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Hybrid Threats and Preparedness Strategies: The Reconceptualization of Biological Threats and Boundaries in Global Health Emergencies

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Abstract

Pandemic emergencies are one of the foremost examples of the turn to preparedness. In this article, I discuss how biological threats are conceptualized inside the frame provided by such turn, connecting with novel governance practices aimed at tackling the challenges posed by the constantly shifting boundaries of global health. First, I review existing literature related to the turn to preparedness. This turn has turned virtual biological threats into the main drivers for preparedness planning. Second, I use empirical material to argue a redefinition of biological threats as entities that go beyond the molecular boundaries of viruses, turning hybrid social networks into the main object of interest for global health response before infectious diseases. This reconceptualization is manifested in three different challenges to the boundaries of global health emergencies: (1) a temporal challenge, which forces institutions to struggle with situating the boundary between event and non-event; (2) an institutional challenge, which brings together different actors, institutions, and organizations redefining their internal and external boundaries; and (3) a spatial challenge, whereby the territorial lines of secure and insecure spaces become mobile and unstable. As a conclusion, I will argue that those three challenges and the redefinition of certain boundaries are ways to govern a wider divide constructed by preparedness that aims at separating the threat and an object of protection.

Keywords

biological threats, boundaries, global health, governance, hybrids, infectious diseases, preparedness, space

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Introduction

In April, 2009, the World Health Organization (WHO) declared a global health emergency as an unexpected H1N1 Influenza outbreak unleashed in North America. This was the first pandemic emergency to fall under the new International Health Regulations (IHR) (WHO, 2005). Such declarations draw the attention from the whole world, turning a local event into a global one. The IHR are characterized by three main features – all-hazards approach, no pre-set measures, and tackling threats at their source – and are the main bearer of a general shift in how biological emergencies are addressed – the so-called 'turn to preparedness' (Caduff, 2008, 2015; Collier and Lakoff, 2008a; Keck, 2008; Lakoff, 2006, 2007; Samimian-Darash, 2009). These principles have become the common denominator in policies for pandemic preparedness and response all over the world, exemplifying the interplay between locality and globality that has become one of the defining features of global health (Tirado and Cañada, 2011; Elbe et al., 2014; Tirado et al., 2015; Wolf, 2016). Clashes between global policy-making and local implementation has also been a key feature in other emergency declaration such as the 2014 Ebola crisis in West Africa or the 2016 outbreak of Zika virus in South America. These examples show the governmentally productive character of pandemic preparedness and emergency declarations: they activate a series of mechanisms for producing knowledge, medical intervention, and the governance of biological threats. This way, IHR have become the main regulatory and legal tool to coordinate and enforce international public health response.

The main objective of the article is to understand how biological threats are conceptualized inside the turn to preparedness and the governance strategies used to tackle the specific challenges posed by the constantly shifting boundaries of global health. First, I review how existing literature has conceptualized the shift as a turn to preparedness. This turn has forced policy to consider virtual threats that, despite not being actualized, still have an effect on actual implementations. Second, I use empirical material to argue that there is a redefinition of the biological threat as something that goes beyond the boundaries between molecular, animal, and human forms of life. This way of defining threats pushes governance strategies to focus on the control of hybrid social networks rather than on the virus itself. Finally, this focus presents three different challenges in terms of governance: a temporal, an institutional, and a spatial challenge. As a conclusion, I will argue that those three challenges and the redefinition of certain boundaries are ways to govern a wider divide constructed by preparedness that aims at separating the threat and an object of protection.

The turn to preparedness

The changes proposed by IHR, which are part of the securitization process of global health, have been framed in existing literature as a turn to preparedness. Even though the turn to preparedness has received much attention in relation to pandemic events, it is actually part of a wider move in security and risk studies (Anderson, 2010; Collier, 2008). While the review that I will present now is promiscuous between pandemic preparedness and the wider security scheme that surrounds it, they both contribute to shape the logics of the turn.

Table 1. Changing features in the logics of anticipation (Cañada; based on literature review).

