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Around the Wire: Telegraphic Infrastructure and Gothic Energies in Late Victorian Britain

Kameron Sanzo

This article explores a link between gutta-percha, the natural South-East Asian latex used nearly exclusively as an insulation for nineteenth-century British telegraph cables, and the development of electromagnetic field theory. Field theory emerged from the non-traditional methods of physicist Michael Faraday, who demonstrated that the energy in telegraph cables is located around, rather than within, the conducting wire. Eventually, the application of field theory in telegraphy required the knowledge and resources of Indigenous forest produce collectors, as well as contingent networks of Chinese and Malay traders linked into local and global supply chains. Telegraphic infrastructure, therefore, is not simply the cables and signalling systems developed by the British, but also the knowledge, resources, and cultures of South-East Asian Indigenous communities and lifeways that resisted the Western energy project 'around' the conducting wire. Britain's global telegraphy enterprise relied on enormous quantities of gutta-percha, procured only by Indigenous collectors whose methods refused settler colonial agricultural practices like the plantation model. Based on the widespread demand for, and increasing shortage of, gutta-percha by the late nineteenth century, this article argues that Stoker's *Dracula* characterizes the Count using language that overlaps with the ambient, uncategorizable energy of field theory, as well as non-Western practices crucial to the gutta-percha supply chain, like animal augury.

Introduction

By the end of the nineteenth century, the cables in Britain's global submarine telegraphy network were insulated nearly exclusively by gutta-percha, a natural latex found only in isolated regions of South-East Asia. Gutta-percha was so vital to telegraphic infrastructure that, in his 1900 book on insulation materials, William Brannt insisted 'that if gutta percha and its properties had not been known, submarine telegraph lines would perhaps never have been successful'.[1] Indeed, gutta-percha was an excellent insulating material, but it was the intersection of developments in energy physics and a standardization of infrastructural materials that shaped gutta-percha market demand for decades.

By examining the gutta-percha supply chain in dialogue with new insights in energy physics that led to gutta-percha's standardization as insulation material, this article exposes the figurative ways in which this unique relationship animated cultural narratives of foreign influence in *fin-de-siècle* Gothic literature. Electromagnetic field theory emerged from the non-traditional thinking of physicist Michael Faraday, who located the energy of electric current-carrying wires in the space around, rather than simply within, the wire. By applying this insight to burgeoning undersea telegraphy projects, scientists focused their attention on cable insulation and created a new market demand for gutta-percha, a relatively obscure product to Western markets before the mid-nineteenth century. Because gutta-percha thrived deep in the forest interior and was difficult to access, Indigenous expertise was the nucleus of gutta-percha extraction and trading. Failed attempts to cultivate the plants left the British reliant on Indigenous tools and knowledges for the duration of the nineteenth-century telegraphy boom.

As such, I argue that Victorian telegraphic infrastructure was not simply the cables and signalling systems developed by the British, but also the South-East Asian Indigenous lifeways that resisted assimilation or mapping to Western notions of energy as a fungible measure of the capacity to produce work. This developing project of codifying energy as a science, which included classifying the two laws of thermodynamics in the 1840s, increasingly assigned moralistic value to states of work production, and employed strategies of standardization to capture labour and eliminate waste. Cara New Daggett explains this shift as an increase in 'energetic metaphors, as a site of energy transformation that require[d] the maximization of efficiency and productivity'.[2] Seasonal gutta-percha expeditions were neither fast nor efficient.

[1] William T. Brannt, *India Rubber, Gutta-Percha, and Balata* (Philadelphia: Baird; London: Sampson Low, Marston, 1900), p. 270.

[2] Cara New Daggett, *The Birth of Energy: Fossil Fuels, Thermodynamics, and the Politics of Work* (Durham, NC: Duke University Press, 2019), p. 5.

Indigenous collectors extracted the latex from the forest interior using traditional tools and spiritual navigation, all viewed by colonizers as slow and primitive; but failed attempts to domesticate gutta-percha ensured that the dwindling population of mature trees would not scale up proportionally with telegraphy.[3] Therefore, while the British continued to extend their global influence, the rate at which they did so depended on the infrastructures at the imperial periphery. In other words, gutta-percha did not flow simply from a forest in Borneo to a cable factory in Woolwich. Its transformation into cable insulation required a distributed intercultural trading architecture and local ecological literacy that remained unnavigable to British settlers.

Energetic field influence around the wire plays out literally in telegraph cables, but it also serves as a concept through which to articulate and explore late century Gothic horrors of imperial decay. Employing the energetic field was a condition for the success of telegraphic networks, but the field remained somewhat obscure as a potentially unruly peripheral form. The concept of an electromagnetic field resembled earlier theories of imponderable matter, a category that described the transmission of invisible yet sensible phenomena like heat, light, and electricity. In the eighteenth and early nineteenth centuries, scientists discussed imponderables as ghostly, weightless matter occupying the space between observable bodies. Sarah Alexander argues that imponderables modelled 'other undetectable phenomena', including universal laws of nature, the workings of the human body and mind, social relations, and the economy.[4] It was not uncommon for the Victorians to collapse the laws of physics and society, or to apply 'the language of the imponderable — untenable paradoxes, undetectable realities, unseen forces — to make sense of new experiences of modernity' (Alexander, p. 8). The nebulous energy of the field is simultaneously Gothic and modern, representing elements of Victorian progress and yet auguring imperial decay by remaining too elusive to tame.

Field influence, therefore, conjures distinctive figurative imagery, different from that of electric flow. As a form, the field expresses the vagueness of ambient, unseen energy that occupies space. Whereas telegraphic flow suggests a direct command of communication and movement, the field is eerily both within and beyond an object, remaining dispersive and atmospheric while controlling flow from a distance.

