EPIDEMIC SPACE

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Abstract

The aim of this article is to highlight the importance of 'spatiality' in understanding the materialization of risk-society and cultivation of risk-sensibilities. More specifically it provides a cultural analysis of pathogen virulence (as a social phenomenon) by means of tracing and mapping the spatial flows that operate in the unchartered zones between the microphysics of infection and the macrophysics of epidemics. I will argue that epidemic space consists of three types of forces: the vector, the index and the vortex. I will draw on Latour's Actor Network Theory to argue that epidemic space is geared towards instability when the vortex (of expanding associations and concerns) displaces the index (of finding a single cause).

Keywords: epidemiology, risk, space, flows, Actor Network Theory

Introduction

> It was the rainy season, and the 'road' was a string of mudholes cut by running streams. Engines howling, wheels spinning, they proceeded through the forest at walking pace, in continual rain and oppressive heat. Occasionally they came to villages, and at each village they encountered a roadblock of fallen trees. Having had centuries of experience with the smallpox virus, the village elders had instituted their own methods for controlling the virus, according to the received wisdom, which was to cut their villages off from the world, to protect their people from a raging plague. It was reversed quarantine, an ancient practice in Africa, where a village bars itself from strangers during a time of disease, and drives away outsiders who appear (Preston, 1995: 132).
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> To go on in our journey we should force these immense extents of space and time generated by geology, astronomy, microscopy, etc., back inside their networks - these phentograms, billions of electrovolts, absolute zeros and eons of times; no matter how infinitely big, long

> or small they are, these scales are never much bigger than the few meter squares of a geological or astronomical map, and never much more difficult to read than a watch (Latour 1987: 229).

Buried beneath the semiotic rubble of the Second Gulf War which flooded the mediascape in the first few months of 2003, there was a small piece of seemingly unimportant news. It concerned an outbreak of Ebola haemorrhagic fever in the Republic of the Congo, where the Ministry of Health had reported 140 cases, including 123 deaths, in the districts of Mbomo and Kéllé in Cuvette Ouest Département (WHO, 2003). A mortality rate of 88 per cent is common for Ebola. In previous outbreaks, for example in Zaire in the village of Yambuku (1976) and the town of Kikwit (1995), there were also mortality rates of up to 90 per cent (Johnson, 1982; McCormick and Fischer-Hoch, 1997; Preston, 1995; Ryan, 1996; Van Loon, 2002). Compared with the heightened media attention to the 'newly discovered' virus of SARS, whose mortality rate is a significantly lower (6-12 per cent), the relative indifference with which the globalised world of news has responded to this outbreak of Ebola warrants at least some critical reflection.

Considering the question why some diseases receive more attention than others, therefore raise more concern and become nodal points in the cultivation of risk sensibilities, we need to emphasize the tempo-spatialization of infectious diseases. This must not be seen as simply an addendum to the 'disease as metaphor' argument put forward by for example Sonntag (1989) and Treichler (1988), but as a reconfiguration of the materiality or *trope* of metaphorical associations (also see Haraway, 1997). Rather than prioritizing the way in which public health is constructed symbolically, this article seeks to argue – by invoking Actor Network Theory - that the disease (or to be more

exact, the virulent pathogen causing it) is itself an active agent in the ordering of its own 'epidemic space'. Epidemic space is not merely a 'figure of speech', but an essential lynchpin in the continuous iteration between the microphysics of infection and the macrophysics of epidemics (Van Loon, 1998). It is the site or 'junctural zone' (Ryan, 1996) where various actors meet, including virulent pathogens, medical experts, politicians and journalists, it is there where sense making condenses into specific realities.

The concept of epidemic space also plays a central role in understanding risk. In a reflection on the continued relevance of his concept of risk society, Beck (2000) defined risk as a 'becoming real', a potentiality. As such it makes no sense to ask whether risks are real or constructions; they are both 'constructed realities' and 'real constructions' in the sense of what Shields (2003) referred to as 'the virtual as real without being actual, ideal without being abstract'. Invoking epidemic space is merely an attempt to clarify how a specific risk (emergent infectious diseases) impacts upon wider social, cultural and political structures. I will argue that a sustained focus on epidemic space forces us to reconsider three key concepts of contemporary social theory: the subject, the social and the public sphere.

Infections and epidemics are events whose becoming-real is primarily contingent upon a combination of spatio-temporal forces, most notably those of vectors (transmitters of the disease) and incubation (the time it takes for an infection to manifest itself). This suggests that epidemiological understanding of the spreading of contagious diseases necessarily implies a bio-cultural geography of infection. Elsewhere (Van Loon, 1998), I have discussed this cultural geography in terms of two concepts: the microphysics of

infection and the macrophysics of epidemics. Whereas the first is mainly concerned with 'clinical' pathologies, the second strikes at the heart of public health (also see Christie, 1987: 1-2), epidemic space refers to the zone that lies in-between both; it is the zone of what Ryan (1996) calls 'aggressive symbiosis': a space where microbes (and the infected/infectious bodies they inhabit) meet technologies of regulation.

