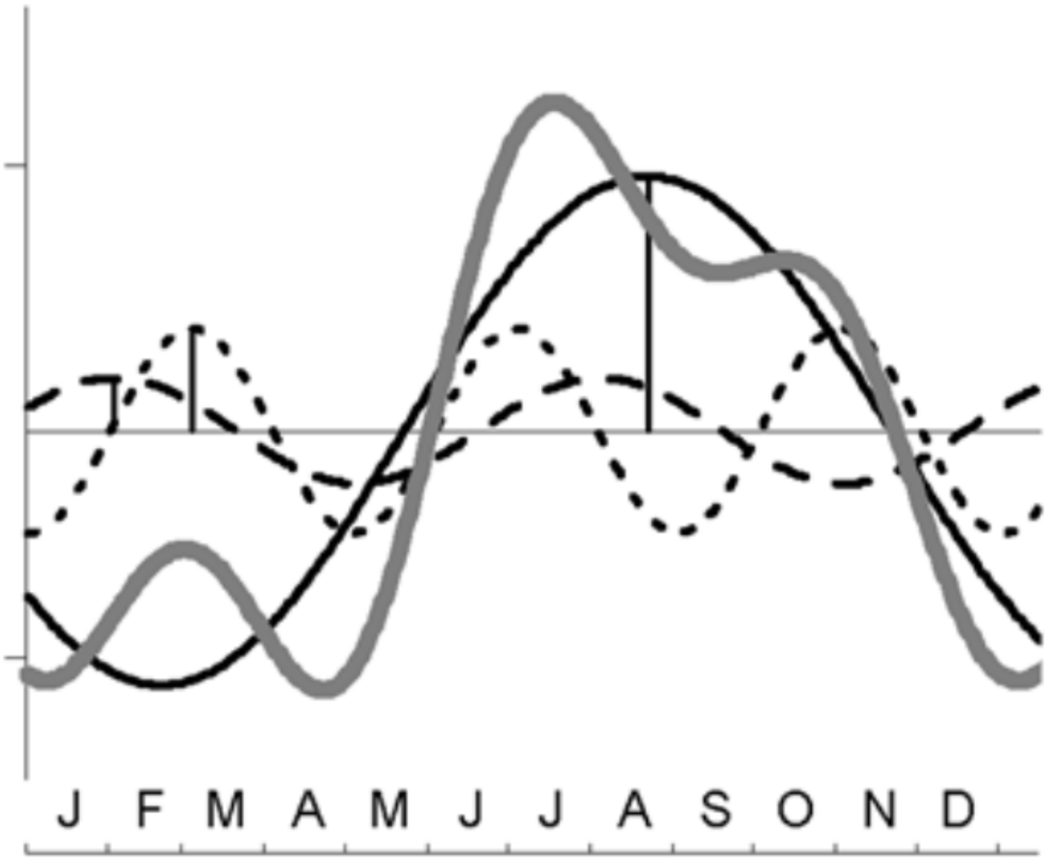

Fig 9. Example of fourier transformed climate data from (Scharlemann et al. 2008)

The maps resulting from all of these modelling endeavors were used to calculate the risk of Zika. Thus, the white area in northern Chad not only contains the absence of cases or the absence of data. It also contains the computed absence of risk for Zika transmission.

Absence multiplies again.

The fake: computing pseudo absence points

However, knowing where the mosquito roam is a difficult proposition on a global scale. It depends on a web of practices that attempt to observe mosquitos in different habitats, in different countries, and in different times. Mosquitos, an increasingly worrying vector for disease in the northern part of the world have been the bane of many tropical countries for centuries. As mosquito species such as the *Aedes aegypti* and *Aedes albopictus* have started to become prevalent (again in some cases) in Europe and the USA, the surveillance of these so-called invasive mosquito species has increased in importance in Europe.

