

**CHANGING CLIMATE IN EARLY MODERN ENGLAND,
c. 1550-1680**

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PHILOSOPHY

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Abstract

This thesis examines the changing idea of climate in early modern England. During a period recognised as an apex of the so-called Little Ice Age, this work critically interprets the cultural and intellectual contexts in which the effects of climate were discussed, debated, and denied. By eschewing a methodological approach based on the insights of historical climatology and paleoclimatology, this thesis interprets a body of neglected sources to demonstrate the conversations that defined the early modern idea of climate. Where other histories of climate have perpetuated a deterministic idea of environmental influence, this thesis questions the variable boundaries between human, environmental, and divine agency during an episode of Global Cooling. Drawing on cultural and environmental historiography, in five chapters it analyses the explanatory power attributed to climate in medicine, society, the home, colonialism and religion. Following recent approaches in environmental and climate history, the thesis considers the early modern climate as a socio-cultural construction that informed political and ecclesiastical decision making as well as the domestic health and lifestyle choices of Englanders. Though the study is largely confined to late sixteenth and seventeenth century England, it provides a meditation on the role of climate in pre-modern history: a subject with cultural significance beyond the physical impact of weather.

For Mum

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Note for the Reader

Quotations from contemporary diary accounts and printed works retain original spelling, capitalisation, and punctuation. To facilitate reading, however, early modern usage of ‘f’ for ‘s’ and ‘v’ for ‘u’ has been modernised. Unless stated, all dates are given in the ‘old style’. All biblical references are from the authorised King James Version, 1611.

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Figure 1: Gerard van Bylaer, Medal commemorating the defeat of the Spanish Armada, 1588 (MEC0012). Produced in the Netherlands. Silver. 51mm. Held at the National Maritime Museum, Greenwich, London.

And thorough this distemperature we see
The seasons alter: hoary-headed frosts
Fall in the fresh lap of the crimson rose,
And on old Hiems' thin and icy crown
An odorous chaplet of sweet summer buds
Is, as in mockery, set. The spring, the summer,
The childing autumn, angry winter change
Their wonted liveries, and the mazèd world,
By their increase, now knows not which is which.
And this same progeny of evils comes
From our debate, from our dissension.
We are their parents and original.

William Shakespeare, *A Midsummers Night's Dream* (2, 1)

INTRODUCTION: HISTORICISING CLIMATE

Climate is an idea that changes like the weather. It is an idea with an ancient past and a contemporary imperative. It is an idea that transcends discipline, sparking debate, disagreement, and denial wherever it is discussed. Whether guiding small talk or macroeconomic policy, it is a popular idea in the broadest sense. It is also an idea that has been curiously neglected by historians, though the *physicality* of climate has always factored in historical discussion. Climatic determinism, i.e. the belief that climate predisposes certain civilisations to greatness or ruin, is common currency amongst historians. From the fall of Rome (408 AD), the so-called General Crisis of the mid-seventeenth century, to the current Syrian Civil War, the climate is commonly blamed for periods of political turbulence, societal collapse and revolution.¹ Since Herodotus, historians have concerned themselves with the historical agency of climate in political history, less so the cultural history of climate.² This thesis will address this imbalance to explore how the idea of climate was fashioned and appropriated by geographers, physicians, statesmen, clergy, colonists and natural philosophers to bolster or challenge dominant myths, institutions, and hierarchies of power in early modern England. The legacy of this period was not a homogenous understanding of climate as ‘average weather’, but an enduring image of ‘climate’ as a discursive enigma: a projection of living standards, national fortune, colonial success, as well as public and personal health.

Changing Climate in Early Modern England c. 1550 - 1680 will explore the changing meaning of ‘climate’ during the peak of the so-called ‘Little Ice Age’: a four-hundred year

¹ Kristina Sessa, ‘The New Environmental Fall of Rome: A Methodological Consideration’, *Journal of Late Antiquity* 12 (2019), pp. 211-225; Peter H. Gleick, ‘Water, Drought, Climate Change, and Conflict in Syria’, *American Meteorological Society* 6 (2014), pp. 331-340; Geoffery Parker, *Global Crisis: War, Climate Change and Catastrophe in the Seventeenth Century* (London, 2013).

