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Fig. 1 here >

An English print of 1749 shows a fireworks display held that year in London under the title ‘The Grand Whim for Posterity to Laugh at’ [Fig. 1]. The firework, which took place in Green Park, was to be the grandest in Britain up to that time, marking the Peace of Aix La Chapelle and the end of the Seven Years War. The reason for the laughter was that this turned out to be a disastrous occasion. One of the wings of the ephemeral ‘machine’ or temple that had been built for the fireworks caught fire and burned to the ground, prompting fights among the artificers who were staging the display. In this unique image for the eighteenth century, the newspaper mocked the performance.¹

Pyrotechnics represent a quintessential form of fire-management in the early modern period which will be the focus of this essay. Fire is a risky material to work with, providing part of the drama of a firework display but also a danger, as the 1749 artificers discovered. This is equally an emotional story. This essay explores the connection between the emotions and the material in fire management and insists that both need to be understood as intimately connected. The verses beneath the ‘Grand Whim’ talk about it being a ‘fantastic idol show’

¹ On the ‘Grand Whim’, see Simon Werrett, “From the Grand Whim to the Gasworks: Philosophical Fireworks in Georgian England”, in Dear, P. Roberts, L. and Schaffer, S. (eds.), *The Mindful Hand: Inquiry and Invention from the Late Renaissance to Early Industrialisation* (Amsterdam and Chicago: 2007), 325-48.

put on during a time after a war when there was no money to look after veterans and pay the nation's expenses. Fireworks were an insulting waste of money, a 'wretched' 'foolish' 'devilish' 'folly'. Observing the fireworks was a deeply passionate experience, evocative of delight, no doubt, in audiences, but also anger, frustration or disdain. Another print made at the time entitled 'The Contrast' showed an Englishman standing in front of the Green Park temple biting his nails in a sweat because he had run out of money after spending it all on fireworks. A jolly and portly merchant stands next to him above the banner 'Money with Commerce'.

Fire is also deeply emotional in the present. At a time of environmental crisis we are confronted with desperate scenes of destructive fire so that understanding the interrelations between human emotions and fire management must be important historical work. This essay is a brief contribution to that process, and seeks to use fireworks as a way to think about the relations of materials and emotions more generally. Scholars have explored this avenue, for example in Oliver Harris and Tim Flohr Sørensen's 'Rethinking Emotion and Material culture' (2010).² Harris and Sørensen propose three categories for linking emotions and materials: an 'affective field' of dynamic relations between 'people, places and things', changing over time; 'attunement', or 'how people notice, observe, perceive and recognize moods and emotions in themselves and others'; and 'atmosphere', the way collectives of people generate emotional environments that effect the persons involved. All three categories will be useful for exploring the emotional dimensions of fire management in pyrotechnics.

² O. Harris and T. F. Sørensen, "Rethinking Emotion and Material Culture", *Archaeological Dialogues* 17 (2010) 145-163.

The novelist Svetlana Aleksievich is another inspiration in this regard. Alekseevich has sought to write emotional histories of events in recent Soviet and Russian history such as the Chernobyl disaster by interviewing participants and their families, often mothers and daughters, to capture not the ‘factual’ unfolding of events but the personal and emotional experience of them.³ Aleksievich might be accused of adhering to a gender stereotype of equating emotion with women’s experience and facticity with men, but her extraordinary writing re-presents these events in ways that capture their intense and fundamental emotions. This is what a history of fire management might also do. Here I propose the category of ‘ematerials’ as a way to achieve this. An ematerial is a process rather than a thing and it refers to the unfolding emotional relationship that bodies have with one another when they interact together, being co-constitutive of identities, feelings, experiences and physicality.

1. Pyrotechnic Performances

In early modern Europe, fireworks were already an ancient technology. Spreading from China and India in the Middle Ages, fireworks were by 1600 being shown around the world. In Europe they were typically performed as courtly and civic spectacles such as royal weddings, coronations, and births, celebrations of martial triumph or holidays and festivals such as the New Year.⁴ Displays were grand, expensive and were typically performed by

³ S. Aleksievich, *The Unwomanly Face of War*, trans. R. Pevear, L. Volokhonsky (London: 2017); S. Alekievich, *Chernobyl Prayer: Voices From Chernobyl*, trans. A. Tait, A. Gunin (London: 2016).

