

## **Infernal Machinery: Thermopolitics of the Explosion**

Nigel Clark (Lancaster University)

Combustion – especially the burning of fossil fuels – is central to the problematic of human geologic agency and to any meaningful political or cultural response to the current planetary predicament. But a consideration of the politics of combustion raises the issue of another kind of fire: the explosive combustion that is at the core of state or military arsenals and the crux of most forms of insurrectionary force. While fire has been part of our planet's history for hundreds of millions of years, there is no natural equivalent to the high-speed combustive chain reaction that is the blast of gunpowder. This paper traces the 'thermopolitics' of firearms that began with the discovery of explosive powders in 9<sup>th</sup> century China, but which builds on a much longer history of experimentation with and application of chambered fire. While the fire of the artisan brought enchanting and beautiful objects into the world, escalating military use of gunpowder installed new powers of destructiveness into the very core of modern social life. Moving from a biopolitical to a thermopolitical perspective, it is argued that the shocking demands of functioning in proximity to the explosion turns the social organization and cultural sensibilities of modernity into a kind of infernal machinery. In our own era, the internal combustion engine has inherited something of the 'infernal' power of the militarized explosion, and ramped it up to the scale of global environmental change. This raises questions not only about to get the runaway forces of planetary fire under control, but about what other uses – more gratuitous and glorious - might yet be made of the explosive firepower we have brought into the world.

### **'A Hell of a Thing'**

We know the damage that explosive weapons can inflict on the living body. If the news hasn't reminded us recently, our moving image culture will deliver its own spin on the capabilities of armaments large and small. It is relatively rare, however, to get an intimate, affective account of what it means to enter into a relationship with a firearm. In the acclaimed A

*Brief History of Seven Killings* (2014), Jamaican author Marlon James deftly conveys how Kingston gang member Bam-Bam gets more than he supposes when a much-desired handgun comes into his possession:

*Is a hell of a thing* when a gun come home to live with you. The people who live with you notice it first. The woman I live with talk to me different. Everybody talk to you different when them see a new bulge in you pants. No, is not that at all. When a gun come to live in the house it's the gun, not even the person who keep it, that have the last word. (2014: 72)

Resisting the ready option of the firearm as phallic object, James conjures a force that exceeds the agency of its possessor even as it seemingly extends his power. Insinuating itself in the space of the everyday, the gun in question provokes a series of shifts. Subtly – and the story progresses, and not so subtly – the social fabric recomposes itself around the deep, rumbling potentiality in its midst.

Today there is growing recognition that humans, some decidedly more than others, are acting as geological or planetary agents. Critical thought most often responds by reaffirming the socio-economic, cultural, political and historical variables that determine and differentiate such powers to impact upon the Earth and upon fellow human beings. In general, social and cultural thinkers have not been as willing to ask whether our own inherited concepts and categories might themselves already be infused or contaminated with ‘geologic’ force, or to consider how inhuman powers might work through us in the very process of us working with them (Clark & Gunaratnam, 2017).

Combustion – in the particular, the burning of fossil fuels – is central to the problematic of human geologic agency and to any meaningful political or cultural response to the planetary predicament (Clark & Yusoff, 2014). Who gets to burn, what they burn, and how much they burn are matters that quickly draw us into the deeply imbalanced power relations of the modern world. But any consideration of the global structuring of political power in turn raises the issue of another kind of fire: the explosive combustion that is at the core of state or military arsenals and the crux of most forms of insurrectionary force. In the words of geopolitics scholar Simon Dalby: ‘The recent history and very obviously the future of geopolitics are shaped by ... pyrotechnics – a matter of “firepower” quite literally’ (2018: 721).

As Dalby and others make clear, differential access to the benefits and costs of consuming fossil hydrocarbons tends to be closely associated with uneven distribution of firepower - in ways that are bound up with long, fraught colonial and military histories. But what sort of fire is this that is so central to the geopolitical ordering of our world? What kind of force, power or potentiality defines the thermal explosion around which modern armaments are configured? And what does it mean that explosive weapons – Bam-Bam’s new gun and its multitudinous kin – come to live with us, accumulate around us, and reverberate through us, even as we might suppose they are serving our purposes?