We have more versions of absence here. The surveillance of the *Aedes* mosquitos in Europe is not the same everywhere. In some places there is ongoing surveillance, in some places there is no surveillance, and in some places there is no data, and in some places it is unknown (see fig. 11).

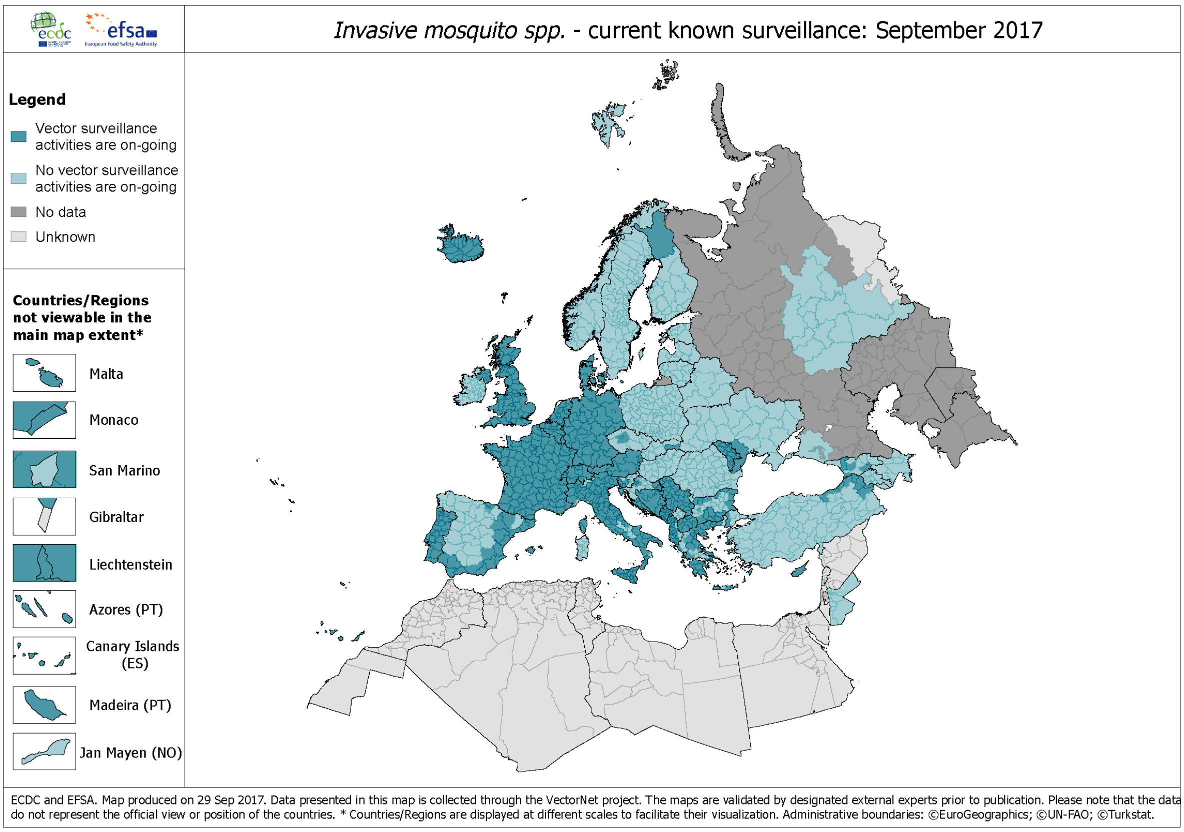

Fig 11. ("Invasive Mosquito Spp. - Current Known Surveillance: September 2017" 2017)

In European mosquito surveillance we can observe a number of familiar absences, but also new ones: absence of surveillance, similar to Chad's absence of case-data; absence of data about ongoing surveillance; and "unknown." This points to the enormous undertaking of predicting the risk for disease transmission based on the presence of mosquitos. As we have seen above, the modelers use any resource they can to find the presence of these mosquitos.