Actor Networks

The first point to be made is that epidemic space is not a void. Instead, it is a dense space; marked by complex connections between a wide range of nodes: patients, medical staff, equipment, modes of transportation, roads, hospital wards, virulent pathogens, parasites, animals, communication technologies, military personnel, weapons, barbed wire, but also less tangible *actors* such as regulations, procedures and accounts. The scope of the links varies. They can operate on the level of cells, molecules, atoms and even digits; they can also operate on the level of organisms, institutions, societies or even continents. The nature of the links also varies: they can be of a 'physical' nature, meaning that they can be made present in, for example, laboratory tests and clinical trials, or of a symbolic or virtual nature, referring to forms of affectivity that operate by means of, for example, news, rumors, metaphors and myths.

In *Science in Action*, Bruno Latour (1987: 180) notes that

> the word network indicates that resources are concentrated in a few places - the knots and the nodes -which are connected with one another - the links and the mesh: these connections transform the scatttered resources into a net that may seem to extend everywhere.

Central to Latour's account of 'science in action' is the way in which particular

statements become ‘matters of fact’. He refers to this process as ‘enrollment’ - the ‘tying in’ of various sorts of resources: financial, symbolic, human, technological, spatial etcetera, through cycles of credit and accreditation (Latour and Woolgar, 1979). Via this extension into a network, the particular claim becomes a ‘matter of fact’. Questioning the claim is not part of the mode of rationality which such a network inaugurates. Hence, the matter of fact is not as much a matter of ideological imposition or deception, but part of the structure of obviousness that constitutes the network itself. The important difference is that such a ‘forgetting to question’ is not a trick played by the unconscious, but a simple pragmatic consequence of the economic, social and political costs involved in challenging such ‘matters of fact’ (and destabilizing the network). For Latour, networks are not all-powerful uncontested systemic forces but, in contrast and despite the huge concentration of resources, still rather fragile achievements, prone to collapse and disorder. It is the doubling of power and fragility. Much of the investment of technoscience goes into the recuperation of social order from potential breakdowns and instability.

At first sight, the type of ‘networks’ woven by pathogen information flows seem anything like ‘cycles of credit and accreditation’. The parasitical aspect of the pathogenic information-flow of infection is that of changing the condition of the host, usually in a negative way, varying from being a nuisance to debilitating and even lethal. At the same time, the parasite benefits from this flow by being able to draw information and resources from the host to increase its own reproductive potential (‘replication’). On this count, the flow of information and materials between host and parasite is far from balanced, and as a consequence, their relationship is far from reciprocal. Hence the term ‘exchange’ is

somewhat misleading.

However, when we consider infection as being a flow of pathogen information *between* hosts, the parasite becomes itself 'a gift', in the negative sense of gift as being poisonous.[1] Here, reciprocity can be invoked more adequately. For example, the process of infection between persons can inaugurate interactions embedded in guilt and blame (negative reciprocity) but could also enhance solidarity, either directly (common experience of the disease, shared suffering) or indirectly (mediated by institutional responses, stigmatization, public imagery). Moreover, it may have longer term benefits in terms of enhancing immunity and resistance to other diseases (McNeil, 1976), also known as co-evolution (Ryan, 2003). That is to say, the 'gift' of infection is an event whose consequences are ambivalent, contingent and open and hence socially and sociologically significant. Indeed, as Wills (1996) has argued, infectious disease evolves with pathogens, parasites, animals and humans (the primordial actor network of epidemic space). This makes immunity of populations an inherently social phenomenon; hence it is a viable subject of analytical concern for social scientists.

In order to bring about a closer synergy between a epidemiological phenomenology of infection and cultural analysis, a theoretical framework is required for understanding the socio-cultural dynamics of infection, both in terms of its brute material force in affecting the conditions of humans and their affiliations with other forms of life and their wider signifying power as symbols of the human condition of (late-) modernity.[2]

By focusing on the closely associated concepts of risk, flow and vortex, I will show

[1] This is derived from the work of Derrida (1993) who in *Given Time* refers to the German word Gift, meaning both 'present' and 'poison'.

[2] For example in the expression that AIDS is a punishment by God for the sinful and immoral nature of sexual promiscuity, especially in the context of homosexuality.

that in late-modernity, epidemic spatialization has a tendency to destabilize the social ordering which facilitates it. Perhaps it is because too much energy has been directed against pathogen flows or too much focus has been given to the sterilization of the human being and 'his' environment. However, if this destabilization continues to prevail, then there will be mounting pressure on the institutions of public health care for a radical overhaul of the way in which they govern epidemic risks. In response to this, we need to reconsider the very nature of governmentality and how it engages with 'subjectivity', 'sociation' and a democratic-political 'public sphere'.