While fire has been part of our planet’s history for hundreds of millions of years, it is notable that no natural fire behaves like the blast of gunpowder. Only when members of our own species, just over a thousand years ago, chanced upon a volatile compound of chemicals did the Earth first witness a combustive chain reaction sped up to lightning speed. As writer Jack Kelly details in his colourful chronicle of gunpowder: ‘Instead of needing minutes or hours to burn, the fuel would go up in a fraction of a second. This violent reaction, a product of inner oxygen, is man’s fire, concocted, singular, unquenchable. It does not exist anywhere in nature’ (2004: vii).

The event of near-instantaneous combustion came about through an exacting combination of sulfur, charcoal, and saltpeter (Kelly, 2004: 2). Though not all its uses have been destructive, what its Chinese inventors termed *huo yao* or ‘fire drug’ and what the English called ‘gunpowder’ was to transform the practice of warfare, and many would say, to shape the very contours of global civilization. As historian Alfred Crosby pronounces: ‘Humanity used gunpowder, which blows things apart, to compress communities together into empires and nations’ (2002: 107). Or as Kelly reflects on the European uptake of the Chinese black powder: ‘To the Western mind, technical advances moved in one direction. The discovery of gunpowder was a momentous and irreversible milestone on the path of history....Gunpowder *was* civilization’ (2004: 97).

We need to be careful, of course, not to credit technical innovations with an autonomous power to convene or shatter worlds. But neither should we recoil so far into conventions of social construction that the forces of the Earth itself appear always already under our jurisdiction. Chiming with Marlon James’s insights on the firearm, researchers specializing in fire

have long insisted that combustion is more than a tool serving our ends. Fire, they propose, is constitutively volatile and excessive – shaping *us* even as we mold and apply *it*. Indeed, fire theorists like to tell stories of our species and planet from the perspective of combustion itself. With the emergence of a fire-handling creature, environmental historian Stephen Pyne muses, ‘*the Earth did not get quite what it supposed*’ (2001: 26). Or as anthropologist Loren Eiseley ponders: ‘What if I am, in some way, only a sophisticated fire that has acquired the ability to regulate its rate of combustion and to hoard its fuel in order to see and walk?’ (1978: 151).

If manipulating fire has helped forge who we are, then the arrival of the thermal explosion – within our own historical memory – undoubtedly brings a new set of demands and opportunities. What might a ‘thermopolitics’ or a ‘pyropolitics’ of explosive weaponry tell us about the emergence of modern subject, its fears and hopes, its *aims* and *trajectories*, I ask here (Clark, 2011: 164-5; Marder, 2015). And how does the conjunction of human bodies and weaponized explosions articulate, more broadly, with the role that combustion – in all its forms – has played in the more-than-human becoming of our species?

Michel Foucault (1991) paves the way with his meticulous mapping of a biopolitics through which bodies emerge as objects of a new ‘anatomy of power’ in a modernizing Europe. As he points out, the originary locus through which ‘an art of the human body was born’ is the training ground of a novel collective being – fire-armed infantry (1991: 137). But while Foucault’s focus is living bodies, much might yet be said about the firearm itself – about the inhuman explosive power with which the human body was in the process of joining forces – in the emergence of a new disciplinary regime.

Today, together with resurgent threats of nuclear conflagration, the deployment of conventional ballistic projectiles coexists with an irruption of newer ‘improvised’ explosive devices. It is not only the amassing of weapons that puts the world at risk, however, but the impact of ceaseless industrial capitalist productivity – an ‘unprecedented accumulation’ that has, even ‘*without war*’, in Georges Bataille’s prophetic words, ‘turned the whole world into a colossal powder keg’ (1993: 428). As climate change stokes ‘planetary burn-out’ (Marder, 2015: 155), thermal upheaval of the Earth is coming to be viewed as a ‘threat multiplier’ – an exacerbating factor of conflict. But if this is indeed a fire planet and we ourselves a fire species, then the current planetary predicament also raises questions about

what other kinds of thermal politics and arts we might conjure, what other modes of fiery transmutation are behind us – and might yet lie before us.

### **Fire as ‘the Great Transmuter’**

Ever since plants colonized dry land this has been a planet of fire or combustion (Pyne, 2001: 3-14; Clark 2011: 170-4). Combustion is the process that occurs when energy-rich carbon compounds are decomposed in an oxygen-saturated environment - triggered by a source of ignition: a reaction through which chemical energy is converted into thermal energy (Smil, 2006: 10). While ‘fire’ is the vernacular term for chain reaction combustion, the technical term for the exothermic process whereby the heat produced ignites still more fuel is ‘deflagration’ – an explosion being very fast deflagration (Helmenstine, 2018).