In addition, disease specialists and entomologists rarely record absences of mosquitos—for example of the *Aedes* mosquitos. As the Oxford modelers state in one of their reports: "Databases only rarely record [mosquito] absences, and rarely a sufficient number of them" (Hay and Rogers, 2012: 6).

The missing data on mosquito absence was a problem for the modelers when they constructed their model of Zika risk. And it is a difficult problem to solve, as determining mosquito presence or absence is resource intensive. That is, going to an area of the world with a mosquito trap, harvesting the trap, and identifying and counting the mosquitos is not a small undertaking.

The Oxford modelers solution to the missing data on mosquito absence is to produce simulated mosquito absence points, what they called "pseudo-absence points" which were "generated from the presence data" (Hay and Rogers, 2012: 6). The generation of pseudo-absence points means that, to solve the problem of the missing mosquito absence data, the Oxford team used the data on where mosquitos have been found to simulate the absence of these same mosquitos. Simulated absence. These pseudo-absence points were calculated using geographical distance and a computed "environmental distance" based on the statistical calculation of what is called Mahalanobis distance.[18] The modelers then used the simulated pseudo absence points as inputs to the risk model that produced the risk map of Dengue as well as Aedes aegypti.

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[18] Mahalanobis distance is a statistical calculation that can be used to calculate the distance between clusters of data rather than just the distance between singular points, and is in this case used to calculate the environmental distance between different points.