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[3] For a detailed history of gutta-percha's uses during this period, see John Tully, *The Devil's Milk: A Social History of Rubber* (New York: Monthly Review Press, 2011), pp. 123–30. Further references to Tully will be to *The Devil's Milk*, unless otherwise stated, and given parenthetically in the text. See also, Helen Godfrey, *Submarine Telegraphy and the Hunt for Gutta Percha: Challenge and Opportunity in a Global Trade*, Global Economic History Series, 15 (Leiden: Brill, 2018), pp. 17–22. Further references to Godfrey will be to *Submarine Telegraphy*, unless otherwise stated, and given parenthetically in the text.

[4] Sarah C. Alexander, *Victorian Literature and the Physics of the Imponderable* (Pittsburgh: University of Pittsburgh Press, 2016), pp. 4, 8.

Field-like energy threats appear in late century Gothic novels, where foreigners invade Britain and wield energy as an unmappable tool of imperial resistance, or as a counter-imperial threat. The energy of influence here is not a flow-like command, but rather a dynamic field of active space that can manipulate Western characters, but also remains illegible to them.

I demonstrate this with a close reading of Bram Stoker's *Dracula* (1897), concluding the article by synthesizing the two conceptual threads on telegraphic infrastructure: field theory and the gutta-percha supply chain. I argue that the novel is representative of a perceived threat to empire that worked across cultural value systems, dismantling British integrity through the settler capitalism and peripheral supply chains on which empire depended. This reading acknowledges and extends criticism noting that Count Dracula's energetic network runs counter to, and accomplishes more than the Western vampire hunters' technologies, including the telegraph.[5]

The telegraph remains central to critical work on Victorian science of communication and energy transmission in the era of British New Imperialism. Many representations of the telegraph in media, literary, and historical studies consider the conducting wire a symbol of transforming information into an object of influence. Human bodies transmitting or receiving information are imbricated in the telegraphic apparatus when consciousness, writing, and thinking occur at a distance. Richard Menke, for instance, locates the moment of information's disembodiment in the nineteenth century, when technologies designed to encode and electrically transmit messages also prompt consideration of what consciousness looks like outside of the human body.[6] Jeffrey Sconce explores metaphors of flow and the 'liveness' we perceive in media powered by electricity.[7] Similarly, Laura Otis argues that organic structures like the nervous system influenced telecommunications metaphors that passed from the public to scientists, and vice versa (pp. 4–5). This article additionally insists that the process of parsing the ambient energy of electromagnetic fields had material consequences for life at the periphery of telegraphic infrastructure networks. Because not all colonial bodies and resources mapped to the developing Western ideal of capturing labour and eliminating waste, bottlenecks to imperial growth were viewed with suspicion. I

[5] See, for example, Barri J. Gold, *ThermoPoetics: Energy in Victorian Literature and Science* (Cambridge, MA: MIT Press, 2010), p. 235; Laura Otis, *Networking: Communicating with Bodies and Machines in the Nineteenth Century* (Ann Arbor: University of Michigan Press, 2011), p. 197; and Kate Thomas, *Postal Pleasures: Sex, Scandal, and Victorian Letters* (Oxford: Oxford University Press, 2012), pp. 148–207.

[6] Richard Menke, *Telegraphic Realism: Victorian Fiction and Other Information Systems* (Stanford: Stanford University Press, 2008), p. 7.

[7] Jeffrey Sconce, *Haunted Media: Electronic Presence from Telegraphy to Television* (Durham, NC: Duke University Press, 2000), p. 7.

suggest, therefore, that *Dracula* is representative of a cultural mood shored up by the science and technologies of misty energetic fields; that threats to empire operated by controlling a field of influence inaccessible to the British, and by disrupting the flow on which empire depended.

Electromagnetic induction, invisible fields, and the problem with telegraph cables

Before Britain's cables wrapped seemingly around the globe, experimental physicist Michael Faraday investigated a fascinating but perplexing link between electricity and magnetism. In 1819 the Danish physicist Hans Christian Oersted discovered that a current-carrying wire deflected a magnetic compass needle nearby, a finding he published in 1820.[8] Almost immediately afterwards, Faraday launched into his career-long study of the interaction between electricity and magnetism, or what he later considered two linked manifestations of the same phenomenon. In 1831 Faraday first reported his discovery of electromagnetic induction, or the phenomenon of producing a current in a wire when it is introduced to a changing magnetic field. He argued that the mechanism behind this effect was that a conductor 'cut' what he called magnetic 'lines of force'. These invisible lines of force extend beyond the physical body of a wire or magnet, transmitting electromagnetic energies through space by the contiguous propagation of electric or magnetic 'tension'. Made visible by scattering iron filings in the space around magnets, lines of force formed the backbone of Faraday's field theory. They demonstrated physical activity in the space around current-carrying wire, and around magnets. Thus, the field was the notion that two or more bodies influence each other via energies in the space around them.

Faraday's idea of the field as a distinct energy tension influencing flow ultimately solved signal propagation issues in long-distance telegraphy, and later led to a massive uptick in the demand for gutta-percha as insulation material. The process of standardizing cable insulation began in 1853, when Latimer Clark of the Electric Telegraph Company invited Faraday and George Biddell Airy, Astronomer Royal, to observe some experiments on long subterranean cables. Clark noted that signals sent through long cables laid underground emerged delayed or distorted. This was a concern for pending transatlantic projects, whose long, undersea cables presented similar challenges.[9] Faraday triaged the cable failure by pointing out that signal time and quality depended on induction phenomena, or the unique way that electromagnetic energy propagated through tensions around the wire. As John Tyndall explained in

[8] Robert D. Purrington, *Physics in the Nineteenth Century* (New Brunswick: Rutgers University Press, 1997), p. 40.

