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Satellites and the New War on Infection: Tracking Ebola in West Africa

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ABSTRACT

Satellite technologies are increasingly being deployed to manage infectious disease outbreaks. Although there is a substantive literature concerned with the geopolitics of space and the ethical issues raised by the use of remote sensing in warfare and counterinsurgency, little study has been made of the critical role played by satellites in public health crises. In this paper, we focus on the 2014–2015 Ebola virus disease (EVD) epidemic in West Africa, which saw the widespread use of public and commercial satellite-derived data, to investigate how overhead orbital and close-up viewpoints enabled by satellites are shaping attitudes to disease and determining responses to infectious threats. We argue that high-resolution satellite imagery is acting as a spur to a new spatio-temporal targeting of disease that parallels the ever more vertical dimension of contemporary warfare. At the same time, this new visualization of disease is promoting a broader ecological perspective on pathogen emergence. How can these divergent perspectives be reconciled? In addressing this question, we analyze the different uses to which satellite imagery has been put in tracking and mapping Ebola 'hotspots' across Guinea, Liberia, and Sierra Leone. We also consider the institutional contexts that have enabled the acquisition of this imagery. Given the rapid integration of space technologies in epidemiology and health logistics, there is now a need to examine how and with what consequences remote-sensing and communication technologies may be reconfiguring the practices and scope of global health.

1. Introduction: technological convergence

Between December 2013 and December 2015, West Africa experienced the largest epidemic of Ebola virus disease (EVD) in history, with more than 28,000 suspected cases across Guinea, Liberia, and Sierra Leone, and over 11,000 deaths.[1] On 9 October 2014, the International Charter for Space and Major Disasters – an agreement between "Authorized Users" to provide free space data "to those affected by natural or man-made disasters" – was activated by the US Geological Survey (USGS) on behalf of the US National Geospatial-Intelligence Agency (NGA) to monitor the Ebola outbreak in Sierra Leone (UK Space Agency, 2014). This marked the first time the Charter's space assets had been deployed to assist in containing an epidemic (CERN, 2014).[2]

While the effectiveness of the World Health Organization's (WHO) response to the Ebola epidemic was widely criticized (Moon et al., 2015; Stocking et al., 2015), the epidemic crisis saw a significant number of remote-sensing initiatives that involved partnerships between multiple national and international agencies and commercial companies. The outbreak instigated a rush for high-resolution satellite imagery that would furnish the basis for more comprehensive mapping. As Mapbox – a company involved in a humanitarian mapping project during the Ebola outbreak – notes on its website: "This is a region where the best available maps are often antiques from the colonial era, two generations ago."[3]

Space data also acted as a spur to discussions across disciplines about the practical application of innovative technologies in the management of infectious disease. An international conference, 'Technology for Ebola', sponsored by Microsoft, was held in Cairo in December 2014 under the motto "The tech industry can empower Africa in its fight against Ebola". As one commentator noted during the crisis: "The Ebola scare may turn out to be one

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[1] The Ebola outbreak has been traced to a two-year-old boy, who died in December 2013 in Meliandou, a village in southeastern Guinea (Maron, 2014).

[2] "Authorized Users" for the main part comprise national space agencies but also include Airbus Defence and Space, and the companies DigitalGlobe and GeoEye (Satellite Imagining Corporation) that formally merged in January 2013. See http://www.disasterscharter.org/web/guest/-/other-in-sierra-leone.

[3] Charlie Loyd, 'Ebola mapping in Guinea: Humanitarian OpenStreetMap Team' (March 25, 2014). Retrieved from: http://www.mapbox.com/blog/osm-ebola-mapping/.

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of health care technology's important trial runs, given the sheer number of apps, mapping tools, collaboration platforms and even robots that have been recruited for duty."[4]

In this paper, we focus on the Ebola outbreak in West Africa to examine how epidemiological knowledge and communication systems are becoming increasingly entwined. What are the implications of this intertwinement for global health? In addressing this question, we draw upon – and seek to contribute to – a growing literature concerned with the way that orbital and aerial perspectives "structure particular ways of engaging with the world" (Parks, 2012, p. 196). The emphasis in this scholarship has been on exploring the role of media technologies, such as satellites, in reconfiguring visual practices and shaping how the 'global' is understood. Satellite images of earth are the upshot of complex interdependencies between state and non-state agencies, and are practically enabled by state and multinational financing. Rather than viewing such imagery as neutral data – the way that those promoting and selling the technology encourage us to do – the focus has shifted onto the geopolitical contexts that determine how data is produced, interpreted, and disseminated.

Epidemic image data generated by remote-sensing technologies, we argue in this paper, are the outcome of a complex technological and institutional matrix that extends from optical instruments to computer processing. During the Ebola crisis, the UN's Operational Satellite Applications Programme (UNOSAT), a division of the UN's Institute for Training and Research (UNITAR), produced an *Atlas of Ebola Care Facilities in Guinea, Liberia & Sierra Leone* to support emergency humanitarian assistance activities on the ground (Figs. 1 and 2). The atlas relied on high-resolution imagery from three DigitalGlobe satellites – WorldView-2, WorldView-1, and Quickbird – but also involved the collaboration of numerous other organizations to process the imagery and create geospatial content (UNITAR, 2014).