Explosive exothermic actions may be relatively new to terrestrial fire regimes, but they inherit a long history. Human capture of fire goes back perhaps a million years – long before ‘we’ branched and evolved into *Homo sapiens*. Early on, fire theorists speculate, humans learnt that fire could transform their living environment, cracking open dense forest, promoting new plant growth, attracting foraging animals. Gradually our forbears gleaned that fire is, ‘above all, the great transmuter,’ as Pyne succinctly puts it (2001: 120). Just as we learned that fire softened the flesh and fibers we fed on, so too did we stumble upon its effects on other materials: ‘what began with meat and tubers eventually fed bone, stone, sand, metal, liquids, wood, whatever might be found, into the transmuting flames’ (Pyne & Pyne, 2012: 99).

At some point during the transition from the seesawing ice ages of the Pleistocene to the more stable Holocene epoch, certain human populations discovered that by enclosing fire in purpose-built containers they could increase its thermal intensity and gain greater control over its metamorphic powers (Wertine, 1973). In fiery ovens, soggy clay transmuted into durable ceramics, crumbly ore morphed into lustrous metal, gritty sand fused into diaphanous glass and glazes (Clark, 2015). While the miraculous nature of such transubstantiations imbued the pyrotechnical crafts with a magical aura, the same arts produced many of the mundane tools and materials of early agrarian society. From out of the kiln came new instruments of field and household labour, measures and tokens that mediated economic activity, and new objects deemed worthy of

accumulation – along with the weapons used to guard or acquire them (Goudsblom, 1992: 63). Long before powder and shot impacted geopolitically, metals were already playing a constitutive role in the shaping of empires. As anthropologist Jack Goody reminds us: ‘(t)he very boundaries of the Roman Empire...were the result of the distribution of metals’ (2012: 80).

Drawing upon earlier anthropological insights, Gilles Deleuze and Félix Guattari have speculatively reconstructed some of the power-knowledge relations at the crux of the ancient agrarian world. They distinguish between two divergent experiences of mobilizing around physical forces: that of the miner-metallurgist whose identity is forged through following the flows of a dynamic Earth and the agriculturist whose life-world is contoured by the seasonal demands of farming and the hard-edged territorial logic of the emergent city-state (1987: 409–15). And yet, Deleuze and Guattari suggest, an uneasy compromise is reached, as ‘itinerant’ metallurgists and ‘sedentary’ state actors come to rely upon each others’ capacities for understanding and tapping into earthly powers (1987: 415, 424-31).

But regulation of pyrotechnology emerged as much from ‘within’ as from any state imperative. With only slender fire walls between themselves and temperatures as hot as lava, artisans spent their working lives inches away from grievous harm. Malfunctioning kilns or mishandled molten material could cause burns, blindness or death, and bring blazing ruin to whole towns (Goudsblom 1992: 110-111). Rigorous discipline, in this context, was inseparable from the miracle of elemental transmutation. ‘Although they might have been launched as innocent and isolated skills,’ high-heat historian Theodore Wertime concludes, ‘the pyrotechnic crafts in the years between 10,000 B.C. and 2000 B.C. became formidable industrial ‘disciplines,’ entailing the most severe chemical controls on daily operations’ (1973: 670).

However novel the ultra-fast exothermic reaction may be in the history of fire, there is an important sense in which the discovery of exploding powders belongs to the ancient lineage of heat-induced transformation. Evidence suggests that it was Taoist alchemists in 9<sup>th</sup> century China who discovered the explosive properties of the charcoal-sulfur-saltpeter mix – in the course of experiments aimed at concocting life-extending elixirs (Kelly, 2004: 2-4). As in the case of clay figurines that came before useful earthenware or jewelry preceding metal tools (Smith, 1981: 242), the first significant deployment of the

unpalatable black power was ceremonial and spectacular: the audio-visual splendor of fireworks. ‘Before flamethrowers, bombs, and guns filled the world with their terror’, Kelly affirms, ‘gunpowder was the servant of delight and the handmaiden of wonder (2004: x).