² James Romm, ‘Herodotus and Mythic Geography: The Case of the Hyperboreans’, *Transactions of the American Philological Association (1974-2014)* 119 (1989), pp. 97-113.

period of global cooling c. 1500 – 1900. Fundamentally, the thesis will interrogate the early modern idea of ‘climate’ and the human, environmental and divine agency that contributed to an understanding of climatic change. Throughout the five chapters that comprise this work – Anatomising Climate, Polluting Climate, Domesticating Climate, Colonising Climate and Worshipping Climate – this question will be approached from five distinct yet interrelated thematic standpoints. I will elucidate the epistemological rifts and continuities that characterised the idea of climate from the ascension of Elizabeth I to the coronation of William III. This one-hundred-and-fifty-year period witnessed the standardisation of many meteorological instruments, as ‘climate’ straddled the categories of qualitative to quantitative analysis. With the advent of coal as a domestic and industrial fuel, the meaning of ‘pollution’ adapted its organic, moral, and social connotations to describe the physical contamination of the atmosphere by fuel emissions. As new technologies in glassmaking, architecture and air conditioning emerged; climate became the subject of infrastructural regulation, management and manipulation. Across the Atlantic, while colonists struggled to acclimate to their new environment, climate was figured as a template for the ethnic classification of the New World. Finally, in the context of the religious wars and reformations that characterised early modern Europe, climate was simultaneously cast as a threat and safeguard to national security and the Church of England. The first two chapters, in their discussion of humoral medicine, reflect a worldview in which the environment dictated physical and mental health. The third and fourth chapters consider how contemporaries sought to override the idea of environmental influence, manipulating domestic and overseas climates. Finally, chapter five examines the enduring concept of providence and the role of climate in public worship.

This thesis treats climate as the culmination of intersecting discourses from the physical and social sciences: as much the product of seasonal variation, atmospheric pressure,

humidity, wind and temperature etc., as ideology. Examining this idea from various disciplinary standpoints, we can envisage a historical idea of climate that contains within it a range of contradictory medical, social, architectural, travel and spiritual advice administered in times of atmospheric change. Not unlike today, during the early modern period climate was a subject of intrigue, debate and denial. While warning against the perils of genital retraction, physicians boasted the effects of the cold on the masculine English constitution. Though several would-be settlements collapsed under climatic stress, colonists praised the New England climate as a temperate haven. Protestants hailed the bitter easterly winds of 1588 and 1688 as a providential signal of England's redemption from Popery just as they publically atoned for that same weather.

The five chapters that follow explore five distinctive themes which characterise early modern English attitudes toward climate. To be clear, these five chapters *do not* represent the only ways that climate impacted early modern English culture. For the purpose of brevity, the thesis is based around five themes which, I believe, have been neglected in environmental histories of the period. Absent from the ensuing thesis are discussions of agriculture, farming, and livelihoods. This does not reflect their significance in the history of climate, but a methodological decision which acknowledges an existing historiographical corpus dedicated to disentangling the daily decision-making based on climatic fluctuations. These works include classic accounts by Hubert Lamb, who is referenced throughout the thesis, and Emmanuel Le Roy Ladurie's *Times of Feast, Times of Famine: A History of Climate Since the Year 1000*.³ This decision was also informed by the methodological direction of the thesis, which is firmly qualitative. To focus on the economic lives of early modern Englanders in the

³ Hubert Lamb, *Climate, History and the Modern World* (2nd edn., London, 1995); see also Lamb, 'An Approach to the Study of the Development of Climate and Its Impact in Human Affairs', in T. M. L. Wigley, M. J. Ingram, and G. Farmer (eds.), *Climate and History: Studies in Past Climates and Their Impact on Man*, (Cambridge, 1981); Emmanuel Le Roy Ladurie, *Times of Feast, Times of Famine: A History of Climate Since the Year 1000* (London, 1971).

context of a changing climate would have required an approach rooted in mixed methodologies, and a greater emphasis on quantitative record keeping. Parts of this introduction will explore why this is an approach fraught by several complex variables.

Anatomising Climate begins with a critique of historical climate reconstructions, their philosophies and methods. As well as scrutinising the empirical basis for studying the Little Ice Age, the chapter will survey the epistemological rupture represented by the arrival of new thermometric and barometric instruments. It will review the efficacy of these early devices and offer an alternate methodology for the study of the early modern climate. Foremost, this process will involve an extensive survey of popular health regimens from the late sixteenth and early seventeenth centuries. Throughout this period, the lack of standard scales for temperature meant that understandings of climatic change and variation were markedly qualitative. The regimen reflected a culture fascinated by the perturbations and effects of the changing seasons on the body and mind. Galenism, as well as Aristotelian meteorology, will be shown as the driving force in ‘popular’ climatological theory and practice. Rather than drawing from the gentlemanly observations and early record keeping, this method seeks to reflect the diverse applications of climate theory in daily life. Climates, or ‘airs’, will be treated as embodied phenomena: measured and regulated by the unconscious machinations of the humoral form. The chapter will continue by explaining the peculiarities of the English climate and the supposed effects on the humors of its inhabitants. The chapter will finally raise the complex issue of diagnosing seasonal mood disorders in past societies and propose a new understanding of England’s emotional climates.