The first step, I suggest, lies in reconsidering what kind of social spatialization is created by epidemics. Latour's main proposition, that humans, technologies and gods constitute 'actor networks' has important spatial implications as networks are themselves first and foremost spatial forms. Moreover, it forces us to take into account the particular functions and operations of (medical) science and technology as something that generates particular mediated contexts that in turn function as self-referential enclosures of 'reality'. Pathogen flows are central to understanding concepts such as enrollment and induction. They constitute the materiality of specific network-relationships.

The meaning of epidemic space is in many ways self-evident. Indeed, the Greek word *'epi'* already contains spatial referents: on, over, upon, 'close in time or space'.[3] *Demic* is derived from the Greek *demos*, meaning 'people'. Hence epi-demic refers to a condition set upon people who are close in time and space. Epidemic is first of all an adjective, describing the nature and intensity of a particular phenomenon or event. In today's vernacular use (since the 19th century), epidemic is most commonly associated with

[3] *The Concise Oxford Dictionary of English Etymology*. Oxford University Press, edition 1986, p152.

pathologies, more specifically infectious diseases (Anderson, 1983; Bouter and Van Dongen 1991: 5).

Epidemic can be contrasted with *endemic* (the Greek word *en* means 'in'), which refers to a condition that is or has become part of the people. Hence whereas for epidemic it is the exteriority or 'imposition' of the condition, for endemic it is the 'interiority' of this condition. The notion of epidemic thus implies a difference between the 'normal' state of being (the order of things) and what it refers to as 'externally imposed'. Epidemic must remain outside the ordinary; it is a turbulence that is expected to disappear. This is vital for understanding our relationship to infectious diseases. Nearly all diseases have a history of ascendance, disappearance and re-appearance (McNeil, 1976; Ryan, 1996, 2003; Wills, 1996). An epidemic is a temporal state of disorder or turbulence. In sharp contrast, endemic is the 'internalization' or 'normalization' of the pathology into the ordinary everydayness of being in the world. When a disease becomes endemic, it ceases to interrupt everyday life as such.

Following Wills' (1996) argument, this becoming-endemic or induction is the fate of many pathogens. Once they have become endemic, their problematic nature tends to fade away as a 'matter of fact'.[4] Central to epidemic space is thus its extra-ordinariness. Epidemic space entails the dis-ordering of everyday life. In other words, in epidemic space pathogen virulence is an 'odd' element in the actor network; one that disturbs its smooth functioning, challenges its integrity and undermines its coherence.

[4] For example, it is a well known fact that human DNA consists of thousands of traces of retroviral genetic material, which are passed on from generation to generation without causing any obvious harm to individuals (Ryan, 2003). It is quite conceivable that in the long run retroviruses such as HIV will also lose their virulence and enter into a far more stable symbiotic relationship with the human species (which is already the case for HIV in Chimpanzees).

The Macro Physics of Epidemics

Epidemiology is principally concerned with describing and explaining diseases as they occur in populations. In terms of descriptions, it uses a triad of place, time and people, in terms of (causal) explanations, it refers to etiological agent, host and environment (Lilienfeld and Stolley, 1994: 1). The latter is of crucial significant here as it is the intersection between the macro and micro physics of infectious diseases. The intersecting of these two different scales is the principle work of 'flows' (Shields, 1997) which thus induce epidemic space.

Lilienfeld and Stolley (1994: 38-9) distinguish between two types of flow of pathogens: (1) common vehicles (water, food, air and inoculation), these are singular and located modes exposure that are faced by larger populations at the same time (horizontal infection) – this is the general meaning of contamination; and (2) serial transfer, in which the emphasis is on person-to-person infection via bodily excreta, insects or other predatorial parasites and attendant-related 'cultural vectors' (Ewald, 1994) . In this second mode, pathogens are 'passed on' in flows from one host to the next (vertical infection), this is generally referred to as contagion.

In terms of microphyics, contamination entails the relationship between host and parasite; it is the violation of a (seemingly) discrete and integral unity by 'pathogen' information. It thus focuses on discrete and different entities. In contrast, contagion could be represented with an arrow, from host A to host B. The 'content' of the arrow is the pathogen information (virus, bacteria). The hosts are seen as similar, and the arrow as a mode of connecting or enrollment. The focus shifts from the infected body to the infectious body. Rather than a parasite whose eradication is seen as central to the

overcoming of the disease, the infectious body is seen as ambivalent – both *a risk* and *at risk*. This ambivalence is highlighted in the organization of the modern hospital which 'processes' at once risky and at-risk bodies, in a complex series of dualisms of 'isolation' (sterilization) and 'care'. The infectious body, however, is never seen as discrete, but always as 'open'. This enables not only a removal of obstacles for medical intervention, but also a label of 'endangerment' being associated with the body itself. For example, this results in all kinds of bodily excreta to be no longer simply regulated by cultural taboos (Douglas, 1984) but above all by medical technoscientitific concepts of risk-management (Lupton, 1994).