	Availability of knowledge	Temporality of the action	Characteristics of the threat
Prevention	Available	Contemporary to the threat	Visible
Precaution	Limited	Before a point of irreversibility	Concrete but uncertain
Pre-emption	Limited	Before the visibility of the threat	Concrete but uncertain
Preparedness	Limited	Before the visibility of the threat	Variable, multiple and uncertain

These diverse ways of addressing biological risks and threats have been called a change in the logics of anticipation (Anderson, 2010) or a change in the rationalities of risk (Keck, 2008). Here, I will use the former as I think anticipation better connects with the way I will later frame my argument. I will, however, combine the conceptualization of Anderson, Keck and other authors to give a clear idea of these logics. According to Anderson (2010), the logics of anticipation are 'coherent way[s] in which intervention in the here and now on the basis of the future is legitimized, guided and enacted' their goal being 'to care for a valued life by neutralizing threats to that life' (p. 12). These logics have been evolving during the last decades to reach their current state (Keck, 2008). This does not mean that one has been replaced by the other but that they accumulate in an overlapping manner. In existing literature, we can find four differentiated types: prevention, precaution, pre-emption, and preparedness.

These different ways of approaching anticipation and risk can be summarized through three key features: the availability of knowledge, the temporality of the action and the characterization of the threat (Table 1). Logics of prevention rely on prevalence and incidence data. Rooted in 19th-century's strong trust on scientific knowledge to control risk (Kittelsen, 2009), they focus on cases and propagation zones and knowing the threat means being able to counter it (Keck, 2008). Therefore, the threat is visible and the action contemporary to the threat. Precaution, on the other hand, is rooted in the 1970s and is inspired by the 'precautionary principle' (Anderson, 2010; Kittelsen, 2009). Knowledge is more limited, and the action is separated from the processes it acts on, acting before the threat reaches a state of irreversibility. As a result, there is a necessity for continuous re-assessment. According to Keck (2008), precaution, in contrast with prevention, pays attention to the limitations of knowledge instead of its availability. Such limitations allow actors to take a leap of faith and proceed to intervene even if the risk has not yet been determined (Caduff, 2014). Pre-emption means to counterstrike if there is evidence of an imminent attack, according to Cooper (2006) who analyses it in the context of warfare. This attack, with the changes in war logics from cold war to terrorist networks, becomes unpredictable. Again, as with precaution, knowledge is limited and the threat is defined but uncertain. The difference is that the action, instead of happening before the point of irreversibility, happens prior to the emergence of the threat (Anderson, 2010). Furthermore, pre-emption has a performative character, meaning that it does not pre-exist its practice (De Goede et al., 2014). In other words, it needs implementation to become effective, actual, and influential, that is, to have an effect on reality.

That is the sort of twist offered by preparedness. Its effect takes place before its practice. This is because it stresses the existence of the threat before acting on it. And it does this not only before the threat materializes but even before the threat is defined or identified. Preparedness main difference with previous logics is that it focuses on the aftermath of a future event instead of trying to stop the threat itself (Anderson, 2010). The question now is not whether we must prepare or not for a given event, but how to prepare and what to prepare for (Lakoff, 2006, 2008). At the same time, often the logics of preparedness identify several sources of threat as one unitary threat, that is, a generic biothreat (Lakoff, 2008). Because of this, elements of public health, national security, and science (Collier and Lakoff, 2008b; Samimian-Darash, 2009) form a melting pot of strategic approaches that configure the future event despite the difficulties to apprehend its temporal and emergent dimensions. It is, however, important to remember that although preparedness is quite an extended shift, it is not a global shift, but it is enacted diversely in different contexts. First, it is mainly a Western initiative that non-Western countries often struggle to engage with (Biehl, 2016). Second, even inside the Western political sphere, different countries have enacted the turn in different ways, although with great overlap (Lentzos and Rose, 2009).