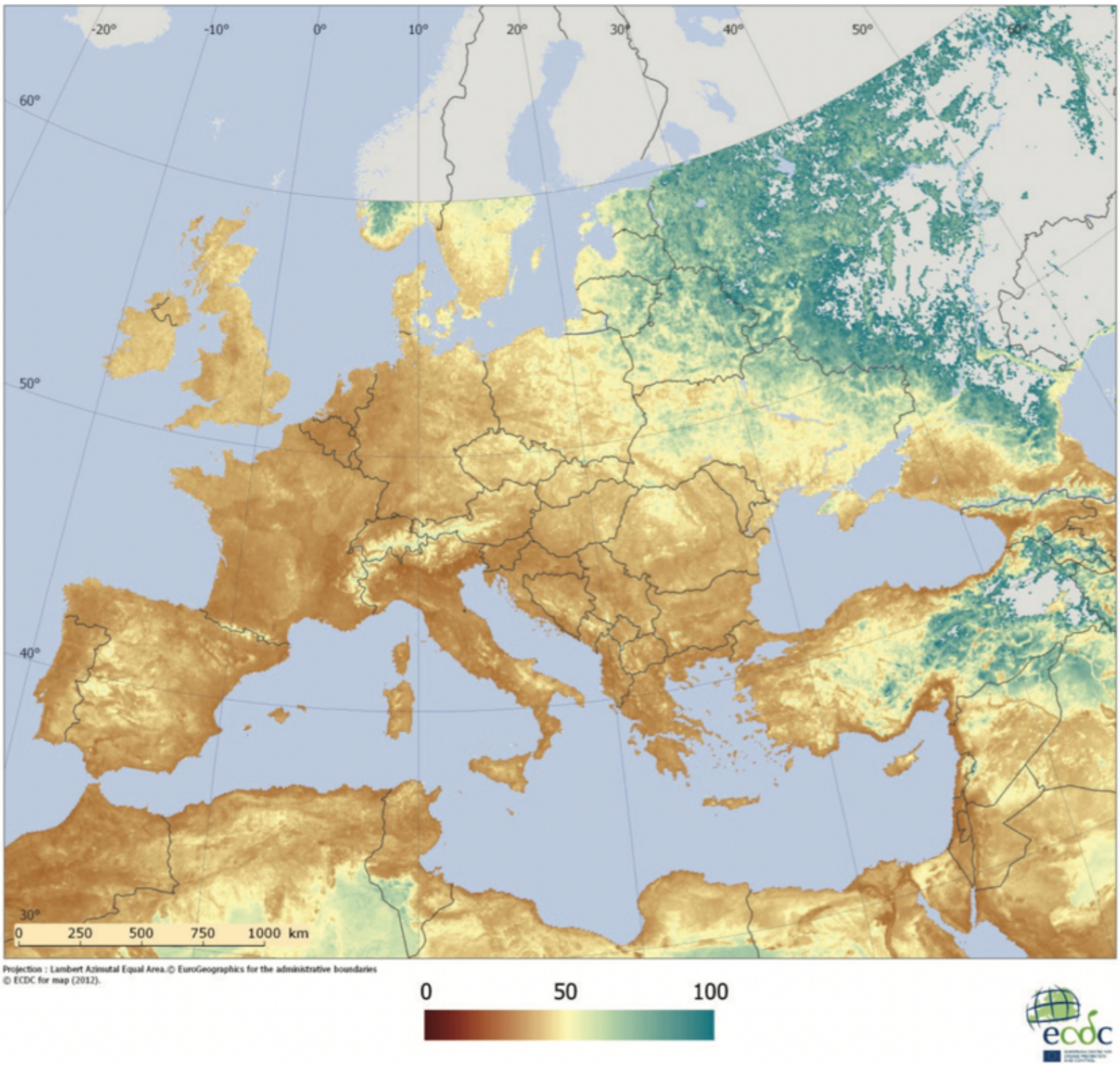

Fig 12. The calculated Mahalanobis distance between different areas in Europe. "[T]he […] image shows how far each point is in environmental, rather than geographic space from any presence area." (Hay and Rogers 2012, 12).

Thus another absence—simulated absence—was folded into the others. Hence, the absence of Zika included modeled absence of *Aedes aegypti* on two levels: pseudo absence of the *Aedes aegypti* as input to the model *and* simulated absence of Zika risk as output.

A veritable multitude of absences.

The blank: absence of prediction

But the multiplicity of absence does not end here. In the absence of Zika is also included another absence: the absence of prediction. This version of absence is not about missing cases, missing data, or modelled absence of risk, but about the risk prediction models predicting neither absence nor presence. For instance, in the Dengue model the absence of prediction looks like below (fig. 10).

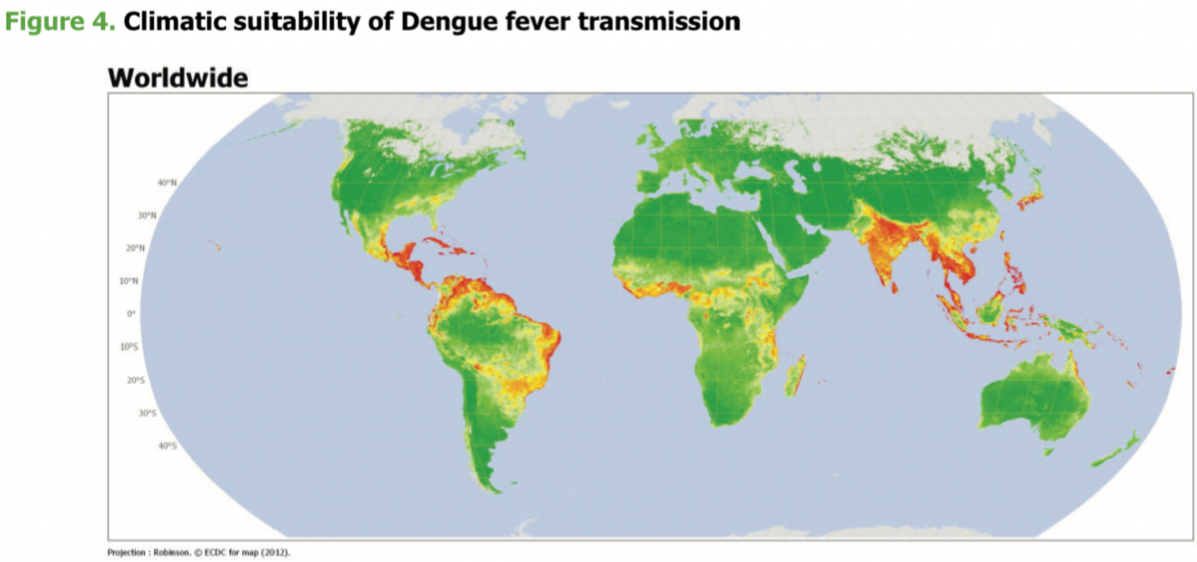

Fig 10. Climactic suitability of Dengue fever transmission (Hay and Rogers 2012, 10)