Gunpowder’s passage from pyrotechnic exuberance to lethal weapon inherits the dialectic of magic and utility characteristic of artisanal traditions. It is a myth that the predominant Chinese application of gunpowder was embellishing the night sky. The exploding elixir soon captured the interest of Sung Dynasty military strategists who were already masters of flaming arrows and other incendiary weapons. Firecrackers morphed into smoke bombs, fire-spurting metal balls and primitive explosive devices, and by the late 10<sup>th</sup> century, Kelly recounts, ‘the Chinese were producing gunpowder fire arrows by the tens of thousands’ (2004: 10). Subsequent rounds of military R&D saw development of rockets, canons and flame-spouting fire lances. Eventually, by the 13<sup>th</sup> century, came a portable weapon capable of delivering an explosion-driven projectile – what we now call a ‘gun’ (Kelly, 2004: 15-17).

The key to weaponization of gunpowder – whether in bombs, projectiles or rockets - is the channeling of rapid-releasing thermal energy through a robust chamber: ‘(t)he tougher the container, the greater the energy that accumulates and the more violent the explosion’ (Kelly, 2004: 7). As a basic principle this again inherits artisanal traditions of enclosing fire, as well as relying directly upon products of the metallurgist’s furnace. But the difference between the two modes of pyrotechnical practice is significant. Whereas smiths utilize thermal power to transmute matter into new forms and structures, military engineers apply thermo-chemical reactions to the singular task of propelling a projectile – or cluster of projectile fragments. What was to the pyrotechnician a catastrophe – accidental breaching of the fire chamber and the escape of super-heated matter-energy – became the *raison d’être* of the weaponeer. Destruction and creativity effectively change places: the power of fire being set to the task not of assembling, catalyzing, transfiguring but demolishing, dismembering, disfiguring.

High-heat artisans brought temperatures of volcanic intensity into the everyday spaces of the ancient town, an enfolding of inhuman forces that called for strict ritual and practical regulation. Such controls, I suggest, pale next to the disciplinary measures devised to deal with the unearthly power of explosions. This not just a matter of what the explosion does to living flesh, but what must be done with individual or

corporate bodies to permit them to function in an intimate relation to the very phenomenon of explosiveness.

### **Making Infernal Machines**

The march of gunpowder across the Eurasian landmass and through the centuries is a tale of intensifying destructiveness on and beyond the battlefield (Dalby, 2018), and pivotal to firepower's escalation is its regulatory enframing. Foucault may be our preeminent guide to the disciplinary practices central to the modern order and all its sensibilities, but it is Deleuze and Guattari who steer us toward full appreciation of the inhuman powers that incite new modalities of both supervision and subversion. Whereas Foucault's notion of the biopolitical still centres on living forces - a vitality and potentiality that never quite disentangles itself from human agency, Deleuzoguattarian 'geophilosophy' is fully committed to a material-energetic dynamism that exceeds the biological (1994: 85-95). And it is on account of the metallurgists' rigorous and experimental engagement with this 'nonorganic life' that they epitomize, for Deleuze and Guattari, the broader human capacity to transform our own being through joining forces with the Earth (1987: 411).

'In short', Deleuze and Guattari propose, 'the being of sensation is not the flesh but the compound of nonhuman forces of the cosmos, of man's nonhuman becomings, and of the ambiguous house that exchanges and adjusts them, makes them whirl around like winds' (1994: 183). Swap 'house' for 'housing' - the 'full metal jacket' of the explosive projectile - and conjoin it with emergent regimes of socio-corporeal control, and we are well on the way to understanding the thermo- or pyropolitical machinery at the heart of modernity.

As with the discovery of gunpowder, the ancient lineage of pyrotechnology required capitalization on chance, most likely fostered by what metallurgist Cyril Smith describes as 'rich and varied sensual experience of the kind that comes directly from play with minerals, fire, and colors' (1981: 203). As long as it hinged upon homemade kilns and non-standardized fuels and 'impure' raw materials, high-heat artisanship always had an element of trail and error - however much it tracked determinate pathways of thermochemical change (Clark, 2015). Accelerate the exothermic reaction of the furnace to the explosive deflagration of the firearm, however, and that residue of unpredictability is likely to prove deadly - for the assailant rather than the target.