From a theoretical perspective, Samimian-Darash (2011, 2013) has conceptualized this turn using the Deleuzian concepts of the virtual and the actual (Deleuze, 1994). For Deleuze, the real is formed by both the virtual[1] and the actual. Those events that have not yet happened and that guide preparedness implementation are constructed through the use of past and current actualizations and through anticipation practices such as calculation, imagination and performance, which help construct virtual futures (Adey and Anderson, 2012; Anderson, 2010; Lakoff, 2007). Samimian-Darash's conceptualization helps to understand the future temporalities inscribed in preparedness. Furthermore, understanding temporality through Deleuze adds a component of multiplicity to those futures. They are indeed determined by past and present actualizations but futures remain virtual, that is, multiple. In terms of global health, past actualizations of threats, such as the Amerithrax attacks, SARS or even the so-called Spanish Flu in 1918, are often the basic premise behind biopreparedness policies. They are necessary to make sense of current threats and invoke the danger they entail. Also declared emergencies and current data guide current actions and decision-making. That knowledge together with elements such as risk assessments, the celebration of simulation exercises (Lakoff, 2007), the construction of pandemic narratives (Caduff, 2015), and even the narratives suggested by works of fiction (De Goede, 2008; Elbe et al., 2014) are used to shape the virtual events that have not yet taken place. Thus, even if biothreats are defined generically, preparedness relies on those elements to make virtual threats specific and prepare for them accordingly. Even though such virtual individuations have not yet been actualized (and might never do), they strongly affect decision-making, implementation and the development of biogovernmental tools, that is, they have an effect on reality. They affect upcoming emergencies independently of how much those emergencies resemble the virtual events that guided preparedness implementations. A great example of this are the declarations of Margaret Chan while reviewing the role of WHO during the H1N1 Influenza pandemic: 'the world was better prepared for a pandemic than at any time in history. But it was prepared for a different kind of event than what actually occurred' (Chan, 2010).

WHO was prepared for a virtual event that did not actualize. Still, the resources used for the actual pandemic were those designed for the virtual pandemic. This way, the turn to preparedness challenges the boundary between the virtual and the actual, between the event and the non-event. Health organizations face the challenge of identifying and governing biological threats before they appear.

Methodology

In the following I will address the question formulated in the introduction: how has this turn affected the way biological threats are conceptualized and, consequently, changed the governance strategies used to bring them under control? I will do this by drawing on material gathered in the context of a project that looked at how knowledge, governance and life are reconceptualised during biological emergencies. The collection of the empirical material process was inspired by what Youdell and McGimpsey (2015) have called assemblage ethnography, which is fitted to study rapidly changing policy issues that involve complex networks of actors. Assemblage ethnography gives space to use all types of methods. The main idea is to be able to follow the different actors and institutions while paying attention to the boundaries that separate them and the assemblages and hybrid associations that they enact. Following the relevant actors of pandemic preparedness led me to interview experts and analyse policies, strategies and protocols of three different countries – Finland, Spain, and the United Kingdom[2] – and of two international organizations – the European Union (EU) and the WHO. I also had the chance to complement the institutional material with a 6-week ethnography in a WHO Country Office located in in the Eastern Mediterranean Region and by attending a Biological Weapons Convention State Party Meeting in Geneva as an observer. Finally, scientific news and articles about pandemic threats were also analysed. There was a total of 182 official documents, 17 interviews, 2 field diaries, and 86 scientific news and articles that covered general biopreparedness policy and specific biothreats, namely, Influenza, Ebola, and MERS-CoV. The material was thematically analysed using Atlas.ti, looking at how themes related to different life forms and governance were conceptualized and categorized. The initial list of categories was then revised by merging redundant categories and removing those that did not appear in more than one document. In the following, some of those categories are presented and discussed in the light of relevant theoretical concepts. First, I argue that biothreats are conceptualized as hybrids that consist of viruses that need to become part of hybrid social networks in order to become threatening. Second, I introduce three challenges that follow this argument and how pandemic preparedness and response aim at solving them.

Conceptualizing the biothreat

At the centre of the pandemic narrative is the biological threat. The way biological threats are conceptualized is not a consequence of the turn to preparedness, neither its cause, but rather an integral part of the process. Understanding how they are conceptualized directly contributes to understand the challenges that preparedness policies encounter in their development and their implementation. In the empirical material, biothreats are most

commonly associated with molecular forms of life with the ability to spread, usually viruses. These molecular forms of life drive research and surveillance. Discovering a new one initiates a research protocol whereby the new virus needs to be known so it can be governed. But these molecular forms of life are not pure threats. Their status can shift depending on their genetic composition and the ability of society to govern them, to submit them to the rule of science. In the analysed material, molecular life was portrayed in two different styles: one rendered life under control and the other one rendered life threatening, although the boundary between one and another was commonly blurry.