The reason for what the modelers dub “no prediction” is given in another paper attempting to predict the habitat of the Tsetse fly, which emphasizes that all environmental conditions will not have been captured by the model, and that when the environment is too different, they prefer creating a category of “no prediction:”

> Mapped outputs record the similarity of each pixel in an entire set of satellite images to the satellite-determined environmental characteristics of the training set sites. Obviously for this to be successful *the training set should have captured the entire range of conditions present throughout the area for which predictions will eventually be made. This is not always the case, and it is then preferable to identify in the output image a separate category of “no prediction”* for those areas where the environmental conditions are some specific minimum distance (in multivariate space) away from any of the training set clusters (Rogers and Robinson 2004, 144. My emphasis).

This means that the training set, that is the data about where the *Aedes* mosquito roams, does not encompass certain environments on the globe.

Further absences become part of the absence of Zika. There are also limits to which satellite data is deemed interesting by the modelers. For the Dengue fever model no climate data were downloaded above 90°N and below 60°S, which is visible as a sharp line cutting through the northern part of the world. Ocean tiles containing "small islands" were also excluded from the climate dataset. Also algorithmic "quality control" excluded certain areas, due to for example cloud cover. Ocean areas were also excluded using a digital elevation model (Hay and Rogers 2012, 19).

Several other absences are added to the absence of Zika. Absence multiplies again. *Ontological overflows* abound.

Concluding Discussion

In this paper I have attended to the assembling of the absence of a pandemic. I have honed in on the making of absence to show the usefulness of tracing *ontological overflows*. My aim has been to show that we also need to tell stories about the things that our informants do not care for. The things that hover just outside of our interlocutors' attention. The things that do not become performed as objects their own right. The objects that are incidental to our actors matters of concern. My question has been: How do we make present in our stories the versions of the world that are not cared for, that are not our interlocutors matters of concern?

Above, I have used a strategy of attending to the making of *absence* in order to highlight the usefulness of paying attention to *ontological overflows*. In disease surveillance, or in society at large, it is often *the-object-that-is-made-present* which is the central matter of concern. Presence of disease, presence of cases, or presence of risk. The eyes of our interlocutors are trained on the making of a particular object, a global outbreak of Zika, a pandemic. By honing in on absence we were able to learn about a multitude of ontological overflows.

The politics of exclusion: At multiple points in assembling the absence-of-Zika there are decisions made about what to include and not include. Is the case laboratory confirmed? Is the geographical area to far north or south to be included? Is the area at sea level? What threshold for trusting the simulation should be used? Absences also stem from the filtering out of noise: is something a "thing" or a "noise," for instance in deciding which satellite data is too noisy to be useful. *The politics of absence*: The politics of absent data also opens up layers of politics.

Some data absences are caused by poverty or just plain lack of surveillance, some absences are caused by machine breakdowns where data is lost or never captured, others stem from secrecy or political positioning. *The politics of simulation*: What are the consequences of using simulation as input to modelling? What my interlocutors call "pseudo absence." What are the looping effects that might occur? What does it mean that different versions of a phenomenon coalesces? How do different modalities of data affect what becomes visualized and made real?

Attending to ontological overflows—to the things that are omitted from the fractional, multiple object that is the matter of concern—seems to be productive for unsettling the objects of our stories. By attending to the multiplicities of overflows we can shine light on the multiplicity of worlds that are made invisible through a single minded focus on particular matters of concern. This move, to trace ontological overflows, to not slavishly follow the actors, is of crucial theoretical, methodological, and empirical importance. It is about the making of realities and about the exclusions of objects from the realm of the real.