⁴ On the history of fireworks, see S. Werrett, *Fireworks: Pyrotechnic Arts and Sciences in European History* (Chicago: 2010).

expert artisans or ‘artificers’ or the local artillery. Styles of performance varied across Europe but usually centered on a piece of ephemeral architecture known as a ‘machine’, often in the form of a castle or classical temple.⁵ Out of this, artificers fired an array of pyrotechnics similar to those still in use today, including rockets that flew into the air to burst with stars, wheels that span in circles of sparks, and fountains that gushed fire into the night sky. Other pyrotechnics were distinct to the period, such as ‘aquatic’ fireworks that disappeared below the surface of a river then erupted back up again to spout fire and sparks. Performances were typically staged amidst allegorical decorations that gave the display a narrative, like a play, telling of princely magnificence or martial might. The evidence that remains of these displays is sparse. To commemorate them, large, elaborate engraved prints were often issued depicting the decorations and their significance. Printed descriptions might accompany these, and audiences sometimes recorded their experience on seeing a show.⁶

Turning to the emotional dimension of these fireworks displays, Harris and Sørensen’s category of ‘affective field’ prompts consideration of the emotional states that artificers sought to invoke in audiences through pyrotechnic effects and the nature of those states induced by observing and experiencing fireworks. Artificers, we may infer, like musicians, were keenly aware of their audiences and sought to manage their reactions to sights and sounds in a manner that would give the audience pleasure and entertainment. Literature on the production and staging of fireworks in the early modern period is quite scarce and was usually limited to recipes and explanations of how to make particular pyrotechnic pieces, and

⁵ S. Bonnemaison, C. Macy (eds.), *Festival Architecture* (London: 2007).

⁶ K. Salatino, *Incendiary Art: the Representation of Fireworks in Early Modern Europe* (Los Angeles: 1997).

discussion of this emotional orchestration are very rare. Prints, however, occasionally tried to capture the process of a display, depicting how it unfolded to generate certain responses in audiences. In 1637, for example, Claude Lorrain made a series of etchings to record fireworks staged in Rome for the election of the new Holy Roman Emperor Ferdinand III. Kevin Salatino has noted how Claude's series mimics the way the layers of a pyrotechnic castle, perhaps of his own design, gradually enflamed and were consumed to reveal a new decoration below. A contemporary account said this display 'ravished the eyes and made them sleepy with wonder and delight'.⁷

Few authors theorized how pyrotechnic effects would induce different states in audiences. However, in the *Encyclopédie* of Diderot and d'Alembert, Jean-Louis de Cahuzac attempted to prescribe such action.⁸ For Cahuzac, fireworks should be a coherent spectacle, not just the setting off of one pyrotechnic after another. 'In all the Arts it is necessary to paint. In the one that we call *Spectacle*, it is necessary to paint with actions'. To instantiate this claim, Cahuzac described a firework staged in Paris in 1730 celebrating the birth of a new dauphin. The motions and contrasts of fire induced effects in the audience. By illuminating the river Seine, the scene of the display, with lamps using 'the greatest speed... the surface of the river suddenly offered an enchanting spectacle'. Above this rose two artificial mountains decorated with plants, waterfalls, sirens and sea monsters, so that 'One saw a pleasant variety on these

⁷ L. Manzini, *Applausi festivi fatti in Roma per l'elezzione di Ferdinando III* (Rome: 1637), quoted in Salatino, *Incendiary Art*, 54.