That life is under control does not mean that it is rendered fully passive but that its agency is constrained through control measures. The place of upmost control for viruses is inside laboratories, where guidelines stipulate strict security and safety rules: practices such as registration of arrival and departure, origin (Pérez Mellado, 2014: 22), or proof of destruction (WHO, 2006: 14) ensure that the biothreat remains controlled. Even though one could instinctively think that the reason to control biological agents is their pathogenicity, non-pathogenic organisms are also submitted to these rules. On the one hand, they are of scientific value and should therefore 'be protected against the risk of loss' and 'carefully safeguarded and responsibly maintained' (WHO, 2006: 18). On the other hand, non-pathogenic organisms always retain the capacity to 'acquire pathogenic features under natural or manipulated environments' (WHO, 2006). This capacity for transformation is one of the main tenets of the pandemic narrative: any organism can potentially become threatening. As a result, they turn into either pathogens – if the transformation was natural or unintentional – or bioweapons – if the transformation was artificial and with nefarious purposes. Now, they become liable to being classified according to their lethality, infectivity, virulence, incubation period, contagiousness, and mechanisms of transmission (WHO 2004b).

But this is not the end of the road in their way to becoming threats: as they become threatening viruses still under control, they must now be protected from 'bad people' with bad intentions (Interviewee, UK01, 2015). As someone lays interest on these pathogens, some control is lost and biosecurity measures need to be strengthened. This engagement between viruses and 'bad people' points out one of the key elements in considering biothreats in pandemic preparedness: biological agents, despite being the central element of the pandemic narrative, are not likely to spread alone. They become most threatening when they engage with other actors. It takes, for example, a person with intent to turn prophylactic, protective, and peaceful uses of biological agents into bioweapons (Wissinger, 2015).

Another key way for viruses to spread is through the formation of animal-virus and human-virus hybrids. The relevance of these engagements becomes visible when looking at how human and animal lives are conceptualized in the analysed material. First, human life often appears as an element that, rather than being affected by the threat, plays a role in its spread. Elements such as human behaviour, population density, movement, awareness, or farming practices drive epidemics. As a WHO (2010) report on public health emergencies describes, 'what people do or do not do can either increase or decrease the risk of epidemic generation or propagation' (p. 6). It is important to note that all those activities are ways in which humans and viruses engage or, in other words, become human–virus hybrids. As I will argue later on, governing the movement of

(potential) human–virus hybrids is one of the main ways to bring emerging diseases under control.

The relevance of animals, on the other hand, is not so much focused on behaviour and is therefore a less agentic perspective. They appear as a sort of natural moving laboratory where viruses can exchange genetic information with each other and mutate. Therefore, the animal–virus hybrid becomes a possibility not only for spread but also for potentiation of the threat. The boundary between domestic and wild animals gains special relevance. As Fearnley (2013) has noted, there are strong efforts to keep the two groups from interacting. Domestic animals are an important part of society and they represent an important element in trade and economy, both internationally and locally. They therefore need to be protected from biological threats. Wild animal–virus hybrids escape that control and new strategies need to be put in practice: engaging bird-watchers as sentinels into the surveillance apparatus (Keck, 2010, 2013; Lakoff, 2013, 2015) or the monitoring of migratory birds (Verhagen et al., 2015) are some examples. This way, migratory birds come to stand for the disease and be at the focus of surveillance. What is being watched is not the virus nor the bird but an animal–virus hybrid.

The way biological threats are conceptualized is, however, not exempt of the interaction between both the human–virus and the animal–virus hybrids. Not only are animals an important part of economy and trade, while providing food for human populations, but they also come to stand for humans as they serve as more or less efficient models to get to know viruses better. The One Health Initiative, which tries to bring together human and veterinary medicine, carries the banner for this reconfiguration of our understanding of molecular, animal, and human life. Furthermore, the initiative aims at carrying medical knowledge-making across the globe and across disciplines. However, as Hinchliffe (2015) has argued, the initiative presents shortcomings in that it puts forward an understanding of infectious diseases that focuses on contamination and transmission while disregarding the social dimensions behind those dynamics. The laboratory and bioterrorist practices explained above are ways in which the virus-host hybrids are enmeshed in wider hybrid networks involving governance, expertise and security. These hybrid networks are key to understand how governance is articulated in pandemic preparedness. Governing biological threats means governing hybrid formations. As scientists, terrorists, and human and animals hosts engage with viruses, they are also submitted to the same logics. In other words, they too become threats for society (even their own society). Thinking of biothreats as hybrids that are an amalgam of different forms of life not only helps understand the way they are conceptualized but also the rationale behind preparedness plans and protocols.