Ontological overflows are both *process* and *result*. But overflows are process before they become are result (cf. Callon 1984, 224). As *process*, ontological overflows are the processes of forgetting, eliding, omitting and excluding. It is the processes of removing objects that are not a matter of concern. Ontological overflows thus are a part of how the "undiscovered continent," the smooth spaces, and otherness are gradually constituted. As a *result*, ontological overflows are the things that do not gain a foothold in the ontologies that our interlocutors make—and the stories we have told about them. A consequence of these ontological overflows is that particular things, objects, people become excluded from object-ness. They become overflow. Part of the blank.

Attending to ontological overflows can never be a conclusion, but must be a starting point for understanding how absence, alterity, and otherness is made. Tracing overflows means to trace how certain objects in the world (data, animals, people, countries) become omitted in practice. By attending to overflows I want to continue the work in STS to remain inclusive of the missing masses—analyzing truths and falsities, agencies, natures and societies, multiplicities and fractionalities, as well as the objects that are not cared for by our interlocutors. By attending to overflows we can attend to the silenced, excluded, and othered.

What is at stake in the politics of ontological overflows? Objects are constantly made and remade in practice. And their enactment changes things around. But what is made absent or not cared for? What multiplicities are enacted alongside our matters of concern? And who can decide what is included in the present or absent? Ontological overflows have great consequences. They decides what objects are not there, how many different things are removed from reality, as well as the boundaries of the objects that are made present.

The ontological politics of our time seems to be increasingly tied to an algorithmic and datafied production of society and nature. Life as we know it is permeated by automated systems, learning machines, tracking devices, and sensors. What is made as real is closely tied to what becomes made absent, to what is excluded from thingness in practice. By attending to ontological overflows we can shine light on how objects, phenomena, and people are un-made.

References

Bloor, David. 1976. "The Strong Programme in the Sociology of Knowledge." In *Knowledge and Social Imagery*, 1–19. London: Routledge.

Bowker, Geoffrey C. 2000. "Biodiversity Datadiversity." *Social Studies of Science* 30 (5): 643–83. https://doi.org/10.1177/030631200030005001.

Callon, Michel. 1984. "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay." *Sociological Review* 32 (1): 196–233. https://doi.org/10.1111/j.1467-954x.1984.tb00113.x.

———. 1986. "The Sociology of an Actor Network: The Case of the Electric Vehicle." In *Mapping the Dynamics of Science and Technology: Sociology of Science in the Real World*, edited by Michel Callon, John Law, and Arie Rip, 19–34. London: Macmillan.

———. 1998. "An Essay on Framing and Overflowing: Economic Externalities Revisited by Sociology." *The Sociological Review* 46 (1_suppl): 244–69. https://doi.org/10.1111/j.1467-954X.1998.tb03477.x.

Callon, Michel, and John Law. 1995. "Agency and the Hybrid Collectif." *South Atlantic Quarterly* 94 (2): 481–507.

Deleuze, Gilles, and Félix Guattari. 1987. *A Thousand Plateaus: Capitalism and Schizophrenia*. London and New York: Continuum.

Derrida, Jacques. 1987. *The Post Card: From Socrates to Freud and Beyond*. Translated by Alan Bass. 1st edition. Chicago: University of Chicago Press.

European Centre for Disease Prevention and Control. 2016. "Interim Guidance for Healthcare Providers and Zika Virus Laboratory Diagnosis." Technical Document. Stockholm, Sweden: European Centre for Disease Prevention and Control.

———. 2017. "Zika Virus Disease Epidemic." Rapid Risk Assessment Tenth update. Stockholm, Sweden: European Centre for Disease Prevention and Control.