After establishing the humoral pathology of climate in the early modern period, the second chapter, *Polluting Climate*, will problematise existing ideas about pollution in the early modern world. Drawing on recent interventions by William Cavert and the classic work

of Mary Douglas, the chapter will survey the diverse environmental and social meanings of early modern ‘pollution’ and interrogate accepted historical chronologies.⁴ By collapsing the distinction between technical and non-technical pollution, the chapter coins ‘organic pollution’ to describe how individuals envisaged the effects of daily behaviour on the condition of their micro-atmosphere. London’s new pollutant, smoke, will be of central importance to this chapter, as will other frequently overlooked forms of organic pollution: blasphemy, oath breaking, swearing, flatulence and smoking, etc. To varying degrees, many human exhalations were perceived as having an impact on the healthfulness of urban environments and their inhabitants. Importantly, the chapter will argue that the changing etymology of ‘pollution’ in early modern England reflected a burgeoning environmental consciousness. Simultaneously, it will show how ‘pollution’ retained its pre modern connotations of sin, depravity, and shame.

Following a detailed examination of the diverse airs that affected early modern England, *Domesticating Climate* will explore a breadth of environmental strategies designed to mitigate the effects of abrupt seasonal change, extreme weather, and pollution. In the context of the Hippocratic revival, the chapter will begin by exploring the influence of the *Airs, Waters, and Places* thesis on early climatic theory. It will map a proverbial culture in early modern England constituted of ‘good airs’, ‘bad airs’ and pestiferous ‘black spots’. To ameliorate the harmful effects of these regions, inhabitants sought advice from health regimens, herbal, and popular horticulture texts. The influence of these three closely aligned genres cultivated an idea of botanical effluence that empowered readers to shape, control, and manipulate their interior environments with ‘artificial air’. At the same time, a new generation

⁴ William Cavert, *The Smoke of London: Energy and Environment in the Early Modern City* (Cambridge, 2016); Mary Douglas, *Purity and Danger: An Analysis of Concepts of Pollution and Taboo* (Abingdon, 1966); Mary Douglas and Aaron Wildavsky, *Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers* (London, 1983).

of architects inspired by Italian Palladianism, birthed an English style which responded to the harsh dictates of the at-times bitter local weather. A desire for fresh air and sunlight characterised this change, with new building materials introduced by architects to combat ‘bad air’. Notably, the chapter will evidence the meteoric rise of glass windows as a popular building material. The section will conclude by examining the emerging influence of mechanical philosophy on new methods of air conditioning, heating and solar power.

In the penultimate chapter, *Colonising Climate*, the thesis will investigate how early colonists restored theories of climatic influence during a period of expansion and national aggrandisement. The beginning of the chapter will acknowledge the many inconsistencies between ancient representations of the English weather and the lived experience of Englanders. Early English geographers, in light of their ‘inferior’ climate, were compelled to reconfigure the boundaries between the temperate ‘middle zone’, the frigid north and the arid south. Through outright attacks on classical thinkers to the reimagining of English temperance, climate became a conduit for an early nationalism based on environmental rather than ethnological criteria. In the context of colonial expansion into North America, climatic discourse was manipulated to assert a proto-racial hierarchy of complexion. The chapter concludes by exploring the emergence of a climatic rationale for colonialism as geographers attempted to embrace, alter, or reject the implications of classical climate theory. In doing so, subsequent analysis will foreground the role of climate theory in shaping later arguments for slavery, settler colonialism, as well as the broader subjugation of native peoples under the later British Empire.