⁸ J.-L. de Cahuzac, "Feu d'artifice", in D. Diderot and J. d'Alembert (eds.), *Encyclopédie, ou dictionnaire raisonné des science, des arts et des métiers*, 17 vols. (Paris: 1751-65), vol. 6 (Paris: 1756), 639-40.

mountains, where nature was imitated with a great deal of art'. Garden terraces and rocks were illuminated with so many lamps that 'the eyes were dazzled, and the darkness of the night entirely dispelled. The movement of the lights, which by confusing them gave them even more brilliance, produced such an effect at a certain distance that one fancied seeing sheets and cascades of fire'. The fireworks set off from this machine were a 'pleasant spectacle' which built through several acts to a climax in several 'girandes' or bursts of stars from rockets above the whole scene. The grand size of the display, its speed of performance, its location on the river, the mix of fire and water, and the diversity of attractions building to a crescendo all contributed to a sense of pleasure and magnificence. Evidently a *sublime* experience, the artificers evoked in their audience a dazzling pleasure and enchantment, achieved through the unfolding manipulation of speeds of ignition and the growing scale of fiery effects.⁹

Harris and Sørensen's category of 'attunement' refers to the interactivity of a community in shaping and expressing emotional states. Fireworks brought together diverse audiences of spectators and communities of performers, whose organization in space, location, movements and relations generated and followed emotions. Fireworks prints indicate a diverse range of audience distributions, from strictly ordered positions for the court to a pell mell of spectators jostling to see the pyrotechnics. No doubt different arrangements were constitutive of different experiences and emotions. In the 1749 Green Park display ticketed seats were offered for different classes of people, indicating a social regimentation that would have correlated with different perspectives on, and emotional reactions to, the display and other

⁹ Salatino takes the sublime as a fundamental category for understanding fireworks. See *Incendiary Art*, 47-98.

audience members.¹⁰ Alternatively, other images show spontaneity as people make merry around bonfires and decorations. In an article on fireworks audiences, Werrett has argued that fireworks were occasions for social distinction, as aristocratic audiences made observations of more ‘vulgar’ audiences that served to distinguish them.¹¹ A literature on fireworks emerged in the sixteenth and seventeenth centuries aimed at an audience of ‘virtuoso’ gentlemen, who attained enough knowledge to know how a variety of technical arts were accomplished but without the particular expertise that marked the artisans who pursued such arts. Gentle audiences expressed this knowledge when writing of fireworks displays by saying that whereas they understood the artifices that created pyrotechnic effects, the ‘vulgar’ did not, and therefore found it hard to distinguish art from reality. Crucially these contrasting awarenesses were manifested in different emotional reactions to fireworks. The comprehending gentryfolk claimed to be unperturbed by pyrotechnics that they knew to be artificial, but spoke of vulgar audiences as fearful and distressed by fireworks, whose mechanisms they did not understand. No doubt the true picture was quite different – after all, the ‘vulgar’ included artisans who knew perfectly well how fireworks worked. But to express constraint and nonchalance before sublime pyrotechnic explosions and effects was considered a mark of gentility. In 1629 fireworks erupted over the Seine around decorations depicting Louis XIII as Perseus, rescuing Andromeda from a sea monster, an allusion to the French

¹⁰ An example of a ‘Ticket for St. James's Park, April 27th 1749, for the Royal Fire Works’ may be found in the Bodleian Libraries, University of Oxford, digital collections, see

<https://digital.bodleian.ox.ac.uk/objects/bf9e5c2a-cba5-4862-86a4-0338f01ce2f9/>

¹¹ S. Werrett, “Watching the Fireworks: Early Modern Observation of Natural and Artificial Spectacles”, *Science in Context: Special Issue: Lay Participation in the History of Scientific Observation*, ed. J. Vetter, 24 (2011) 167-182.

capture of La Rochelle from Protestant forces. Canova-Green has noted how the official record of the display described a contrast between noble and vulgar audiences watching the display. '[N]aïve bystanders along the shore... were stunned and frightened and... thrown about pell-mell [...] The Court alone remained still and undaunted, being well acquainted with the vanity and ostentation of these diversions'.¹² Another representation of French fireworks, staged in Meudon in 1735, depicted the courtly audience engaged in nonchalant conversation in front of an explosive scene of pyrotechnics, again suggesting a capacity not to be outwardly moved by the display. Werrett notes the similarity to the frontispiece of Bernard de Fontenelle's cosmological primer *Conversations on the Plurality of the Worlds* in which an astronomer dispassionately instructs a lady before a sublime fiery apparition of the heavens in the skies above them.¹³ A scientific nonchalance thus reflected the courtly control of emotions that fireworks demanded.