In epidemiology, the mode of passing on (flow) is called 'vector'. Although vector can also be used for contamination, where it simply means 'vehicle for pathogen transmission', its usage in the analysis and explanation of contagions is far more specific. Vectors can occupy different roles in flows of infection. They can be simple transmitters, receptors, or more complex reservoirs and incubators.

Through the usage of vectors, one could draw up an 'abstract space' of a particular contagion as it 'moves'. As it moves, it spatializes the epidemic, it constructs an epidemic space. When comparing the etiology of different diseases it becomes apparent that different pathogens use different 'vectors'. Influenza, for example, is largely airborne and travels without the aid of any other organism or body-substance; Ebola travels through blood-particles and nearly all forms of bodily-excreta; HIV through blood and semen and Malaria through mosquitoes. Understanding the vectors of particular diseases is a fundamental part of the diagnostic mapping of an infectious disease. Interestingly, Paul Ewald (1994: 38) notes that vectorborne infections are far more lethal than non-

vectorborne ones, because the virulence itself does not reduce the mobility of the vector. In this scenario, there is no evolutionary incentive for a more co-existence oriented symbiosis between host and parasite.

Cultural Vectors: attendant-borne transmissions

During the build-up to the second Gulf War another piece of unobtrusive news failed to attain much publicity. In a publication of a series of studies on the epidemiology of HIV in the *International Journal of STD and AIDS* (Brewster at al, 2003; Gisselquist and Potterat, 2003; Guisselquist, et al, 2003), it was revealed how since the 1980s, AIDS experts have systematically over-exaggerated the role of heterosexual transmission in the spread of HIV/AIDS in Africa. They do not reflect on the question why this may have been the case, but it is clear that stressing the role of sexual transmission resulted in the promotion of specific sexual health strategies at the expense of others. In other words, the 'epidemic space' of HIV/AIDS in Africa was conceptualized around 'sexual flows' (e.g. of semen-blood contact).

Questioning the sexual hypothesis, however, the authors argue that

> epidemiological evidence from field studies completed through 1988 allowed that health care transmission was not only significant, but might well have been responsible for more HIV than heterosexual transmission (Gisselquist et al, 2003: 151).

For example, whereas the high incidence of HIV amongst prostitutes is generally explained in terms of the centrality of frequent sexual activity with multiple partners as part of their profession, it is equally remarkable that all of them had been exposed to injections, immunizations and other medical interventions such as surgical abortions that pose potential risks regarding HIV-transmission (ibid: 154). Additionally

> [r]apid HIV transmission in Africa has often occurred in countries with good access to medical care like Botswana, Zimbabwe and South Africa … It is difficult to understand how improved access to health care, with its offers of public health messages, free condoms, and preventative services would be associated with increased HIV transmission (Brewer et al, 2003: 145).

This anomaly seems unintelligible if the majority of HIV transmissions are due to heterosexual intercourse. However, if one associates HIV-transmission with medical care itself – including improper sterilization of medical equipment and (method and/or user-related) contraceptive failures - the anomaly disappears. Suddenly, it becomes clear why in urban areas – where people have much greater access to medical care - HIV-incidence increases far more rapidly than in rural areas. It also explains why in Southern Africa, HIV is particularly prevalent among groups of higher socioeconomic strata (ibid: 146).

The idea that medical care itself plays a significant role in the development of epidemics is well known (Ewald, 1994: 87-108). For example, in the aforementioned case of Ebola in Yambuku as well as in later cases of outbreaks of Ebola, syringe transmission was identified as one of the key vectors in the spreading of the disease, which, together with the concentration of people and poor hygienic environments, turned medical centers such as clinics and hospitals into 'hot zones' of infection (Peters et al 1993: 162).

> One room in the hospital had not been cleaned up. No one, not even the nuns, had had the courage to enter the obstetrics ward…The room had been abandoned in the middle of childbirths, where dying mothers had aborted featuses infected with Ebola. The team had discovered the red chamber of the virus queen at the end of the earth, where the life form had amplified through mothers and their unborn children (Preston 1995: 133).

In the previous section it was mention that infectious space is an interiority: a relationship between host and parasite. It is this between-ness of host and parasite that constitutes the field in which 'cultural vectors' operate. Cultural vectors are all media of

infection that are technologically induced. Therefore, although humans and mosquitoes are media of infection, it is quite clear that the technological induction of the mosquito can only be indirectly affected (e.g. by insect repellent), whereas for the human it is always direct and immediate. That is, the revealing possibilities of technology (Heidegger 1977) often have a direct affect on cultural vectors. For example, a patient who is ill and diagnosed as such, attracts the attention of medical assistants and their equipment – within the ambivalent 'risky' space of the hospital - and thus a whole new range of possibilities for infection.