[9] Bruce J. Hunt, *Michael Faraday, Cable Telegraphy, and the Rise of Field Theory*, History of Technology, 13 (London: Bloomsbury Academic, 1991), pp. 2–3.

his 1870 biography of Faraday, the induction phenomena that challenged telegraphy construction were all mentioned in his work years before a commercial need arose to illustrate them:

> This [the induction phenomena] was only a *prediction*, for the experiment was not made. Sixteen years subsequently, however, the proper conditions came into play, and Faraday was able to show that the observations of Werner Siemens and Latimer Clark on subterraneous and submarine wires were illustrations, on a grand scale, of the principle which he had enunciated in 1838. The wires and the surrounding water act as a Leyden jar, and the retardation of the current predicted by Faraday manifests itself in every message sent by such cables.[10]

Here Tyndall explains Faraday's original (1838) logical extension of the principle of induction. Faraday supposed that long cables underground or under water would act as Leyden jar capacitors, storing up charge and releasing it after long time delays, rather than allowing a signal to simply flow unimpeded.

Leyden jars were early capacitors that stored voltage, or electric potential difference, across inside and outside conducting surfaces separated by an insulating material, or what is called a dielectric. As Figure 1 indicates, these capacitors were literally jars or containers with an insulator, usually glass, sandwiched between inside and outside conducting surfaces. When Tyndall described the telegraph cable as a Leyden jar, he was using Faraday's reasoning to explain why signals manifested differently in cables laid underground, underwater, and in air. The Leyden jar is a metonymic substitution for the telegraph not because of mere association or analogy, but because they are different manifestations of the same phenomenon. It was initially puzzling why there was no signal lag or distortion in cables above ground, while the signals of subterranean and submarine cables

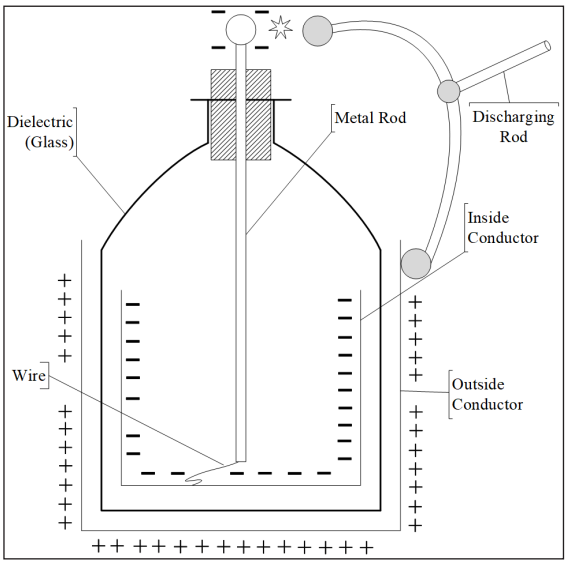

Fig. 1: Kameron Sanzo, A basic Leyden jar capacitor.

[10] Quoted in Bence Jones, *The Life and Letters of Faraday*, 2 vols (London: Longmans, Green, 1870), II, 83, emphasis in original.

suffered. Faraday argued that the cable's dielectric material was creating a different variation of electromagnetic tension based on the cables' submersion in assorted external media: air, wet earth, and salt water. When Tyndall explained Faraday's argument, writing that the wires and the water 'act as a Leyden jar', he meant that the same phenomenon at work in Leyden jars of different dielectric materials is responsible for signal variability in submarine, subterranean, and overland telegraph lines. If the entire telegraph cable functions as a Leyden jar, then the copper wire is its inner conductor, gutta-percha is its insulating dielectric, and air, salt water, or wet earth (respective to the type of cable) is its outer conductor.

Figure 2 makes this visible. Dispatching a telegraph signal depends on an electromagnetic field created around the dielectric material. The field is induced between the outer conductor (the water, in the case of submarine cables) and the inner copper cable. Electric current can move through the copper but is stopped by the dielectric. Faraday registered this phenomenon as a tension propagating through the dielectric. If the tension is too strong, the signal cannot move along the wire and will instead be stuck until it can discharge. Energy around the wire is thus an active component of the telegraphic apparatus, and the medium surrounding cables influences signal flow.

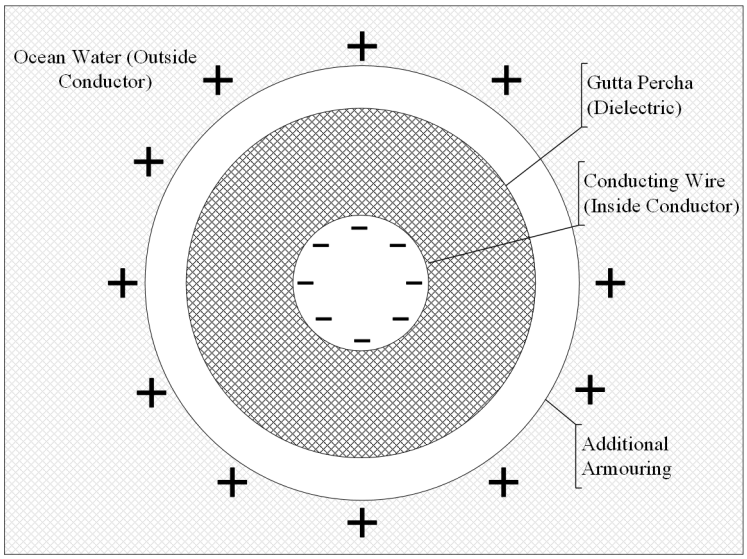

Fig. 2: Kameron Sanzo, A simplified submarine telegraph cable cross section, as compared to a Leyden jar.