In order to ‘domesticate’ the explosion, the container of the explosive force, together with its fuel and ignition systems, needed to be rendered trustworthy. For centuries, the forging of cannon and gun barrels maintained its dependence on the arts of the metallurgist: ‘practitioners who were comfortable with risk’ and who tended to persist in the itinerant habits of their predecessors (Kelly, 2004: 47). By the 16<sup>th</sup> century, European gunsmiths were turning from bronze to iron for casting barrels, not only taking advantage of lower cost iron issuing from proliferating industrial-scale blast furnaces but actually driving this development (Mumford, 2010: 87-8). Because guns, unlike rockets or incendiary bombs, required near-instantaneous deflagration of the gunpowder charge, they posed particular challenges - especially if firearms were to be portable and fast-loading enough to be advantageous during ‘live’ exchanges (Kelly, 2004: 59). Successive innovations that upped the efficacy of ‘killing from a distance’ included a more granulated powder that facilitated chain reaction combustion, purification of saltpeter, spring-loaded ‘matchlock’ and later self-sparking ‘flintlock’ ignition, rifling of barrels to put spin on bullets, cartridges combining charge and shot, the repeating single barrel and – eventually – the revolving multi-barrel firearm (Kelly, 2004: 71, 61-3, 70, 187-9).

If reliability conditions the ascent of explosive weaponry, then standardization - of the entire assemblage - is the key to precision, dependability, and speedy manufacture. While industrial mass production has many tributaries, innovation in firearm fabrication holds special significance (Crosby, 2002: 136-7). Taking cues from late 18<sup>th</sup> century French efforts to assemble muskets from standardized components, the US Department of War successfully introduced mechanized production using interchangeable parts to its armories in the early 19<sup>th</sup> century (Mumford, 2010: 90). As writer and journalist Iain Overton concludes: ‘It was soon to be the central way to mass produce so many things that define our modern life – cars and bicycles, clocks and furniture. And, of course, guns in their millions’ (2015: 1689).

Crucial also was the ability to actually hit a target. While medieval thinkers fell short of understanding the dynamics of exploding gunpowder, they also struggled to comprehend the forces determining movement of projectiles through the air. This was a challenge that had momentous implications for conceiving of motion and force more generally. Galileo’s insights on the parabolic curve described by cannonballs and Newton’s extrapolation from projectiles to planetary motion,

Kelly argues, were pivotal in establishing the modern scientific premise that the object world followed predictable trajectories (2004: 140-1). Although, he adds, it took centuries to fully translate this into accurate artillery.

Neither the evolving accuracy nor the growing reliability of arms makes much sense without consideration of the social body that was at once the militarized explosion's agent and its target. If one half of the story is the progressive construction of containers capable of channeling the energy of high-speed exothermic reactions, the other half is the fabrication of social beings able to function in environments that for the first time include the power to blow them apart. 'While swords, arrows, and battle axes had injured men grievously', laments Kelly, 'the trauma inflicted by gunpowder was of a new variety' (2004: 79). Blasted entry and exit wounds, buried shrapnel, burns, dismemberment: the corporeal impressions made by explosive weapons hardly need recounting. Indeed, geographer Deborah Dixon notes, much of our 'enlightened' knowledge of anatomy has been pieced together from the empirical – and *visceral* – experience of dealing with the carnage of the modernizing battlefield (2015: ch. 4).

Though the increasing efficiency and power of explosive weapons has generated new challenges for organizing combative bodies, much of the formative drilling of men-at-arms addressed the long-standing problem of painfully slow reloading while exposed to enemy fire (Kelly, 2004: 183). Foucault is surely correct to follow military historians in attending to the breakdown of battlefield operations into discrete, rehearsable gestures that could be performed in unison by corporate bodies (1991: 135). Or as cultural historian Lewis Mumford earlier insisted: '*The army is ... the ideal form toward which a purely mechanical system of industry must tend*' (2010: 89). But what defines the modernizing battlefield is not only the 'microphysics' of power through which soldiers' bodies are recalibrated, it is also the literal microphysics of the explosive exothermics around which these bodies convene.