Governing the biothreat

Conceptualizing biothreats as explained above brings some challenges to pandemic preparedness. In the material, I have found three different challenges that are associated with the instability of three different sets of boundaries at stake in pandemic preparedness. First, the pathogenic/non-pathogenic divide brings in a temporal challenge. Second, the different competences and mandates associated with preparedness bring in an institutional challenge whereby different organizations and governments are forced

to redefine the boundaries between them. Finally, the mobility of hybrid threats forces preparedness to understand the barrier between the healthy and the diseased as a movable and permeable one.

Temporal challenge: standby practices

Declarations of emergency, as explained in the beginning, serve as a temporal reference that marks the productive implementation of pandemic policy. However, the challenge in preparedness remains to implement it before the emergency has been declared. In my analysis, I was inspired by the many references in the material to preparedness implementation elements as 'standby', such as capacities (European Commission, 2009: 10), facilities, committees (European Commission, 2001: 1, 2), evacuation systems (European Commission, 2015: 25), response teams, hospitals (WHO, 2015: 55, 137), or duty personnel (Ministry of Defence, 2010: 55). Thus, I started to think of preparedness implementation as a collection of standby practices directed at keeping measures and resources as ready as possible. Here, I describe three standby practices aimed at governing that temporal challenge of fighting an event before it happens.

First, stockpiling is probably one of the best illustrations of how virtual events have material and economic impact in the present. Stockpiling of medical countermeasures covers material such as vaccines, drugs, or personal protective equipment (PPE). One of the main challenges here is to reconcile different views between different actors, as they often consider different virtual scenarios. A clear example of this is the Joint Procurement Agreement to Procure Medical countermeasures (European Commission, 2014b), which works as a standby agreement between two actors with often different views (Lentzos and Cohn, 2014): national governments and pharmaceutical corporations. This agreement was reached after the 2009 H1N1 pandemic, where purchase of medical countermeasures took place in a panic situation resulting in the massive buy of medical countermeasures by some countries, with most of those purchases remaining unused and some others seeing their effects and efficacy put in doubt (Fuyuno, 2007; Jack, 2014; Lakoff, 2015; Vogel, 2015). Standby purchase agreements establish collective conditions for purchase in advance so countries can make effective the agreement at the time of the emergency.

The second example of standby practice is the training of specialized units. They are in charge of applying specific knowledge to deal with virtual events. It is therefore not enough to just stockpile medical countermeasures. Having personnel with the ability to use them correctly is as important:

> The use of biological and chemical protective equipment requires special training, and the adaptation of existing procedures for emergency management. Without careful development of the necessary procedures and intensive training, the introduction of such equipment can hamper the ability to respond. (WHO, 2004b: 62)

Training and stockpiling of equipment depend on each other and are both necessary for successful preparedness. But training as a standby resource is harder to maintain than material stockpiling. Standby special units are trained and exist organizationally but are on and off between emergencies:

> The danger of making the response to biological and chemical incidents the task solely of dedicated specialized response units is that the relative infrequency of call-out could lead to the deterioration of skills. (WHO, 2004b: 57)

Know-how cannot be stored, it does not have a 'best before' date as drugs do, so constant training and regular exercises become essential (European Commission, 2008; WHO, 2006). Thus, besides knowledge and skills being or not adequate to face an actual emergency, they are exposed to deterioration over time.

The third practice is perhaps less visible but still has a productive effect on how the temporal challenge is managed before biothreats. Drafting and preparing plans and protocols might seem like an all-encompassing activity but can be considered a practice in itself with its own challenges. As the biothreat is defined generically (Lakoff, 2008), planning both precedes and follows simulation exercises and real events. It can be understood as a reiterative process, through which planning helps better address future threats. That reiterative process becomes a loop whereby plans and protocols are tested and refined in a never-ending cycle of planning:

> Usually after every exercise or real situation, we do what is usually called *lessons learnt* […]. What we do is to turn back the whole process to see if it has been executed well at all levels, if the decision has been well made, if the processes and the protocols have been applied, if the material used is the appropriate one, and there we redo again the whole sequence from the beginning for the next situation. In other words, it is a never-ending cycle of planning. (Interview, SP02, 2015, translation by author)

Furthermore, plans and protocols always need to incorporate planning assumptions, which are assumptions that allow a generic definition of a biothreat to become a more specific virtual individuation. As in the example of preparing for an Influenza pandemic, where the assumption was made that the type of virus would be H5N1 only to end up facing a H1N1 virus in 2009, these assumptions take off from the actual and create virtual futures for which is worth planning. Public controversy often stems from understanding them as actual instead of virtual (DH Pandemic Influenza Preparedness Team, 2011).