Since there was nothing to be done about the cables' external medium (that is, salt water), the solution was to optimize the dielectric material. Gutta-percha insulated wires before these signal interferences were identified, and companies continued to use gutta-percha after an 1859 joint committee convened to resolve scientific and

manufacturing issues in cable telegraphy. However, field theory also changed Britain's economic and imperial attachments to gutta-percha. Before 1859 gutta-percha was employed in some cable construction, but it was not standardized. After 1861 when the joint committee published its findings, other dielectric materials were dismissed in favour of gutta-percha, which became the new standard for cable insulation. One reason for this decision was gutta-percha's superior performance in salt water. Rubber and gutta-percha share similar chemical compositions, but gutta-percha is denser and thus more watertight (Tully, p. 124).

The decision to standardize telegraph insulation based on field tension around the wire expedited telegraphy projects and dramatically altered Britain's relationship with gutta-percha; and yet Faraday's ideas about invisible field tension were obscure enough for many of his colleagues to dismiss them until mid-century. Indeed, science historian Bruce Hunt argues that the scientific community invested in Faraday's induction hypotheses only when there was a commercial need to apply them.[11] It is possible that the strangeness of field influence, as well as Faraday's unconventional scientific training, discouraged his classically educated contemporaries from taking an interest in induction phenomena until telegraphy occasioned its application.[12] As opposed to expressing his ideas in conventional mathematical notation, Faraday preferred a more sensory approach, sketching his lines of force in auras around magnets and describing what he measured in language that summoned, as Bence Jones suggested, 'almost tangible matter' (II, 5). Tyndall characterized Faraday as a 'magician', who 'sees the invisible lines along which [the Earth's] magnetic action is exerted, and, sweeping his wand across those lines, he evokes this new power' (Jones, II, 13). The mistiness of Faraday's fields, his experimental modalities, and the unique language he used to describe induction phenomena influenced figurative representations of energy as telegraphic science and infrastructure developed in tandem.

The concept of energy fields appeared mystifying, conjuring up images of invisible lines of power, but the tendrils of telegraphy's extended colonial infrastructure were also unusual, in some ways working against the growth of metropolitan demand. As the question of sourcing gutta-percha began charting the course of telegraphy projects, it became clear that this developing infrastructure included a colonial trading architecture that debarred British settlers from controlling the flow of gutta-percha from the South-East Asian forest interior to the metropole (Godfrey, p. 46). Harvesting the latex was

[11] Hunt, *Michael Faraday, Cable Telegraphy, and the Rise of Field Theory*, p. 2; and Hunt, 'Insulation for an Empire: Gutta-Percha and the Development of Electrical Measurement in Victorian Britain', in *Semaphores to Short Waves*, ed. by Frank A. J. L. James (London: Royal Society of Arts, 1998), pp. 85–104 (p. 85).

[12] Faraday was self-educated and began his scientific career as Sir Humphry Davy's assistant at the Royal Institution.

slow and dangerous. It required intimate familiarity with local terrain and ecological literacy. Additionally, the traditional method of harvesting felled the entire tree and yielded only a small quantity of gutta-percha, which was bartered along with other forest produce before entering the global economy.[13] Because gutta-percha insulated nearly every mile of submarine telegraph wire, Britain shipped it out of Singapore at a rate devastating to the gutta-percha trees (Hunt, 'Insulation', p. 92).

In relatively recent criticism this gutta-percha shortage has been couched as an ecological crisis, or a paradox of 'profligate and inefficient trade' undergirding the highest Victorian technology.[14] Helen Godfrey's work on the gutta-percha trade has complicated this narrative. Godfrey underscores the sovereignty of the Indigenous populations whose tools, knowledge, and spiritual practices made accessing gutta-percha possible (pp. 149–50). Rather than hindering its progress, the gutta-percha supply chain and the Indigenous lifeways at its core were a vital extension of telegraphic infrastructure, even as they resisted the broader project of collapsing colonial bodies, labour, and resources into a productive force for growth.

Sourcing insulation: the gutta-percha supply chain

Although gutta-percha became one of the most imperative colonial resources of the British periphery by the late nineteenth century, the gutta-percha trade did not follow a typical core–periphery relationship. Unlike other agricultural resources, gutta-percha resisted domestication: the trees' insular location, their cell structure, and the planet's sheer finitude of mature trees are among factors that debarred their access to non-Natives. Since gutta-percha did not grow along the coast, collectors embarked on dangerous and lengthy upriver expeditions deep into isolated regions of Malaya, Borneo, Singapore, and Sumatra. The mechanisms of accessing and harvesting gutta-percha preserved particularized skills and knowledge and thus shielded the trading infrastructure from total British intervention.

The *fin-de-siècle* gutta-percha shortage most threatened British consumers, rather than Native collectors, because the trees were of little or no spiritual and nutritive value, and because traders had other market options.[15] Native and Malay populations

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[13] See F. L. Dunn, *Rain-forest Collectors and Traders: A Study of Resource Utilization in Modern and Ancient Malaya*, Monographs of the Malaysian Branch, 5 (Kuala Lumpur: Royal Asiatic Society, 1975), pp. 99–103; as well as Helen Godfrey's expansion of Dunn's model for gutta-percha; specifically, *Submarine Telegraphy*, pp. 158–59.

[14] John Tully, 'A Victorian Ecological Disaster: Imperialism, the Telegraph, and Gutta-Percha', *Journal of World History*, 20 (2009), 559–79 (p. 571).