The third category used by Harris and Sørensen to discuss emotions and materials is 'atmosphere' - how do collectives of bodies in space create an emotional environment that affects those within it? Many fireworks began with a prelude in the form of lighting illuminations, whereby thousands of lamps were ignited to create a glowing picture of scenery or architecture in outline before the display began. Spectators recalling displays invariably expressed wonder at the atmosphere illuminations produced. The most famous illumination was that of the Castel Sant' Angelo in Rome, which was illuminated before

¹² Quoted and translated by M.-C. Canova-Green, "Fireworks and Bonfires in Paris and La Rochelle", in J. R. Mulryne, H. Watanabe-O'Kelly, M. Shewring (eds.), *Europa Triumphans: Court and Civic Festivals in Early Modern Europe* (Farnham: 2004), 145-153, on 150.

¹³ Werrett, *Fireworks*, 139-141.

fireworks celebrated the election of a new Pope.¹⁴ According to Vannoccio Biringuccio, who gave the first detailed account of the display in his *Pyrotechnia* of 1540, all the embrasures and merlons of the castle were studded with ‘two small lanterns made out of a sheet of white paper over a mound of clay in which a tallow candle is put. When they are lit at night it is a very beautiful thing to see that shining and transparent whiteness in many rows as far as the eye can reach’.¹⁵ Following its completion in 1615, the nearby Basilica of St. Peter’s was illuminated for the festivals of Holy Week and the feasts of Saints Peter and Paul. Enduring into the nineteenth century, this display began with the marking out of the dome in the light of large paper *lantermoni*, before, as an observer in the 1820s recalled,

instantly ten thousand globes and stars of vivid fire seemed to roll spontaneously along the building, as if by magic; and self-kindled, it blazed in a moment into one dazzling flood of glory [...] In the first instance, the illuminations had appeared to be complete, and one could not dream that thousands and tens of thousands of lamps were still to be illumined. Their vivid blaze harmonized beautifully with the softer, milder light of the *lantermoni*.¹⁶

Illuminations thus created an extraordinary atmosphere that dazzled the spectator with beauty, scale, and harmony. Johann Wolfgang von Goethe saw the illuminations in Rome in

¹⁴ Salatino, *Incendiary Art*, 78-83.

¹⁵ V. Biringuccio, *The Pyrotechnia of Vannoccio Biringuccio: The Classic Sixteenth-Century Treatise on Metals and Metallurgy*, trans. & ed. C. Stanley Smith and M. Teach Gnudi (originally Venice, 1540; New York: 1990), 442.

¹⁶ W. Hone, *The Every-Day Book* (London: 1826), 885-88.

1787, recording how, ‘a spectacle has to be really grand before I can enjoy it [...] To see the colonnade, the church and, above all, the dome, first outlined in fire and, after an hour, become one glowing mass, is a unique and glorious experience’.¹⁷ Such experiences were examples of the sublime. In his essay on the sublime of the 1750s, Edmund Burke proposed that, ‘A quick transition from light to darkness, or from darkness to light’ would generate a great effect.¹⁸ Audience-members frequently noted this aspect of illumination displays, ‘by the darkness of the night, the splendour of the effort to convert night into the brightness of day was the more conspicuous’.¹⁹

Emotions and material circumstances in fireworks displays were thus intimately connected. The interplay of human and other bodies, of audiences, artificers, pyrotechnics, the environment, performance techniques and atmospheres always correlated with various emotional reactions and experiences ranging from pleasure, wonder and delight to fear and confusion. Various agents sought to manage these experiences by managing fire, with more or less success. Things could go wrong, as the ‘Grand Whim’ testifies, and accidents were common in displays. But the risk of ‘playing with fire’ added to the pleasure of beholding them and countless testimonies record these pleasures. Not everyone agreed these displays were pleasing. Critics expressed anger and frustration at the expense or lamented fireworks as

¹⁷ J. W. von Goethe *Italian Journey (1786-1788)* trans. W. H. Auden and E. Mayer (San Francisco: 1982): 344.