Institutional challenge: standby networks

The enactment of the practices discussed above involves many actors and is the result of many layers of social engagements. Governmental institutions, researchers, pharmaceutical companies, first responders, physicians, farmers, patients, animals, and biological agents come together to shape those practices. They are therefore collective practices enacted during emergencies but also ahead of them. Regulating efficiently those actors during emergencies is one more challenge for pandemic preparedness. Here, preparedness is not only about preparing individual elements – resources, specialized personnel and plans – but about bringing together the networks behind them. Networks that, the same way as emergency interventions, must be left on standby.

Standby networks are loosely connected social entities that are brought together with the objective of a future interaction which will be more productive than the original one.

In a way, they are networks left half empty that can then be filled with different kinds of knowledge. Such content depends on the emergency and the actors that are part of the network when it is activated at the outset of an emergency, with special attention to the way the biothreat and the consequent biorisk have been defined. They must necessarily remain partly empty in order to be adaptable and flexible. Accordingly, they must be one and many networks at the same time.

Biological threats remain at the centre of the network, both when that position is still empty and when it has been filled, that is, when the biothreat is unknown and when it has been defined. I want to suggest this as a form of 'institutional biosociality' (Brown and Michael, 2004), by which biosocial processes happen inside institutional frames through processes of regulation and governance. Even though original accounts of biosociality have focused on the involvement of lay citizens in expert medical matters (Novas, 2008; Rabinow, 2008), Brown's and Michael's approach leads the way for a different consideration of biosociality. I think that the configuration of standby networks offers an interesting case whereby a given disease (usually an unknown disease) brings together different social actors: health institutions, governmental institutions, diplomats, researchers, pharmaceutical companies, security forces, or civil society, to name a few.

Similarly to new biotechnologies, emerging viruses question the institutional boundaries that try to control and regulate them. Using the words of Brown and Michael (2004: 208), pandemic preparedness regulation would 'occupy highly unstable positions within regulatory structures, often limiting their effectiveness as instruments of oversight'. Such instability is at the core of the institutional challenge. Even if the biological interactions – the emergency– that bring together these networks are not present at the moment of their creation, those interactions are virtually projected as the network's reason of being.

Constructing these networks also requires hard work from the actors involved as often their scope is wide or undetermined. Three different types of activities are part of that work: coordination, sharing agreements, and the distribution of responsibility. First, coordinating practices and tools aim at bringing different actors together. Second, establishing sharing structures promotes collaboration between actors. Sharing may include different sort of objects valuable enough to be shared: information, samples, plans, protocols, staff, or medical countermeasures are some examples. Third, distributing responsibility means assigning roles to avoid overlaps. This helps establishing evaluation criteria once the emergency is over and needs to be evaluated as a failure or a success. The material analysed is full of agreements that address coordination, sharing, and distribution of responsibility in times of emergency. This linking together of different institutions has been argued to be one of the main characteristics of current logics of security (Lentzos and Rose, 2009).

Examples of how these networks are brought together are found in different sites and different levels. The Joint Procurement Agreement of the EU explained above the bringing together of private pharmaceutical companies with public administrations. The relationship between the private and the public sector can even sometimes be legally regulated and enforced (Interview, FI_02, 2015). Also at the European level, exercises are often organized in order to bring people together:

> I think that one of the, quite often, major benefits of this type of exercises is that you forge these sectors together in peace times, so in case you got a real emergency, you already had contact maybe with complementary institutions. (Interview, EU_03, 2015)

At the national level, the way preparedness networks are activated before emergencies varies from country to country, although as some studies indicate, it is common to have similar structures even if denominations differ (Hancox et al., 2018). But even if operational protocols are in place, sometimes practice finds its own way, as in the case of the Finnish system: 'what has happened in practice thus far is that Finland is a small country, we know the people, who we are, come to work when we need them, as it happens in practice and it has happened in practice' (Interview, FI_02, 2015). Although a detailed discussion of the different operational command systems in the studied contexts is beyond the scope of this article, the excerpt above comes to point how standby networks can be shaped both at a formal and an informal level.