The hospital ward is an ideal epidemic space and conducive to the development of increased pathogen virulence (Ewald, 1994: 96). Cultural vectors such as medical attendants are connected to technological devices such as syringes giving optimal opportunities for opportunistic infections to prey on already vulnerable human beings, whose immunity is likely to already have been compromised by whatever brought them to seek medical attention in the first place. Although Ewald (1994) links this process to the widespread use of antibiotics which effectively encourage increased pathogen virulence (also see Cannon; 1995; Garret, 1994 and Wills, 1996), he stresses that even without antibiotics, pathogen virulence tends to increase with the frequency of attendant-borne transmissions. Using evolutionary biology, his conclusion is that attendant-borne pathogens favour increased pathogen virulence.

In other words, the cultural vector hypothesis emphasizes that humans, technologies and pathogens engage in networks by bringing together their own singularities of engagement. An epidemic space emerges around a set of flows which often amplify each other. The motivation of pathogen virulence, for example, forms an alliance with the

motivations of medical care, even though both may have completely oppositional intentions. Flows of pathogen virulence effectively appropriate the technical infrastructure of modern medical care and for human beings, the consequences are often detrimental. For epidemiologists, mapping an epidemic space therefore requires a wide-ranging and open-ended scope in which a multiplicity of vectors and flows are included.

Tracing Epidemic Space: Index and Vortex

A focus on vectors enables one to map the complex connectivity of epidemic space. However, epidemic space also incorporates a 'temporal dimension'. This involves a tracing of origins, causes and effects over time. Epidemiologists call the first identified case of an epidemic the 'index case' (Anderson, 1983: 133). Especially in analyses of (vertical) contagion, tracing the index is of enormous importance since it supplies a wealth of information on possible causes of the disease and possible vectors of infection. By tracing the index case backwards, along the various vectors that are abstractions of flows of pathogen information, the epidemic space is subsequently mapped and traced back to its alleged 'origin'. Indeed, one could argue that a central part of the epidemiological endeavour to map a disease is also to understand its 'indexicality'. Indexicality entails both a phenomenological and a semiotic concept. At once, it refers to the *context-specificity* of utterances (in terms of deixis – this, that, these etc.) and to a specific relationship between signifier and signified in which there exists a seemingly 'causal' *relationship* between the two as present and absent (Van Loon and Rockwell, 2002). The latter thus also highlights that indexicality implies temporalization.

Combining both notions of indexicality, it can be argued that (epidemic) spatialization

takes place through indexicality. In this sense, space is always particular and relational, (Lefebvre, 1990. Moreover, it is not only marked by what is visible and present, but also by what is *virtual* – a potentiality of coming into being that is none-the-less more restricted than 'the possible', because it is already being indexed. In this sense, epidemiology is like cultural geography - a form of sense-making through mapping indexicalities - the context-particular tracing of affectivity of spatial forms and relationships (cf. Eyles and Woods, 1983)

However, equally important is the subsequent link with *abstraction*. It is through abstraction that 'logos' is added to epidemic. Transforming the local and lived indexicalities (traces) into a more general framework of understanding flows of infection, requires representations of space that are discursively regulated. Space becomes a site of regulation, governance and control. To obtain a higher level of generality than that of the particular incident, epidemiologists use population statistics as well as laboratory and clinical experiments to decontextualize a particular outbreak and reconfigure it within an abstracted space of flows (Latour, 1988). This includes both knowledge about the general condition of the population at stake, including the environmental as well as medical factors that characterize it, as well as knowledge about the possible pathogens, their genetic structures, vectors and natural habitat.

Alongside mapping indexicality of epidemic space as a virtuality, followed by its abstraction into a decontextualised account that can be replicated within laboratory tests and clinical trials, the epidemiological rationale has a third dimension. This is related to what might be called 'epistemic politics' and is mainly framed within the wider logic of modern medical science, whose 'will to know' is directly coupled with the bio-politics of

individual bodies and populations (Foucault, 1979). Their main public ethos of the scientific concern of epidemiology is the 'prevention of diseases' (Anderson, 1983; Bouter and Van Dongen, 1991; Evans, 1982; Lilienfeld and Stolley, 1994). That is to say, as a technoscience, epidemiology is not merely concerned with tracing the origin of a disease, mapping its trajectories or explaining its patterns and regularities; as technoscience, it also feeds into public health management, and it is here where epidemic space is above all a space of risk-flows.[5]

Epidemiologic technoscience effectively operates between the space of flows of abstracted knowledge and the immediate lived (but virtual) epidemic space of infectious diseases. It thereby complicates the dualism between abstract knowledge and embodied concern. Alongside vector and index, this third dimension of epidemic space operates as a *vortex*: a 'cosmic whirlpool' of strange attractors. It brings together the trajectories of seemingly unconnected events that constitute the complexity of cosmic rhythms and flows. Vortexicality is set-into-work by an initial disturbance or discontinuity, and leads to a more or less volatile intensification of speed of flows. Hence, the role of the Yambuku missionary hospital in the spreading of Ebola, or the role of the Kinshasa highway and sexual health clinics as main arteries of HIV transmission in Africa, are cases of vortexicality in which 'hot zones' are constructed by the very same technoscientific practices that were designed to contain them.[6]