¹⁸ E. Burke, *A philosophical enquiry into the origin of our ideas of the sublime and beautiful* (London: 1757), 62.

¹⁹ Anon., “The Proclamations of Peace”, *Gentleman’s Magazine* 72 (May 1802) 456-62.

evidence of moral decline. In the *Expedition of Humphry Clinker* (1771) Tobias Smollett lambasted the commercial pleasure gardens as corrupting spaces,

The diversions of the times are not ill suited to the genius of this incongruous monster, called *the public*. Give it noise, confusion, glare, and glitter; it has no idea of elegance and propriety [...] Vauxhall [pleasure garden] is a composition of baubles, overcharged with paltry ornaments, ill conceived, and poorly executed; without any unity of design, or propriety of disposition. It is an unnatural assembly of objects, fantastically illuminated in broken masses; seemingly contrived to dazzle the eyes and divert the imagination of the vulgar.²⁰

Fireworks were also political, in the sense that they constituted a social order both physically and through the representations made of the event. This becomes more evident if we focus more closely on early modern ideas of emotional states.

2. *Pyrotechnic physiologies*

A full account of fire management with regard to early modern pyrotechnics should not be limited to the fireworks displayed in performances for princes, cities, and the like, since early moderns imagined another arena of pyrotechnic fires existing inside the human body.

Pyrotechnic language and ideas penetrated the human body, so that the internal management of fires within the body was as much a part of pyrotechnic culture and the external fire

²⁰ T. G. Smollett, *The Expedition of Humphry Clinker* (London: 1771), 187.

management involved in staging displays. This section explores these pyrotechnic physiologies.

Werrett has argued that the human body was long understood as an economy of fire.²¹ The renaissance saw a revival of the ancient notion of the *flamma vitalis*, the idea that some vital flame enlivened the body. Aristotle had said the heart was where ‘the soul is set aglow with fire’ and renaissance courtiers such as Balthasare Castiglione urged the necessity of managing one’s fiery passions and burning desires in order to survive at court.²² This management of internal fires grew into a complex pyrotechnic physiology in the seventeenth and early eighteenth centuries, entangled with religious and political ideas. The English fellow of the Royal Society John Mayow proposed that some micro-mechanism of gunpowder explosions inside the body might be responsible for life. Mayow argued that air contained ‘nitrous particles’ like the saltpetre in gunpowder, which were needed for respiration, and which gave off heat when they burned. When air was exhausted of this nitro-aerial spirit things ceased to combust, while animals deprived of it died.²³ The Oxford physician Thomas Willis expanded on these ideas and proposed muscular action as the product of micro-explosions of such nitrous and sulphurous particles inside the muscles. The

²¹ S. Werrett, “Sparks of Life”, *Cabinet* 32 (2009) 91-98.

²² Werrett, “Sparks of Life”, 92.

²³ Werrett, “Sparks of Life”, 93-94; H. Guerlac, “John Mayow and the Aerial Nitre – Studies on the Chemistry of John Mayow I”, *Actes du Septième Congrès International d’Histoire des Sciences, Jérusalem 4-12 Août, 1953* (Paris: 1954), 332-349.

nerves passing from the brain served as ‘the fiery inkindling or the match [...] [to] blow up the Muscle’.²⁴

An important site, in England at least, where this ‘pyrotechnic physiology’ becomes apparent is in seventeenth and eighteenth-century discussions of enthusiasm, the religious and political fanaticism that early modern English felt to be responsible for the Civil War of the mid-century and constant threats and plots after the Restoration of the monarchy in 1660. This tendency to extremist and unbendable convictions and erroneous beliefs was put down to an excess of fiery spirits igniting inside the bodies of enthusiasts, turning them into ‘firebrands’ with an overheated disposition who were liable to use fire to destroy England. Worst of all were the Catholic Jesuits, lambasted in *Pyrotechnica Loyolana, Ignatian Fire-works. Or, the Fiery Jesuits Temper and Behaviour* (1667), for devilish attempts to burn London,

That, the Jesuits are ambitious, their Founders name signifies a fire-brand, *quasi ab igne natus*; and that his disposition was Fiery, and his profession Military; whereupon they affirm he came to send Fire. Hence *de jure* they profess the Art of making and casting about Fire-balls and Wild-fire to burn Houses and Cities: to promote which, they have two Colledges, one at Madrid, another at Thonon [in France] to advance the study of Artificial Fire-works, and to subdue Protestants by fraud and Arms: they keep stores of powder in their Colledges.²⁵

²⁴ Quoted in Werrett, “Sparks of Life”, 93.