Territorial challenge: spatial interventions

The third challenge is a territorial one in the sense that governmental tools try to deal with the ability of the threat to move and spread. Foucault's (2008) depiction of three historical diagrams of life and power associated with different epidemiological moments becomes relevant at this point. First, during leprosy in the Middle Ages, people infected with the disease were excluded from the rest of the population, sent to a colony. Consequently, population was divided. This first diagram of life and power was applied through law, punishment and interdiction. Second, during the plague, both in the outbreaks of the 14th and 17th centuries, governance relied on observation, surveillance and correction. People were not excluded and divided but included and organized. Population and goods were subjected to quarantine. Finally, in the third example, smallpox in the 18th century, governance acts through means of calculation and intervention: inoculation and vaccination become the seed for modern public health and hygiene programmes.

Current approaches to public health suggest a fourth diagram where life is again redefined. This fourth diagram takes life as a more-than-human object of governance: the population is covered by the technical knowledge of the molecularization of life (Rose, 2007). The focus is now on the biological threat and the engagement of viruses with humans and animals. As in the Foucauldian diagrams, the spaces of action are redefined. Advances in biotechnology and globalization have moved the focus from local spaces to global networks of laboratories, hospitals, and airports. Those globalized networks turn the boundaries between healthy and diseased populations into multi-sited borders. There is a shift from governing life forms to governing their movement (Torrejón et al., 2016). The challenge, therefore, is to prepare those boundaries to be hard to penetrate, yet able to move. I would like to now present three examples that illustrate this shift.

One example are laboratory biosecurity and biosafety measures. As one of my informants put it, 'biosafety is about keeping bad bugs away from people, biosecurity is about keeping bad people away from bugs' (Interview, UK_01, 2015). While biosafety measures have a long history, the rise of laboratory biosecurity as a concern is connected to more or less recent developments in biotechnology (Collier et al., 2004) and so-called

'do it yourself' biology (Blatny and Lausund, 2012). What is more interesting is how these two measures are enacted in a globalized world. I would like to present here two hybrid formations to illustrate this. First, in the case of humans, the constant mobility of researchers between universities and laboratories have made screening central. The background of researchers applying to certain position must be carefully checked by the host laboratory (Interview, EU_03, 2015). As researchers can potentially perform as bioterrorists and engage with viruses – forming threatening hybrids – any researcher exchange appears as an opportunity for the threat to breach the secure/insecure boundary. Second, in the case of nonhuman entities, biosafety and biosecurity regulations must also accompany the shipment of biological samples. When viruses travel, they must do it in a secure and safe way, that is, biosafety and biosecurity measures must become portable and accompany them. The safe and secure environment proper of laboratories should surround the shipment: from authorization and clearances to proper isolating packaging. Packaging and shipping protocols appear as a way to provide both the virus and its surrounding with extra protection.

A second example is the threat posed by travel hubs, especially airports,[3] as they nowadays allow for fast travel of threatening hybrids across the globe. Airports are both an opportunity and a threat. An opportunity because they have a funnel effect by which a high density of individuals allows to test many people and identify threats in one place at the same time. And a threat as they also are the perfect space for the spread of a virus. The funnel effect is illustrated in protocols to leave Ebola-stricken areas during the emergency in West Africa. A protocol for exit screenings reviewed during a EU/WHO review mission (European Commission, 2014a) established up to five screenings before finally accessing the airplane: airport arrival (including friends and relatives not travelling), terminal entrance (friends and relatives not allowed), before check-in, check-in desk, and boarding gate. Each of the steps included repeated temperature measurements and the filling of surveys, with passengers not fulfilling the criteria being turned down or rechecked for verification. The example shows how the airport is organized spatially from entrance to boarding gate with a series of filters that allow to keep threatening hybrids from accessing the global space.