———. 2019. “Zika Virus Disease: Annual Epidemiological Report for 2017.” Annual epidemiological report. Stockholm, Sweden: European Centre for Disease Prevention and Control.

———. 2021. “Zika Virus Disease: Annual Epidemiological Report for 2019.” Annual epidemiological report. Stockholm, Sweden: European Centre for Disease Prevention and Control.

Galis, Vasilis, and Francis Lee. 2014. “A Sociology of Treason: The Construction of Weakness.” *Science, Technology, & Human Values* 39 (1): 154–79. https://doi.org/10.1177/0162243913512681.

Garfinkel, Harold. 1963. “A Conception of, and Experirncnts with, ‘Trust’ as a Condition of Stable Concerted Actions.” In *Motivation and Social Interaction: Cognitive Determinants*, edited by O. J. Harvey, 187–238. New York: The Ronald Press Company.

Goffman, Erving. 1986. *Frame Analysis: An Essay on the Organization of Experience*. Northeastern University Press ed. Boston: Northeastern University Press.

Haraway, Donna. 1988. “Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective.” *Feminist Studies* 14 (3): 575–99.

Harding, Sandra. 1991. “Feminist Standpoint Epistemology.” In *The Gender and Science Reader*, edited by Ingrid Bartsch and Muriel Lederman, 145–68. London: Routledge.

Hay, Simon, and David J. Rogers. 2012. “The Climatic Suitability for Dengue Transmission in Continental Europe.” Stockholm: ECDC.

“Invasive Mosquito Spp. - Current Known Surveillance: September 2017.” 2017. European Centre for Disease Prevention and Control. October 10, 2017. https://www.ecdc.europa.eu/en/publications-data/invasive-mosquito-spp-current-known-surveillance-september-2017.

Laet, Marianne de, and Annemarie Mol. 2000. “The Zimbabwe Bush Pump: Mechanics of a Fluid Technology.” *Social Studies of Science* 30 (2): 225–63. https://doi.org/10.1177/030631200030002002.

Latour, Bruno. 1987. *Science in Action*. Cambridge, MA: Harvard UP.

———. 1996. *Aramis or the Love of Technology*. Cambridge, MA: Harvard UP.

———. 1999. “On Recalling ANT.” Edited by John Law and John Hassard. *Actor Network Theory and After*, 15–25.

———. 2004. “Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern.” *Critical Inquiry* 30: 225–48.

———. 2005. *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press.

———. 2012. “Paris, Invisible City: The Plasma.” *City, Culture and Society*, Traceable Cities, 3 (2): 91–93. https://doi.org/10.1016/j.ccs.2011.11.002.

Latour, Bruno, and Steve Woolgar. 1986. *Laboratory Life: The Construction of Scientific Facts*. 2nd edition. Princeton, NJ: Princeton University Press.

Law, John. 1994. *Organizing Modernity*. Oxford: Blackwell.

———. 1997. “Traduction-Trahison: Notes on ANT.” 1997. http://www.comp.lancs.ac.uk/sociology/papers/Law-Traduction-Trahison.pdf.

———. 1999. “After ANT: Complexity, Naming and Topology.” Edited by John Law and John Hassard. *Actor Network Theory and After*.

———. 2002. *Aircraft Stories: Decentering the Object in Technoscience*. Science and Cultural Theory. Durham, NC: Duke University Press.

Lee, Francis. 2021a. “Enacting the Pandemic.” *Science & Technology Studies* 34 (1): 65–90. https://doi.org/10.23987/sts.75323.

———. 2021b. “Sensing Salmonella: Modes of Sensing and the Politics of Sensing Infrastructures.” In *Sensing In/Security: Sensors as Transnational Security Infrastructures*, edited by Nina Witjes, Nikolaus Pöchhacker, and Geoffrey C. Bowker, 97–131. London: Mattering Press.

Lee, Nick, and Steve Brown. 1994. “Otherness and the Actor Network: The Undiscovered Continent.” *American Behavioral Scientist* 37 (6): 772–90. https://doi.org/10.1177/0002764294037006005.