[15] Helen L. Godfrey, 'Pulled by Wire, Pushed by Desire: Submarine Telegraphy and the *Gutta Percha* Trade of Nineteenth Century Sarawak, an Indigenous Trade in the Global Economy', *Borneo Research Bulletin*, 44 (2013), 150–77 (p. 157).

in South-East Asia had been using gutta-percha for centuries before it piqued the interest of Europeans, for whom gutta-percha was a relatively new product. In his 1898 *Cantor Lectures on Gutta Percha*, Eugene Obach cites the first gutta-percha specimen brought back to Europe as that of seventeenth-century curiosity hunters.[16] From 1843 to the 1860s gutta-percha transformed from a relatively obscure material into one without which global telegraphy might not have existed. The British, therefore, relied on the expertise of Indigenous groups to procure the gutta-percha that sustained and expanded the telegraph industry.

The Iban, Kayan, Punan, Kelabit, Murut, and Kenyan were all groups of nineteenth-century gutta-percha collectors who had intimate topographical and ecological knowledge, developed over generations of dwelling and subsisting in the harshest regions of Borneo (Godfrey, p. 138). As a complement to their extensive knowledge of the natural environment, such collectors applied their spiritual beliefs to the art of forest navigation and agricultural cycles. Animal augury guided most aspects of daily living and was influenced by a general belief in *Antu* or *Toh*, the spirits with which humans share the material world.[17] European explorers and scientists who accompanied collectors on gutta-percha expeditions recorded demonstrations of their spiritual practices. Alfred Haddon, for example, produced an ethnographic study of Sarawak from his 1888 travels in the region. He reported a 'cult of omen animals [...] of such importance in the daily life of most of the tribes of Borneo', and catalogued several scenarios where bird augury guides decision-making.[18] In one example Charles Hose, the Resident of the Baram District, expresses frustration during a forest expedition when the appearance of a *pelandok* (greater mouse deer) obstructs their progress:

> On the second day of one of Hose's journeys through the jungle, the chief who was with him saw a *pelandok* rush across the path. Hose being behind did not observe it, but he saw all his party sitting on a log, and the chief informed Hose that he could not proceed that day as his 'legs were tied up'. This was most inconvenient, as Hose was in a hurry; but the men would not go on. Hose freely took upon himself all the responsibility, and said he would go first and would explain to the *pelandok* that he was the person in fault. The chief would not agree even to this, and did not budge, but said he would follow the next day. (Haddon, p. 386)

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[16] Eugene F. A. Obach, *Cantor Lectures on Gutta Percha* (London: Trounce, 1898), p. 2.

[17] Charles Hose, William McDougall, and A. C. Haddon, *The Pagan Tribes of Borneo: A Description of Their Physical, Moral and Intellectual Condition, with Some Discussion of Their Ethnic Relations*, 2 vols (London: Macmillan, 1912), II, 19–20.

[18] Alfred C. Haddon, *Head-Hunters Black, White, and Brown* (London: Methuen, 1901), p. 381.

Besides accounting for Hose's impatience, Haddon describes the slowness of augury in gutta-percha expeditions, explaining that the *beragai* (scarlet-rumped trogon) was a requisite signal to start a journey, followed by sighting a *nendak* (white-rumped shama), followed by a three-day waiting period, and finally catching a glimpse of another *beragai* on the right (p. 390). This singular combination foretold a healthy journey for all and plenty of gutta-percha, and was therefore worth the wait. It was considered additionally requisite to consult the hawk before expeditions of any kind. Addressed as *Bali Flaki* by Kenyahs and *Laki Neho* by Kayans, the hawk was a formal guide, and expeditions could not proceed without first securing the proper favourable omens (Hose, McDougall, and Haddon, II, 51–55).

In contrast to the uniformity and interchangeability of Western agricultural models like the standard plantation, animal augury ensured careful and individualized attention to each gutta-percha expedition. Whereas Europeans blamed Indigenous collectors for their 'wasteful' tree felling, foragers' expeditions refused the mappable, wholesale extraction of labour that colonial industry demanded from their bodies and natural resources. Moreover, Indigenous agriculture and foraging were accurate because they required experts to interpret and synthesize evidence from the environment. Iban scholar Benedict Sandin confirms that there is little guesswork involved in animal augury. Regarding birds in particular, message interpretation involves what he describes as 'four major sets of variables':

1. The place at which the call is heard, the conditions under which it is heard and the direction of the call relative to the hearer;
2. The nature of the call itself and its possible occurrence in a sequence with the calls of other augural birds;
3. The direction from which an augural bird flies across a person's path, the individual's purpose of travel and the place at which the bird crosses his path relative to his place of departure or destination;
4. The condition of the person who hears a call or sees the flight of a bird, his status and age, or that of the person to whom the omen bears reference.[19]

Based on Sandin's variables, we can see that the Iban used repeated observations about their environment to construct a rubric for social and natural encounters. Like the Iban, the Punan and the Kenyah practised bird augury on gutta-percha expeditions; and, though they named birds differently, they respected similar omens.[20] Their shared

[19] Benedict Sandin, *Iban Adat and Augury* (Penang: Penerbit Universiti Sains Malaysia, 1980), pp. 109–10.

[20] Benedict Sandin, *The Living Legends: Borneans Telling Their Tales* (Cawangan Sarawak: Dewan Bahasa Dan Pustaka Malaysia, 1978), p. 35.

spiritual literacy and experience in the forest allowed different Native peoples to trade knowledge of where gutta-percha could be found and how to avoid danger.