While Foucault's biopolitical inquiry focuses on the practices through which the vital energies of biological bodies are redirected, a thermopolitical perspective draws attention to the power of a new kind of fire as an incitement for reconstructing corporeality in the modernizing world. The military port may be a 'crossroads for dangerous mixtures,' that calls forth new ordering imperatives (Foucault, 1991:144), but the model and apotheosis of the 'dangerous mixture' is the coming of a chemical compound capable of runaway deflagration. Not just

one more admixture – the explosion is a threshold in the 400 million-year history of fire, a turning point in the million-year excursion of a fire-tending primate. Something very significant, if difficult to define, changes in the construction of social being in order that foot soldiers – ordinary men, seconded from the ‘masses’ – are put in charge of explosive devices; something rends and buckles in the fabric of sociality when exposure to the explosion enters daily existence.

More than a *vital* machine, the modern military corps is an ‘infernal machine,’ the term coined by film theorist Bill Krohn in response to Stanley Kubrick’s genre-defying war movie *Full Metal Jacket* (1992: 435). But Foucault’s fundamental lesson holds up: what is most important is how the ‘body-weapon, body-tool, body-machine complex’ is generalized, how it comes to pervade modern social life (1991: 153). What matters, in our case, is how the shock, the paroxysm, the brutal oxymoron of a ‘body-explosion complex’ comes to infiltrate the social organization and cultural sensibilities of modernity. And how we might conceive of modernity itself as profoundly, constitutively, *infernal*.

### **Internal Combustion, Planetary Conflagration**

In its tactics and investments, ‘if not exactly and directly,’ Foucault ruminated, modern politics is a continuation of war (1991: 168). But then modern warfare, in circuitous ways, might also be seen as a continuation of art, as an enfolding and repurposing of the aesthetic, the miraculous, the enchanting.

Earlier in our modernity, successive political and aesthetic avant gardes envisioned a fiery detonation of prevailing social worlds from within. Communists dreamt of a revolutionary ‘fire of freedom’, futurists yearned for an explosive exit from stultifying tradition, some anarchist factions actually attempted to blow up their nemeses (Marder 2015: 42; Davis 2007: 1-3). In the wake of World War 1 and attuned to the nascent reverberations of nuclear physics, Virginia Woolf imagined a kind of dynamic, all-pervasive creativity that would shatter social conventions. ‘The idea has come to me’, she wrote in her diary in 1928, ‘that what I want now to do is to saturate every atom’ (qtd. in Reynier, 2009: 86).

As with many fellow modernists, Woolf’s molecular dream of socio-cultural transformation resonates with Kelly’s depiction of the thermochemical reaction at the heart of the firearm - ‘(f)ire spread through the mixture by means of a spray of hot,

molten saltpeter and gas that leaped from a burning particle to its neighbors' (2004: 62). In our own time, however, such imagery seems at once irresponsible and insufficiently ambitious. It feels metaphorically insensitive on account of the horrific proliferation of actual explosive events in public spaces. But it also falls short in a literal sense when we consider the immense practical challenge of reconfiguring the combusive core of our social order.

Today's world indeed seems to be detonating itself from within, but its fiery dynamics play out deep in the mundane circuitry of global modernity. While the great majority of the planet's estimated 1 billion guns at any moment lie idle (Overton 2015: 35-6), a good proportion of its 1.2 billion hydrocarbon-powered motor vehicles are in use. This means that somewhere in the vicinity of 400 trillion small but rapid deflagration events take place every day, each one pushing a cylinder up or down within a metallic casing (Clark & Yusoff, 2014). Mumford presciently grasped the shared thermophysical logic of the motor and the firearm when he observed 'the gun was the starting point of a new type of machine: it was, mechanically speaking, a one cylinder internal combustion engine' (2010: 88). Or as science historian Joseph Needham later put it: 'For half a dozen decades past the idea has been hovering among the minds of historians that the cylinder and the cannon-barrel are essentially analogous, and that the piston and piston-rod may be considered a tethered cannon-ball' (1986: 544).

Already in the late 17<sup>th</sup> century, Dutch polymath Christiaan Huygens had hit upon the idea of harnessing the force of gunpowder - that had 'hitherto served only for violent action' - to the more productive task of propelling an engine: a '*moteur à explosion*' (qtd. in Kelly, 2004: 116). Huygens imagined a controlled series of explosive charges propelling a piston - a concept he was unable to bring to fruition and one that was sidelined for several centuries by the ascendance of external combustion engines as the driving force of industrialization. Huygens' proposal did not overtly come of age until the rise of the internal combustion engine - with its shift from gunpowder to hydrocarbon-based deflagration (Kelly, 2004: 118). However, Needham insists that the steam engine - via Papin's advancements on Huygens' research - emerges directly from experiments with 'gunpowder engines'. 'Though Denis Papin never harnessed his piston-rod to anything, his historical position in the transition from gunpowder to steam is a central one', affirms Needham - though he credits the inauguration of this line of development to Chinese military inventors (1986:

558, 545).