In a manner similar to Jody Berland's description of weather forecasting, epidemic surveillance and prediction involve a "technical convergence and economic interdependency of a specific technological assemblage of satellite communication transmission, GPS monitoring, television, digital information processing, digital graphics, security systems, and the management of urban space" (Berland, 2009, p. 246). The term 'satellite imagery' thus underplays the degree to which satellite technologies are contingent on an assemblage of different organizations with "different social goals and ways of understanding the hardware itself" (Mack, 1990, p. 4). It also elides the different phases of the image production process: from the acquisition of data to their processing, spectral analysis and interpretation, and finally the development of specific information products (Lillesand et al., 2004, p. 3). This interdependence of state agencies, NGOs, and other organizations and corporations working as service providers, constitutes a "contracting nexus" that Crampton, Roberts, and Poorthuis identify as a "new political economy of geographical intelligence" (Crampton et al., 2014; see also Parks and Schwoch, 2012).

Until recently, geopolitics has tended to be understood as a fundamentally "flat discourse". As Weizman has observed: "It largely ignores the vertical dimension and tends to look across rather than to cut through the landscape. This was the cartographic imagination inherited from the military and political spatialities of the modern state" (Weizman, 2002). Over recent years, however, there has been a fresh emphasis on the vertical dimension of geopolitics; on how aerial and orbital perspectives are reshaping notions of territory, security, and conflict (Adey et al., 2011, 2013; Elden, 2013; Graham, 2004; Williams, 2013). Aerial warfare in World War I "prefigured a symptomatic shift in target-location", while the development of spy-satellites and drones after World War II enabled a "strategy of *global vision*" (Virilio, 1989, p. 1) that challenged existing cartographic techniques. In short, twentieth-century aerial and orbital technological innovations have increasingly moved geopolitics onto a vertical axis, and as a result have called for a new multi-dimensional representation of space (Weizman, 2002).

The contemporary dependence on satellite imagery for mapping might be viewed as an extension of the state's historical reliance on mapping to manage risks and threats (Crampton, 2003). However, the involvement of multiple non-state actors in the production and distribution of such imagery could be said to reflect "a shift in the institutional locus of disciplinary power" and a diffusion of surveillance that challenges a "state-centric view of world politics" (Litfin, 2012, p. 67).

As Parks notes, "It is especially when technologies converge that we notice and understand their definitions" (Parks, 2005, p. 9). Today epidemiology and public health are being reconfigured through the uses of high-resolution satellite imagery and global-positioning (GP) maps that are also central to military strategy and underpin commercial entertainment. Media broadcasting, mobile phones, air travel, as well as national security, all rely on the same constellation of satellite technologies. "When technologies converge", Parks observes, "they develop in discursive, economic, and institutional interdependence with one another. Convergence, then, is a relational model of understanding how technologies inflect, inform, and interact with one another in processes of their emergence" (Parks, 2005, p. 77).

This inter-reliance of public and private sectors has triggered heated debates about the potential for conflicts of interest, particularly in the context of security policy, which "is in the midst of a fundamental shift in tone and quality as a result of remote sensing satellite technology" (Livingston and Robinson, 2003; see also O'Connell et al., 2001). Satellite imagery constitutes an important component of the military "surveillant assemblage" (Haggerty and Ericson, 2000) that has been succinctly defined as "a heterogeneous set of intelligence gathering and command systems whose unity depended upon their smooth and transparent interoperability" (Harris, 2006, p. 103). The purchase by the Pentagon in 2001 of the rights to images of Afghanistan taken by the IKONOS satellite owned and operated by DigitalGlobe, is one example of the devolution of security technology. This use of commercial high-resolution satellites is widely understood to carry political and operational security challenges for national policy-makers (Livingston and Robinson, 2003).

From the late 1980s, disease emergence has been increasingly construed as a problem of global security. As the preface to the influential 1992 report *Emerging Infections: Microbial Threats to Health in the United States* declared: "There is nowhere in the world from which we are remote and no one from whom we are disconnected. Consequently, some infectious diseases that now affect people in other parts of the world represent potential threats to the United States because of global interdependence, modern transportation, trade, and changing social and cultural patterns" (Lederberg et al., 1992, p. v). Public health security became the framework for dealing with new biological threats produced by this global connectedness (Lakoff and Collier, 2008, p. 7). In his critique of Western humanitarian and peace interventionism, Duffield argues that development has functioned primarily as a mechanism for maintaining and policing the divide between development and underdevelopment (Duffield, 2007). In this paper we suggest, similarly, that the mobilization of geosurveillance technologies for health and humanitarianism is further merging development and security agendas (Duffield, 2001). Rather than relying on biodefense – on safeguarding national borders – the emphasis

[4] See 'How technology is helping fight Ebola', *GCN* (October 22, 2014). Retrieved from: https://gcn.com/articles/2014/10/22/ebola-technology.aspx.