Even after an expedition's completion, animals remained key signifiers in the gutta-percha trade. Animal effigies made of gutta-percha were often found in produce shipments. Photographs of such statues appear in the transcript of Obach's *Cantor Lectures*, as they, along with curated displays of Native tools, informed a British public of the purportedly primitive origins of telegraph insulation (p. 24). However, British observers who dismissed the effigies overlooked their nuances. These figurines may have been markers by which Chinese traders identified the collectors they bartered with (Godfrey, p. 174). Traders translated Indigenous cosmologies into logistical value in a system of credit and barter where creditors and debtors needed to identify each other, maintain relationships, and operate on trust. In a high-risk system like this, the resignification of gutta-percha figurines may have aided traders in credit and barter transactions. The gutta-percha animal figurines, at once spiritual and logistical, remind us of how a world view inaccessible to colonizers ended up literally around the wire. The systematic transformations that strip a multivalenced, spiritual, and logistical object into insulation material gesture to the erasure of cultural and infrastructural complexity involved in resignifying gutta-percha as standardized cable insulation.

The British approached the shrinking gutta-percha forests with a sense of urgency and held Native tools, approaches, and spiritual beliefs accountable for the resource shortage. Even recently, gutta-percha extraction has been described as 'primitive and wasteful' (Tully, p. 128). As such, Europeans, including the British, unsuccessfully attempted to cultivate the trees themselves (Godfrey, p. 86). In accounts such as John Tully's history of the rubber industry, plantation ventures were mostly failures to launch, rather than ecological impracticalities (p. 128). On the contrary, there are numerous possibilities for the failure of gutta-percha cultivation projects. Foremost among these, the vascular tissue of gutta-percha plants makes tapping trees for sap difficult, if not prohibitive. The latex vessels do not interconnect, so there is no possibility of 'bleeding' the tree, which must instead be felled (Godfrey, p. 3). Another approach attempted to coax latex out of less valuable parts of the tree. Around 1890 Frenchman Eugène Sérullas developed a method to extract latex from the leaves and twigs of gutta-percha plants by mechanically chopping them and treating them with acid (Tully, p. 129). This process required European factories to be geographically nearer to the leaves and twigs they treated.[21] The final product was of poor quality, and the cost

[21] J. S. Gamble, 'Gutta Percha Trees of the Malay Peninsula', in *Royal Botanic Gardens, Kew: Bulletin of Miscellaneous Information*, 4 (1907), 109–21 (p. 118).

of production and shipping sank profits (Godfrey, pp. 82–83). It was only in 1915 that Britain's cable company, Telcon, established a plantation. Telcon sought to completely displace Indigenous labour and 'unsustainable' tree-felling, yet the company could not find a way to viably tap the gutta-percha trees (Godfrey, pp. 91–92). The plantation was never a large-scale success. Gutta-percha trading peaked in 1903 and telegraph construction waned soon thereafter because of World War I trade interruptions and the development of wireless telegraphy. After the war synthetic insulation materials supplanted gutta-percha and the 'crisis' was inconsequential (Godfrey, pp. 150–53).

The tactics deployed to control the gutta-percha trade reveal a desire to bring the people, plants, and ecosystems of South-East Asia under a universalizing, mappable rubric. The attempt to make things knowable and thus governable, assimilable to a rubric already in place, is a cornerstone of Western science, industry, and capitalism. As the nineteenth century moved forward, energy science increasingly supported, and drew support from, the notion that all ideas, bodies, and lifeways could be linked together and flattened into lean extractive processes. The mechanisms of the gutta-percha trade were incompatible with models of settler agriculture and thus resisted the expectations of universalism, interchangeability, and profitability.

Much of Britain's so-called imperial control via commerce and information distribution depended on the 'invisible' empire, which did not operate through direct flows from periphery to centre, but rather relied on the modalities of accumulation *around* the infrastructure of cables themselves (Godfrey, pp. 24–25). The infrastructure of telegraphy therefore includes the many supply chain nuances that remained unnavigable to British settlers. The illusion of total British control goes beyond the gutta-percha trade, as Carl Trocki argues in his study of Victorian opium supply chains.[22] The viability of invisible infrastructure obtains for many nineteenth-century colonial materials.

Therefore, it is worth emphasizing that unorthodox scientific thinking and knowledge impervious to colonial mapping and control appear in *fin-de-siècle* literature as threats to British integrity and identity. Faraday's unconventional programme for field theory, which was at first dismissed, was later valued by institutional science when large-scale telegraphy projects required his approach to induction phenomena. Field theory, in turn, depended on Indigenous knowledge and translations of value across cultural systems. British subjects ultimately learned that gutta-percha trees and trade were governed by their own diverse, unscalable structures. Such failed attempts at laterally distributed

[22] Carl A. Trocki, *Opium, Empire, and the Global Political Economy: A Study of the Asian Opium Trade, 1750–1950* (London: Routledge, 1999), pp. 58–87.

control presage the counter-colonial threats in late Victorian Gothic texts like *Dracula*, whose villain confronts Englishness with electromagnetic qualities and a mastery of logistics that both imbricates and counters Western technologies like telegraphy.

Dracula's field infrastructure

Bram Stoker's *Dracula* does not self-consciously reproduce the cultural concerns of the gutta-percha trade and its relation to field theory, yet it is a noteworthy representative of Britain's reflexive critical turn in the late Victorian period. In the last two decades of the nineteenth century, Britain reached the zenith of its imperial dominance in the 'scramble for Africa', but not without encountering growing competition from other Western powers like the United States and Germany. Additionally, with its increased reliance on fossil fuels, Britain needed more land and labour on the periphery to supply raw materials for industry (Daggett, pp. 137–38). The British employed what John Darwin calls 'informal empire', or 'pragmatic acceptance of limited power'.[23] Rather than explicit sovereign control and blunt subjugation of peoples, informal empire indirectly influenced colonial subjects by enforcing various government styles that disrupted local sociopolitical life. While informal empire enacted violent cultural and economic transformations, it was also a tactical choice deployed as 'the maximum influence that Victorian governments *could* exert [...] rather than the most they wanted to' (Darwin, p. 617, emphasis in original). Therefore, Britain's empire was massive but unstable. The widespread popularity of *Dracula* evidences the resonance of imperial identity crisis with a late Victorian readership.