Arguably, the more peaceable *moteur à explosion* is inflicting deeper, longer-lasting damage to the world than ever has the profusion of militaristic explosive devices. Human-induced climate change is largely a matter of combustion. Given available fuel, terrestrial fire follows an exothermic chain reaction, and as we have seen, the last 1000 years – a geohistorical eye-blink – has witnessed a singular acceleration of this dynamic to the near-instantaneous feedback loop of the explosion. If we were to speed up geological time to a velocity suited to human vision, it might well appear as though the last few centuries had initiated a runaway global deflagration event – constituted by the self-amplifying combustion of the Earth’s subterranean stocks of fossil hydrocarbon. In short, we may have sparked a planetary explosion – which is one way of conceiving of the shift into a new geological epoch or Earth system state of which many geoscientists now speak (see Clark & Yusoff, 2017; Dalby, 2018).

How to defuse this thermophysical outburst is perhaps the paramount political and cultural challenge our species has faced. And the thorniness of this problem would seem to lie at once in the formidable casing that has been constructed around the explosion in order to facilitate its insertion into the core of daily existence and in the substantial armature we have forged around ourselves so that we can live on in the vicinity of explosiveness. Indeed, given the contribution that individualized internal combustion-powered vehicles make not only to climate change but to international accidental death and injury statistics, it’s worth considering that motorized carnage might never have become acceptable without a prior history of fortifying ourselves through and against fire-arms. Light-armoured and propelled by explosive force, many of us cleave to the entitlement of automobility as others hold tight to the right or opportunity to bear arms. We might say, *it’s a hell of a thing* when a car comes home to live with you.

Sociologist Max Weber made an apt choice in referring to a ‘*stahlhartes Gehäuse*,’- a steel-hard casing or housing - that he feared would define modern selfhood ‘until the last ton of fossilized coal is burnt’ (1976: 181). It’s a diagnosis that gains a new charge read alongside Deleuze and Guattari’s accenting of ‘man’s nonhuman becomings’ and ‘the ambiguous house that exchanges and adjusts them’: a concern that foregrounds the dynamism of the inhuman elements forces that we enfold into social life – along with the immense challenges that their incorporation poses. To draw out and elaborate upon the

potentialities of the Earth, Deleuzoguattarian thought suggests, we must find ways to bring these forces down to a more human scale, to extract and isolate them (Grosz, 2011: 38; Clark, 2015) – as it might be said the pyrotechnologist does with the fire-walled kiln and the explosive engineer with their steely casings. But taking hold of, concentrating, and intensifying such earthly powers no longer seems to be the main challenge we face, so much as how we might go about this capture and discharge without escalating our capacity for violence - against each other and against our planet.

In this context, we might see Georges Bataille as a vital intermediary between the social thought of Weber and the continental philosophy of Foucault, and Deleuze and Guattari's generation. Bataille inherits Weber's alarm over the steely disdain for 'the spontaneous enjoyment of life' in early capitalist asceticism (Weber, 1976: 166; Bataille, 1991: 115-6). Inflating this into a full-blown theory of excess and exorbitance, he passes on to post-structuralist thinkers a sense that all forms of reason, calculation and utility open out into a vaster realm of unreason, monstrous force and inevitable waste (Clark, 2011: 128-133). But even his successors rarely match Bataille's determination to put a blazing excess of energy figuratively and substantively at the core of our human and planetary condition (Stoekl, 2007: xiii).

As Bataille contended, in conversation with physicist Georges Ambrosino, any anthropic drive to commandeer the prodigious matter-energy of the cosmos - in the absence of adequate discharge or release – will inevitably stoke a vast, planet-scaled 'conflagration' (1991: 37; fn 2, 191; 1993: 428). The pointless, destructive blow out of warfare was one way of releasing this pressure - though Bataille feared that even the frightening escalation of nuclear and conventional weaponry he observed in the postwar era could not keep pace with the inhuman energetic potentiality being amassed through industrial capitalist accumulation. And this is a prognosis that must be confronted afresh as we consider the sublimation of the battleground explosion into the ceaselessly expanding thermo-physical forcing of the internal combustion engine – and the 'world historical blaze' it is igniting (Marder, 2015: 164).