²⁵ Anon., *Pyrotechnica Loyolana, Ignatian Fire-works. Or, the Fiery Jesuits Temper and Behaviour* (London: 1667), 124. See Werrett, *Fireworks*, 77-79.

Incendiary plotting and internal pyrotechnics were thus linked together as equally in need of control. Historians of science are familiar with the account of Steven Shapin and Simon Schaffer who argued in *Leviathan and the Air-Pump* that the new science of the seventeenth century was in part an attempt to use natural knowledge-making as an antidote to enthusiasm.²⁶ Against the personal inspiration of fanatics, fellows of the Royal Society in Restoration England argued that knowledge should be made communally and in a way that avoided as much as possible the heated and fiery exchanges typical of enthusiastic forms of life. Focusing on the pyrotechnic language used in the period manifests the intense emotions at play in these debates. Just as enthusiasts were over-heated and incapable of controlling the fires raging within them, so experimental philosophers were supposed to be ‘cool’ and temperate, working against fiery passions, not least by explaining and domesticating them through natural knowledge of pyrotechnic physiology. Apologists for the Royal Society and experimental philosophy celebrated it as a means to bring sobriety and therefore national security against ‘violent and fiery’ tempers that could ignite another civil war. Thomas Sprat praised experimentalists for having ‘onely the discreet, and sober flame, and not the wild lightning of the others Brains’.²⁷ In the early eighteenth century, John Harris attacked a foe of the experimenters as an enthusiast, ‘the Heat and Fire of your Spirit and Temper makes you, as it doth all Men, ignorant and precipitant in your Judgments of things: your fiery Zeal is

²⁶ S. Shapin, S. Schaffer, *Leviathan and the Air Pump: Hobbes, Boyle and the Experimental Life* (Princeton, NJ: 1985).

²⁷ T. Sprat, *History of the Royal Society of London, for the Improving of Natural Knowledge* (London, 1667), 38.

without Knowledge'.²⁸ Only those who managed these spiritual fires could be reliable makers of knowledge and hence worthy citizens.

Conclusion

Pyrotechnic fire is only one kind of fire, and similar stories might be told in relation to, for example the 'electric fire' in the eighteenth century, which gradually replaced pyrotechnic fires in explanations of a range of natural phenomena, including internal physiological processes. Here, however, I have sought to draw attention to two interacting economies of fire management, in the organization of fireworks displays and in the comprehension of internal physiology in pyrotechnic terms. The integration of these economies suggests the need for a sociomaterial approach, that recognizes the constant connection of human and material lives. Such sociomaterial histories also need to be emoterial, recognizing the permanent emotional dimension of such episodes. Emotions may be mapped, as in the approach of Harris and Sørensen to describing affective fields, attunements and atmospheres, but it also needs to be recognized that comprehensions of emotional states were intrinsic to the whole form of life that generated these experiences in the first place. Natural and physiological knowledge set and reflected the social, political, and religious stakes that communal events like fireworks displays were seeking to manifest.

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²⁸ Harris, quoted in Werrett, *Fireworks*, 96.

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Index Terms

Biringuccio, Vanoccio

Burke, Edmund

Cahuzac, Jean-Louis de

Castiglione, Balthasare

Coga, Arthur

Goethe, Johann Wolfgang von

Harris, John

Lorrain, Claude

Mayow, John

Smollett, Tobias

Sprat, Thomas

Willis, Thomas

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Fig. 1. Anon. ‘The Grand Whim For Posterity To Laugh At’. 1749, etching and letterpress printing, 469 x 351mm. British Museum Department of Prints and Drawings. © The Trustees of the British Museum

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