Dracula stands out in the late Victorian literary archive for marshalling Gothic tropes and energy logic against knowledge and bodies that appear unknowable, unmeasurable, or unassimilable. The Count is like the ouroboros of vampire capitalism. As the ouroboros serpent consumes its own tail, vampirism is also self-consuming: devouring human bodies and producing new vampires until no human bodies remain to sustain the process. Dracula is horrifying to British sensibility because he is brilliant at controlling the infrastructures of influence. He can do what the British have failed to do on the fringes of their own empire. He translates value across technological, economic, and cultural differences. He enrols animals, English women, and asylum patients to do his bidding at a distance. Physically, he is an ambient, atmospheric force, controlling weather and bodies in a region of space, like Faraday's invisible field lines. In this case Dracula does not merely set up a 'flow' of occult influence between his

[23] John Darwin, 'Imperialism and the Victorians: The Dynamics of Territorial Expansion', *English Historical Review*, 112 (1997), 614–42 (pp. 617–19).

subjects to control them; if Dracula's powers are at all electromagnetic, he commands the entire field. *Dracula* investigates the crisis of empire by turning the union of energy and capitalism into a monster who can extract value across many infrastructural strata, that is, the entire 'field'.

Here I consider how electromagnetic field theory and a conception of the 'invisible' colonial networks that sustained British power converge in the late Victorian literary imagination to render visible an extended telegraphic infrastructure. *Dracula* centres telegraphy as a Western technology of control, positioning occult fields variously against and within telegraphy's electromagnetic science. The novel reinforces the industrial values that underpinned early energy science, despite that non-Western and otherwise unorthodox knowledges resisted a singular framework for energy. Finally, the text acknowledges other ways of conceiving of and mobilizing energy infrastructures yet forecloses their viability by exterminating and vilifying the Count.

The gesture of looking 'around' the telegraph wire is also a method of seeking out the multilayered, distributed infrastructures that buttressed the British Empire and its sciences. As such, one might likewise examine any number of 'keystone' colonial resources, or 'pivotal agent[s] of change' that determined the contours of trading relationships (Trocki, p. 58). For example, opium, too, functioned as a keystone factor; yet opium remains more visible than gutta-percha, which disappeared into near obscurity with the advent of synthetic insulation materials. To readers of *Dracula*, however, gutta-percha would have been universally recognized as an important colonial resource, particularly for its use in telegraphy. I argue that this makes it a crucial variable in any political and literary history of energy science.

Count Dracula's 'mistiness', or his command over his body's dimensions and composition, is an index of his field-like influence. He does not organize direct flows of power to his advantage, but rather mobilizes multiple strata of energy in his field of control. For example, he becomes the wolf, but also uses wolves as extensions of his centre. The Count literally orders and reorders his material body, appearing variously as a wolf, a bat, fog, or a pillar of dust. Otherwise autonomous animals serve as 'allies [...] at his command', working for him from a distance.[24] Even when he appears as one shape, his form is unstable and one cannot trust it. When Dracula commandeers the *Demeter*, its crew struggles to describe the threat on board. The ship's captain paraphrases his seaman's sketch of an encounter with the Count. The seaman cannot confirm whether he saw a man or a shape, and he fumbles to describe his experience in language. Instead, he calls Dracula 'It', as nothing in his prior experience resembles the vampire: 'I saw It,

[24] Bram Stoker, *Dracula* (New York: Dover, 2000), p. 42.

like a man, tall and thin, and ghastly pale [...]. I crept behind It, and gave It my knife; but the knife went through It, empty as the air' (p. 73). Indeed, Dracula is *on* the ship, but he is also ambient: he conjures a violent storm and he appears simultaneously as man and mist. It is not accurate to describe Dracula in concrete, unambiguous language. He is more like Faraday's 'centres of force', occupying an active region of space.

Like energy, Dracula seems to be nothing and everything at once. He is dynamic and transforming. And, like field energy, he is an area of active space more than a discrete individual commanding a flow of power. He is disturbing because he appears to violate several inviolable laws of nature, including the newly codified thermodynamics. Moreover, like electromagnetic field theory, he also appears to defy an established onto-epistemological order. He diffuses into a subtle mist and yet reorganizes his matter against an entropy gradient to form his solid body at will. We experientially understand that bodies do not do this. And yet, echoing the seaman's description, Dracula makes himself perhaps *emptier* than air, as he can slip through soldered metals (Stoker, p. 205). Barri Gold argues that such 'entropic individuals' in nineteenth-century literature should be seen not as defying thermodynamic law but rather as concentrating enormous amounts of energy for their own administration by creating a complementary disorder in the larger, surrounding system (p. 227). If one builds Gold's reading into the notion of Dracula as a threat to the British Empire, then Dracula is exploiting energy-rich resources on a massive scale to the detriment of Britain (and of humanity), and he is doing it very well.