Hot zones are particular intensified epidemic spaces that are at once abstract and lived. They call forth a range of technoscientific concerns, often enforced by the state's

[5] See for example Latour's (1988) account of the way in which in 19th Century France, the hygiene movement was able to reconfigure public health management around the paradigm of germ theory.
[6] See Shope and Evans (1993) for a more overall review of the role of geographic and transport factors in the emergence of new viruses.

policing apparatuses. Quarantined zones of containment are such extraordinary places because normality, indeed the very logic of modernity, is suspended; the boundaries are often regulated by brute force rather than consent. The status of those inside suddenly changes as civic entitlements (e.g. liberty, equality and brotherhood) are suspended. When vortexicality becomes visible, panic strikes because modern technoscience is no longer 'in control'. This is the case, for example, when media engage in a rhetoric of endangerment (Ungar, 1998). When the cosmic order re-arranges itself and 'man' is (temporarily) displaced from the center of the universe, and more importantly the myth of the human-centered universe is being displaced, it may only be a temporary event but also one which deeply upsets the institutional logic of modern world society. It is this induction of hot zones into other domains (e.g. political, military, economic, and symbolic) that makes 'epidemic space' never just an issue of bio-medical containment. It subsequently requires political, military, economic, cultural and social containment.

Hence, whereas indexicality maintains an ideal of determinability of origin, vortexicality only operates in relation to the whole; it induces a complexity in which traces are always-already multiplied and diffused. Instead of a linear tracing of origins, it requires an induction of new forms (hence transformation). It is the technoscientific intervention in-between the abstracted and lived epidemic spaces that engenders these new vortexical forms. The impact of epidemiological technoscience cannot be determined in advance because it is contingent upon the unpredictability of events. It forces us to think of infections and epidemics less in terms of linear processes or matters of scale, but rather as 'nested' complexities whose time-scales are multiple and interconnected and whose overall composure co-evolves with and not independent of, our

attempts to reconstruct it. Conversely it is important to understand epidemic space as being more than 'merely' a zone of microphysical contagion. Instead pathogen virulence affects more than human organisms, its epidemic space involves an ensemble of forces that may or may not been contained in quarantine.

The Instability of Epidemic Space

Latour's Actor Network Theory provides a means by which we can come to terms with the 'stabilization' of specific socio-technical settings. Although it is not really a 'theory' in terms of a relatively coherent body of assumptions, hypotheses, explanations and predictions, it does generate an analytical and conceptual framework with which we can understand the formation of specific social practices.

Epidemic space could be understood as a specific framing of 'actor networks', one which is governed by a multiplicity of flows that can be understood in terms of vector, index and vortex. A virus is a major actor in this network-engendered epidemic space. Between living and non-living matter, viruses exist only in becoming. Their networks are highly temporalized and fragmented. Its fragility is intensified with an inability to sustain itself. The point to make here is that whereas all networks are fragile, it is their ability to adjust the 'currency flows' to newly emerging environmental complexities that allows them to sustain themselves. In other words, if the technoscience of epidemiology is to be successful, it has to be able to translate the highly intensive but also highly temporal force of epidemic space (set into work by viral infections) into more enduring flows of financial, symbolic, human, technological and spiritual matter/energy. Indeed, only virulent assemblages are capable of becoming actor networks.

Alongside the matter-specific microphysical enframing of pathogen virulence, the focus on epidemic space also allows for a more situation-specific understanding of risk-society and risk-culture. It enables us to extend concerns over identification (including clinical diagnostics, see Grist at al, 1979) and embodiment in risk-cultures with notions of 'movement' (vectors), 'speed' (virulence) and 'tenacity' (incubation) that cannot be analyzed at the level of 'individual bodies', but force us to take into account the relational-contextual framework of actor-networks.

> The smallest AIDS virus takes you from sex to the unconscious, then to Africa, tissue culture, DNA and San Francisco, but the analysts, thinkers, journalists and decision- makers will slice the delicate network traced by the virus for you into tidy compartments where you will find only science, only economy, only social phenomena, only local news, only sentiment, only sex (Latour, 1993: 2)

The compartmentalization of epidemic space is the main job of the medical technosciences such as clinical virology, immunology and epidemiology, who – often with the aid of governance and commerce – create specific 'zones' within networks that appear to operate autonomously from other particle flows. Identifying a limited number of vectors and indices indeed enables a 'tracing' that is also a reduction of complexity (cf. Christie, 1987). Vortexicality is thus written out of the script of the disease etiology - that is until its fractal-movements start to seriously affect other parts of social organization.