A third and final example of how movement is governed is the use of barrier techniques as infection control. PPE and the organization of isolation wards are key ways to understand how the healthy healthcare personnel and the ill patients are situated at the boundaries. As Pallister-Wilkins (2016) explains, these barriers are not fully impermeable (and should not be). For care to be given properly, certain elements need to flow. For example, PPE should stop bad circulation – bodily fluids – while allowing good circulation – such as oxygen for healthcare workers to breathe. As for isolation wards, they still need to allow the circulation of caregivers, medicines, food and water. So, in this case, no barrier can be constructed as hermetic, which contrasts with the classical logics in which isolation and PPE are thought.

Hybrid biothreats and objects of protection

In this article, I have argued that in preparedness policies the threat is always configured as a hybrid. Therefore, governing threats requires governing the social networks the

hybrid is a part of. It is important to note that the main question of this paper focused on life forms but it would be reductionist to think that biothreat hybrids are only made of viruses, humans, and animals. Besides the association of threats with plants or food (Barker, 2010), threatening hybrids can also be formed by non-living entities. Isolation packaging for travelling like the one explained above, means of delivery in case of bioterrorism (e.g. envelopes in the Amerithrax attacks) or even cities and urban structures (Wolf, 2016), are some examples of how viruses can associate with non-living actors to further their spread. To analyse the hybrid possibilities that make biothreats productive remains a key object of inquiry in studying biopreparedness. Also, the paper illustrated the way those hybrids challenge governance. I presented three challenges: a temporal, an institutional, and a spatial challenge. The strategies to face them are the standby organization of material, capacities and institutional relations, and the spatial governance of hybrid threats.

These points support a long time held claim made in Science and Technology Studies: that boundaries are unstable (Bowker and Star, 2000). I would like to contextualize this claim before the specificities offered by pandemic preparedness. Indeed, the strategies described are more or less successful attempts to make those divides stable and, therefore, governable. What is at stake here is the necessity to neutralize biological threats through the separation of biological threats and objects of protection. Literature has often presented this separation in terms of the healthy and the diseased. This divide has, for example, been well analysed by Hinchliffe et al. (2013) and, here, I would like to build upon it. In the material, the challenge was not only to divide the healthy from the diseased – as Foucault (2008) already illustrated in his diagrams of life – but, as I argue, to separate the threat from the object of protection.[4] Non-diseased actors must be kept away already before becoming threatening hybrids: bad planning, bioterrorists, suspicious researchers, or wild animals are some examples that I have discussed throughout the paper. Therefore, dividing threat from the object of protection is more multiple in spatial terms than separating the healthy from the diseased. Therefore, 'the walling in of "good" life and [the] walling out of risky lives', as expressed by Hinchliffe et al. (2013: 534) is a multi-sited process. As threatening life flows become a part of global health processes, the boundaries designed by preparedness must follow threats wherever they go: institutions, countries, hospitals, airports, planes, or laboratories to go back to some of discussed examples. The strategies addressed here aim at making those walls stable in their movement, solidifying the divide, and optimizing its permeability.

Focusing on the divide between the threat and the object to be protected is one of the effects of the preparedness logics, and it shows a new way of understanding the governance of life. As they try to establish solid and permeable boundaries, the identification of healthy, or diseased lives needs to take a step back from a temporal perspective. Threatening life needs to be identified before it becomes threatening and, to do that, preparedness tries to work out those boundaries in advance, to stabilize them and regulate the circulation between both sides, turning the potentially diseased into a threat and the still healthy into an object to protect.

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Notes

1. The virtual here is not connected with the digital realms that configure the Internet. As Levi R. Bryant (2004) has explained, the Internet falls under the category of the representational rather than the virtual and conceptualizing it as virtual is the result of a misreading of Deleuze's work.
2. I would like to emphasize that this is not a comparative study. The selection of these countries was made to add variability to the empirical material through the fact that they occupy different political and cultural spaces inside Europe.
3. Although spread could take place by means other than flights, airports remain especially relevant because of the speed and ease of travel they afford (Tatem et al., 2006).
4. Similar logics have been described by Castel (1990) in making sense of risky behaviours associated to mental health issues. For Castel, a shift towards preventive action becomes possible when the notion of risk becomes autonomous from the notion of danger. Risk is not caused by a particular danger but from the combination of factors rendering undesirable modes of behaviour more or less probable. Castel's notion relies on social factors and statistical data. In the case of biothreats and objects of protection we must add the construction of virtual narratives of threat.

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