In fact, as a grotesque competitor in the scramble for empire, the vampire can accomplish what Britain cannot. Where Britain and the Western energy programme failed to extract from human and non-human life, Dracula moves across many dimensions of energy to extract labour from a complex infrastructure of humans, animals, weather, and other vampires. Renfield, the institutional patient who invites Dracula inside John Seward's residence, gives us a glimpse of the psychic and physical layers of the vampire's infiltration:

> I laughed at him, for I wanted to see what he could do. Then the dogs howled, away beyond the dark trees in His house. He beckoned me to the window. I got up and looked out, and He raised his hands, and seemed to call out without using any words. A dark mass spread over the grass, coming on like the shape of a flame of fire; and then He moved the mist to the right and left, and I could see that there were thousands of rats with their eyes blazing red — like His, only smaller. He held up his hand, and they all stopped [...]. The rats were all gone, but He slid into the room through the sash, though it was only open an inch wide — just as the Moon herself

> has often come in through the tiniest crack and has stood before me in all her size and splendour. (pp. 239–40)

If Dracula's industry is vampire production, here we witness the 'invisible' supply-chain transactions he orchestrates before reaching the factory, Mina Harker's bedroom. With their blazing red eyes, the thousands of rats are a spatial extension of the Count, like active field lines sensed at a distance by howling neighbourhood dogs. He uses these animals to goad Renfield into inviting him in, after which he can access Mina. Only then does Dracula set up a 'telegraphic' connection between his mind and hers.

Scholarship on *Dracula* frequently analogizes blood and electricity as vital 'fluids'. Mina's blood connection with Dracula is a figurative telegraph through which consciousness flows, though her ability to communicate with him is limited by the technical restrictions of the apparatus. She can be hypnotized only during certain hours, for instance. Likewise, Dracula can use her body for his own intelligence only when she is not using his. But, when considering a broader, more field-like approach, his manipulation of Mina is not direct. The conditions for their communication are created by the Count's manipulation of resources into tools of control. Most directly, he gains access to Mina's bedroom by extracting information and labour from Renfield (p. 239). Dracula also drains the blood of four men through the vessel of Lucy Westenra, supplying energy to order and reorder his body's matter, to grow younger, and to further influence minds. He enlists rats, moths, flies, and wolves to labour for him. If there is a wire between Mina and the Count, they battle for control of the electromagnetic field more than they do of the flow of electricity.

If the mechanism of Dracula's powers is inscrutable, the *rules* are not. Despite Dracula's supernatural command of energies, hard limitations do restrict his powers. He cannot, for example, shapeshift in the daytime, or enter a household without an invitation (pp. 205–06). The immutable limits of vampire being allow the Western hunters to track Dracula down and destroy him. Stoker's novel is constructed entirely from transcribed notes and epistles, phonograph recordings, and various other print matter, all ordered chronologically. The Western characters conclude that ordering this narrative will serve as a weapon against the Count as they mount their logistical plan to cut him off mid-retreat to Transylvania. Even if they cannot compete with Dracula as master of his energies and of those in his field of influence, they can nevertheless 'stamp him out' by writing him into the bounded constructions they understand. Van Helsing galvanizes the team by reminding them, 'He can do all these things, yet he is not free […]. We can confine him to his coffin and destroy him, if we obey what we know' (p. 206). The power for the Western crew thus becomes controlling the authority of

knowledge and extending that authority to energy and its infrastructures. In this way, train and ship schedules complement the vampire's ontological restrictions, allowing the hunters to follow, record, and home in on Dracula's movements. The Count has no authentic voice in this novel, although Mina's mind connection with him arguably brings us closer to his perspective.

At the end of the novel, the foreign threat is ultimately destroyed by the systematic management of information. Still, the horror remains because the yoking of capital and energy extolled by Western powers has found a way to turn itself on Britain. The vampire is a master of translating non-vampiric resources into the industry of vampire production. As such, Dracula mocks Britain's failure to work the field of its periphery, where human and non-human life resisted energy's union of work and capital.

Conclusion

In the mid-nineteenth century electromagnetic field theory matured out of Michael Faraday's unusual and famous experiments on induction, the phenomenon of generating electric current when a wire is introduced to a changing magnetic field. The idea that energy exists around, rather than within the wire drastically changed Britain's approach to cable construction, which required gutta-percha for insulation after 1861. Because gutta-percha grew only in the interior of South-East Asian forests, the British found themselves increasingly reliant on Indigenous ecological knowledge to locate and extract the latex. When the trees grew scarce, the British blamed Natives for the 'crisis', though it was clear that Europeans were the most desperate party. By the end of the century, Britain was scrambling for a solution, but could not successfully domesticate gutta-percha as they could other plantation crops.

Meanwhile, the *fin-de-siècle* Gothic revival reflected Britain's attitude towards energy's role in the global circulation of information, commodities, and bodies. The Victorian vision of energy, shored up by newly codified sciences like thermodynamics and electromagnetic field theory, wedded energy to labour, and labour to capital, though not all labour was valued equally. Because energy supposedly standardized work across organic and inorganic domains, the Victorians used energy science to standardize and industrialize labour. As such, energy's basic transposability was assumed as natural law and used to support and enforce Western hierarchies. Yet during the period of New Imperialism, the gutta-percha trade demonstrated pockets of resistance to that dogma, revealing possibilities of using energy contrary to exploitation and accumulation. *Dracula* has been read through a multitude of late Victorian anxieties, to which I would add a counter-imperial threat who has mastered capitalist-energy resistant worlds

and translated them as accumulation into a world-dominating industry. For this, Dracula manages the field, rather than the flow, of energy. The Western characters in *Dracula* systematize energy and logistics against him; that is, because his powers are limited and knowable, he can be killed. The political and literary history of telegraphic infrastructure and field theory thus deserves our recognition of the collapse of energy into capital that translated non-traditional ways of knowing, as well as Indigenous lifeways, into extractive machinery in the service of Britain's empire.