Latour's main concern is with the *sociologics* of reason (1987: 205). Rather than tracing, his work focuses on 'mapping' as a way of bringing everything into a singular scale on which the event can be 'handled' without compartmentalizing its complexity. Cartography, photography, modeling and simulations allow scientists to have a clearer *overview* of the event by making it 'present at hand' but also to enroll their 'immutable

mobiles' (vectors that travel across different zones without apparent modification). The function of immutable mobiles is to pass on information, connecting different 'coding systems' into one network. It allows networks to 'act at a distance' (Latour, 1987: 232). This 'scaling down' of the world is thus also a process of intensification of information - the formation of 'nodes' in networks. In other words, the formation of networks is a proliferation of hybrids (Latour, 1993: 1-3).

Vortexicality, however, sits not comfortably within Actor Network Theory. As the latter is more concerned with ordering and stabilization, it does not really enable us to come to terms with the extraordinariness of epidemic space. It focuses on routines, alliances and representation As a result, it runs the risk of neglecting those bits that do not fit (Van Loon, 2002).

Moreover, whereas the socio-logic performs the bottom-line argument for Latour, this logic appears rather 'thin' when we consider the motivational aspects of 'enrollment'. It seems that at best, the motivation is the enhancement of life-chances, which might manifest themselves as either self-interests or collective interests (or both). Indeed, the connection of multiple 'fates' under a particular mode of rationality of technoscience is driven by both an anxiety over death and a lust for life. Latour would be the last to neglect the cultural embedding of such anxieties and desires. However, as an ethnographer interested in science-in-action and in forms of practical reasoning, he does not conceptualize that which is not present-at-hand in practical reason. This makes it rather difficult to think of modes of rationality that are not primarily invested with deliberate and conscious strategies. That is, enrollment seem to require some form of mediation in terms of awareness and intelligence. Consequently, it is insufficiently clear

how such cultural embedding of anxiety and desire operates for the non-human actors in the network; unless they are being anthropomorphized into being similar consciousness-bearing creatures. What are the strategies employed by technologies, non-human organisms and gods (or spirits)? This question is of extreme importance to understanding the macrophysics of epidemic space. Indeed what motivates a virus?

Evolutionary biologists such as Ewald (2000) and Wills (1996) have put forward a strong case for arguing that what motivates a virus is self-replication. However, such a view tends to an extreme tautological reductionism which simply replaces the entire multiplicity of epidemic space with the singular but mythical signifier of survivalism, for it can be invoked to explain both increasing and decreasing pathogen virulence.

The problem with the survivalist myth is that viruses are not like cellular life forms; they can never rely solely on themselves to 'exist'. As Ryan (2003) has argued, they are always-already geared towards symbiosis. The virus is perhaps the most primitive form of 'hybrid'. It cannot be categorized as a life form outside living cells; it is not geared towards stabilizing its own cellular form but only to reproduce particles of itself at an enormous rate (Holland, 1993) that need to be linked up with host DNA or RNA to complete the reproductive cycle (Cann, 1997; Levine, 1982). Hence, its fate is still connected with that of its host; if the host dies, so do its cells and hence the viruses that form reproductive systems with them. Following the logic of actor networks, the virus must attain the ability to enroll others into is actor-network; its fate is connected to establishing a successful ensemble of connected fatal flows. Whereas this does not necessarily mean that viruses suffer from killing their hosts, it does mean that the more aggressive and virulent a virus, the more it will rely on cultural vectors for its survival

(Ewald, 1994).

If we understand the virus as part of an actor network, it is not difficult to see how it operates as a modality of spatialization. This effectively takes place when a virus (or bacteria) takes a turning, by allowing the symptoms of infection to surface and spark a ‘concern’. The concern is in direct biological terms one over the violation of the organism’s immune-system.

This concern, however, is rarely restricted to the individual body; but – by means of being enrolled within wider networks including those of politics, media and economics – can induce a ‘vortex’ and spark off a series of unexpected translations; whose stability depends on the extent to which the network itself can maintain a symbolic integrity (i.e. this would be a form of systemic immunity). If the vortexicality of the event is low, then there is very little that contaminates the symbolic ordering of this concern and business may go on as usual. We may then even speak of a regular or normalized epidemic space. Many outbreaks of flu could be classified as such, but not all. The 1997 outbreak of Hong Kong flu, supposedly a variation of a disease normally found in chicken, was not contained within the quarantine-zones of mythology and sparked a rather more widespread panic about public health and food-safety. Likewise, recent food scares, particularly in the United Kingdom, over BSE, Food and Mouth Disease, Salmonella and E-Coli can all be interpreted as ‘vortexical’ phenomena, in which epidemiology is as much part of the problem as it is of the solution and has failed to attain mythical closure.

Conclusion

In this article, I have argued that epidemic space operates on the intersections between the microphysics of infection and the macrophysics of public health. I have tried to show that infection can be theorized as a particular form of sociation, one that immediately brings to the fore the risk-laden and especially contagious nature of the social. At the same time, it enables us to see the social as a constellation of flows, as shifting perspectives and positions, and thus inherently unstable.