### **Counterblast**

Fire, observes Pyne, 'appears more profusely during times of rapid and extreme climatic change' (1994: 890). The fiery irruptions of pent-up energy we are observing today across the

planet - roaring wildfires, crop fires, peri-urban blazes – are far from the generous, generative discharges of which Bataille dreamt. Even more shocking are the flaring fires of conflict, for which growing environmental stress – ‘if not exactly and directly’ – may often be a contributing factor. Amongst the novel modes of explosive device now proliferating, the car bomb – what urban theorist Mike Davis describes as ‘the nuclear weapon of guerilla warfare’ (2008: 130) - has a cruelly ironic centrality. For just as the modern automobile enfolds the explosive force of the firearm within its cylinders, the vehicle-borne improvised explosive device unfolds the force of explosive deflagration back into an act of war: the steal-hard casing of the ubiquitous car reconverted into the full metal jacket of the militant projectile.

Still more horrific - if we can imagine a scale to horror - is the suicide bomber, who instantiates the ‘body-explosion complex’ in the rawest, most palpable way, literally saturating every atom of their being with incendiary force. It is worth recalling that Bataille spoke of the profundity of the break with the infernal logic of accumulation in terms of sacrifice (1991:182). And though his hope was to imbue ordinary social life with a spirit of giving without return, he did not shy away from the anguish of actual lives being put on the line (1986: 85-8).

For Bataille, the path out of the predicament of the planetary powder keg lay in the pointless expenditure – or ‘squandering’ – of our amassed material-energetic forces. So he called on us ‘to consume, to annihilate, to make a bonfire of our resources’ – linking such exuberance to the experiences that were once referred to as ‘divine, sacred’ (1986: 185). If the idea of non-utilitarian expenditure seems to grate against the conditions of mass deprivation that the current global order engenders, we should keep in mind how, above all, it is the planet’s least privileged who have been most pressured to forgo their customary landscape burning practices, their artisanal fires, their multitudinous ways of becoming with and through fire (Clark, 2015). As we should insist that any thermopolitics or pyropolitics to come – any attempt to cut firebreaks in a blazing modernity – needs to work with and through the historical depth of fiery experimentation and all the multitude of ways that the inhuman force of fire has been enfolded into human collectives.

Throughout this paper I have been tempted, am still temped, to draw a distinction between the thermal generativity of the pyrotechnical craftsman and the fiery nihilism of military explosive engineers: to insist that the wild entropic outburst of

the explosion is categorically destructive while the tempered transmutations of the artisanal flame are definitively creative or productive. Until I remember the first use of runaway deflagration, before militarism dressed the explosion in its steel-hard housing. Kelly's evocation of pyrotechnic display would make Bataille's heart sing. 'Many have tried to describe the evanescent beauty of firework', he writes. 'The explosions are splendid waste. They are wild-haired comets, silver rain, tinsel-starred bouquets' (2004: 238).

At the other end of our infernal modernity, Alfred Crosby embraces the post-conflict repurposing of the rocket - which now tasks exploding fuel with journeying beyond Earth. After collecting data about the gas giant Jupiter, he recounts, the Pioneer 10 spacecraft is 'whiplashed around the planet and hurled away from the Sun at a velocity fifty-five times that of a rifle bullet and off toward interstellar space' (2002: 188). Heading into the void, the rocket in Crosby's telling seems more like a firework - a 'wild-haired comet' - than a ballistic projectile, a great burst of flame on a glorious trajectory that no longer remembers its target.

It is possible that our species' primordial infatuation with fire could have found modern, intensified forms of expression other than escalating military firepower and the proliferation of autonomous internal combustion vehicles. As it might just be conceivable that the high-speed deflagration of the firework could have segued into the explosive propulsion of the space-venturing rocket along some trajectory other than a thousand-year spree of killing-at-a-distance. What we can be more certain of is that no steel-hard casing, no full metal jacket, is going to protect us from a profusely burning planet. To live in the midst of resurgent flame would seem to summon a perviousness, a transmutability, a raging curiosity whose embers - if we are lucky - still smolder somewhere deep within our being.

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