Lynch, Michael. 2013. “Ontography: Investigating the Production of Things, Deflating Ontology.” *Social Studies of Science* 43 (3): 444–62. https://doi.org/10.1177/0306312713475925.

Marcus, George E. 1995. “Ethnography in/of the World System: The Emergence of Multi-Sited Ethnography.” *Annual Review of Anthropology* 24 (1): 95–117. https://doi.org/10.1146/annurev.an.24.100195.000523.

Martin, Aryn, and Michael Lynch. 2009. “Counting Things and People: The Practices and Politics of Counting.” *Social Problems* 56 (2): 243–66. https://doi.org/10.1525/sp.2009.56.2.243.

Mol, Annemarie. 1999. “Ontological Politics: A Word and Some Questions.” Edited by John Law and John Hassard. *Actor-Network Theory and After*, 74–89.

———. 2002. *The Body Multiple: Ontology in Medical Practice*. Durham: Duke UP.

Mol, Annemarie, and John Law. 1994. “Regions, Networks and Fluids: Anaemia and Social Topology.” *Social Studies of Science*, 641–71.

Moser, Ingunn. 2006. “Sociotechnical Practices and Difference: On the Interferences between Disability, Gender, and Class.” *Science, Technology & Human Values* 31 (5): 537.

“Mosquito-Borne Diseases: An Emerging Threat.” 2014. European Centre for Disease Prevention and Control. August 12, 2014. https://www.ecdc.europa.eu/en/publications-data/mosquito-borne-diseases-emerging-threat.

Muniesa, Fabian. 2019. “Societe du comportement, information de la sociologie.” *Zilzel* 2019/1 (5): 196–207.

Peel, M. C., B. L. Finlayson, and T. A. McMahon. 2007. “Updated World Map of the Köppen-Geiger Climate Classification.” *Hydrology and Earth System Sciences Discussions*, 1644.

Rappert, Brian. 2010. “Revealing and Concealing Secrets in Research: The Potential for the Absent.” *Qualitative Research* 10 (5): 571–87. https://doi.org/10.1177/1468794110375229.

Rogers, David J., and Timothy P. Robinson. 2004. “Tsetse Distribution.” In *The Trypanosomiases*, edited by Ian Maudlin, P. H. Holmes, and Michael A. Miles. Wallingford, UK ; Cambridge, MA, USA: CABI Pub.

Scharlemann, Jörn P. W., David Benz, Simon I. Hay, Bethan V. Purse, Andrew J. Tatem, G. R. William Wint, and David J. Rogers. 2008. “Global Data for Ecology and Epidemiology: A Novel Algorithm for Temporal Fourier Processing MODIS Data.” *PLOS ONE* 3 (1): e1408. https://doi.org/10.1371/journal.pone.0001408.

Star, Susan Leigh. 1990. “Power, Technology and the Phenomenology of Conventions: On Being Allergic to Onions.” *The Sociological Review* 38 (1 Supplement): 26–56. https://doi.org/10.1111/j.1467-954X.1990.tb03347.x.

———. 1991. “The Sociology of the Invisible: The Primacy of Work in the Writings of Anselm Strauss.” In *Social Organization and Social Process: Essays in Honor of Anselm Strauss*, 265–83. Aldine de Gruyter Hawthorne, NY.

Strathern, Marilyn. 1992. *After Nature: English Kinship in the Late Twentieth Century*. Cambridge: Cambridge University Press.

Vogel, Else, David Moats, Steve Woolgar, and Claes-Fredrik Helgesson. 2021. “Thinking with Imposters: The Imposter as Analytic.” In . Bristol University Press. http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-449933.

Woolgar, Steve, and Dorothy Pawluch. 1985. “Ontological Gerrymandering: The Anatomy of Social Problems Explanations.” *Social Problems* 32 (3): 214–27. https://doi.org/10.2307/800680.