The 'subject' of modern democratic politics is equally problematic when considering epidemic space, as the sheer otherness of the pathogen who forms constellations with the human body, inherently problematizes the latter's alleged integrity. Instead, bodies are 'opened up', i.e. 'disclosed' by pathogen flows and are – as a result – doubled – as infected and infectious.

This doubling creates an ambivalence operating at the center of public health – to whom is it to be responsive – the sick or the healthy? Most would say both, yet one must acknowledge that they do not add up. As a result all strategies of risk-management are 'corrupted' by ambivalence. By using the concept of vortexicality, I suggest that this ambivalence is the primary engine of a growing sense of loss of control, paired with an emergent apocalyptic anxiety as expressed, for example, in popular cultural narrations of medico-military conspiracies.

In contrast, symbiosis theory (Margulis, 1993; Sapp, 1994) shows that by adopting a long term evolutionary perspective it is possible to question the alleged dysfunctionality of many pathogens (Ryan, 1996; Van Loon, 2000a). Instead, one might argue that pathogens are the best possible vectors of symbiosis, the synthesizing process of life

(even if it entails its partial destruction). Perhaps this is why genetic engineering technologies often look for viruses as vectors of genetic manipulation (Old and Primrose, 1994).

If we understand epidemic space as both a trope for the organization of anomalous space and a materialization of a particular assemblage of forces which integrate embodied immune systems with wider socio-cultural and politico-economic constellations, we are perhaps able to make more sense out of the way in which infectious diseases operate upon society and culture. As a form of expression (trope), epidemic space is a particular symbolic organization dominated by - but not exclusively consisting of - bio-medical discursive formations, often engaging in a paradoxical relationship with embodied experiences and non-expert forms of knowledge and morality. As a form of content, epidemic space is constituted by the clashing forces of regularity, ordinary practices, normalized routines and habits on the one hand, and those of ontological extra-ordinariness, abnormality, irregularity and deviance, on the other hand. Crucial here is the regularity of irregularity of epidemic space which has allowed the creation of expert-systems of epidemic management that operate upon the monadic logic that every contingency is to be colonized.

Perhaps we should see epidemic space as itself a matrix of paradoxical forces - body/institution; discourse/experience; regularity/irregularity; difference/repetition; control/excess; risk/opportunity. It is this multiple implicatedness that allows it to be a node of the production and reproduction of ‘order’, but also as a site of struggle and perhaps even - albeit in exceptional cases - a liminal zone of social change. For social and cultural analysts, epidemic space relates to the very core of their respective domains: the

social and ‘sense-making’. Epidemic space allows for the understanding of infections, immunity and epidemics as social and cultural phenomena. However, likewise, a socio-cultural sensibility towards epidemic space also engages the bio-medical sciences. It is well known that the representatives of these so called ‘hard scientists’ have been less than inviting to the humanities and social sciences as far as mutual engagement of knowledge is concerned. However, their monopoly on understanding infectious disease has in effect been eradicated by the failures of technoscience to live up to its grandiose predications. In a risk society, techno-science itself faces a crisis of legitimation. This legitimacy crisis is directly related to the displacement of the basis of agency from the integral subject to the infected/infectious body, which itself is situated in complex of flows of contagion. It calls into question the very justification of regimes of regulation and the nature of decision-making that is often obscured by the subpolitics of expertise (Beck, 1997).

Viruses are enrolled in actor networks that stretch far beyond the clinic and the laboratory. Government agencies often allied with judicial, political and military institutions, media organizations and commercial enterprises all have a stake in the management and control of epidemic space. Indeed, one could argue that if taken to its logical limit, epidemic space is rapidly becoming the public sphere of the risk society. As epidemic spaces are produced and reproduced by an ambivalent constellation of forces, they are therefore not contained by the physical properties of quarantine and may mobilize concerns. These concerns operate as energizers of possible actor-networks that involve apart from scientists and engineers, also policy-makers, journalists, entrepreneurs, and lawyers to name but a few. It is vital therefore, that the notion of epidemic space should not be colonized by the technosciences of epidemiology, virology

and immunology for exactly the same reasons why the management of a nuclear plant should not be seen as an exclusively nuclear-physical issue.

Cultural analysis could provide a modest contribution to understanding the socio-cultural embedding of both the indexicality and the vortexicality of infections and epidemics. We could function as cultural mediators between technoscience and the political spheres of media and policy-making. For me at least, the way ahead is not in entrenching ourselves in epistemological debates over reality and construction, in guarding the artificial boundaries that separate the disciplines or in instrumentally recording the public understandings of technoscience. Making sense involves all of us and as long as our species-being remains dependent upon the social functions of collaboration and solidarity, cultural mediation could provide one vital source of kinetic energy - that of 'setting into-work' and engaging particular movement-rhythms of social transformation and cultural transgression.

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