Worshipping Climate, the final chapter, will examine how Church authorities fashioned an interpretation of climate that reflected the confessional changes of the period. Bookended by two dramatic events in English meteorological history, the defeat of the

Spanish Armada (1588) and the 'Protestant Wind' which guided William of Orange to the shores of England (1688), the chapter will survey the many special days of prayer, atonement and fasting issued by the Church of England and used in times of adverse weather to bolster confessional sentiment. By examining material artefacts and memorials, this will analyse the relationship between climate, religion and memory in a period of continental infighting. It will also pay attention to dissenting interpretations of climatic change as well as challenges to providentialism which emerged during the late seventeenth century. Climate, through Protestantism and the doctrine of providence, became a battleground for dissenting beliefs and existential question asking. Extreme weather events were not merely read as portentous but as an affirmatory or chastening signal from a watchful deity. How the early-modern English State and Church collaborated in their responses to moments of climatic hardship can be said to represent the first moment that governments imagined climate as a threat to national security and sovereignty. Weather events, during the first Anglo-Spanish War, English Civil War, and first Anglo-Dutch War, became newsworthy. Public opinion changed with the wind as the nation's moral barometer swayed from fair to changeable.

The thesis will conclude by reflecting on the discursive themes raised. Within the context of our present climate crisis, this conclusion will also serve as a final reflection on the implications of anthropogenic climate change on the study of history. It will consider the significance of the LIA in present-day climate debates, the relevance of early modern history in a field dominated by modernists, and return to reflect on the significance of the English in this story. The broader implications of these arguments are considerable in number and scope. Despite repeated calls in recent scholarship for new tools and methodologies with which to study our weathers, pre-instrumental histories of the English climate are still few and far between. Of those scholars who have dedicated their work to a cultural understanding of

climate history, few are based in early modern English studies. Unlike many comparable histories of climate and environmental change, this thesis begins from an unashamedly qualitative perspective. It promotes a new understanding of climate history which is relative and holistic. Firstly, however, I shall begin by establishing this study's terms of engagement: its methodology, sources, definitions and direction.

'The Last Refuge of the Unimaginative': Discourse, Disagreement, and Definitions

In a play written by John Heywood in 1533, a cast of humble characters debate that timeless English grievance: the weather.⁵ To resolve this gripe once-and-for-all, Jupiter descends from heaven to amend the English weather and 'shape remedy for their relefe'. Jupiter appoints a courtier as his consul on earth, who petitions from 'Suthampton' to 'Wakefelde' to discern the English people's ideal climate. On his journey, the courtier first meets a gentleman who recommends that the weather be 'pleasaunte Drye and nat misty', perfect for hunting. Secondly, he meets a merchant who desires fair weather and gusts of wind from all directions, so that he may 'passe frome place to place. Beringe our selles for spede moste valeable'. Upon meeting a Ranger, the courtier is asked for a 'good rage of blusterynge and blowinge', so he can supplement his income by selling fallen branches. Fourthly, he engages both a water-miller, for whom wind is his 'mortall enemy' and a wind-miller who naturally pleads for it to 'never rayne but wynde continuall'. The courtier then encounters a Gentlewoman, who wishes for Jupiter 'to sende us wether close and temperate/ No sonne shyne no frost nor wynde to blowe' so that the Gentlewoman may preserve her complexion. Next, the courtier

⁵ John Heywood, *The Play of the Wether* (1533) in Greg Walker (ed.), *Medieval Drama: An Anthology* (Oxford, 2000), pp. 455-478.

chances upon a laundress who requires ‘the sonne shine so that our clothes may dry.’ Finally, he encounters a young Boy who, in his naivety, asks for ‘plente of snowe to make my snowe balles.’⁶

Reporting to Jupiter, the courtier reveals his predicament: ‘No one thyng coule stande more wyde frome the other’ he aches, ‘not one of their suters agreeth with another’. Having listened to the several testimonies given by his consul, Jupiter deliberates upon his final judgement. Unwilling to prioritise one subject over another, he resolves to keep the weather *exactly as it was*, so that each can pursue their chosen occupation or hobby (albeit intermittently). Jupiter’s subjects celebrate their God’s savvy diplomacy. By attending to the discrete climatic preferences of his followers, Jupiter validates his position of authority and duty to ‘serue as many or as fewe as we thynke best’. As scholars have exhaustively noted, *The Play of the Wether* can be read as a fairly brazen allegory of Henry VIII’s absolutism.⁷ In fact, English scholars have treated the matter of the weather in the *Play of the Wether* as little more than a footnote; an inconsequential and ‘innocent meteorological plot’, to quote David M. Bevington.⁸ Thankfully, recent scholarship has begun to interpret the interlude drama from an ecocritical perspective.⁹ Nevertheless, one central, and reasonably obvious theme has thus far evaded existing scholarship on the work; namely, the theory of knowing what constitutes ‘good’ and ‘bad’ weather in early modern England. Fundamental to the debate between Heywood’s characters are the discrepancies between what they define as a desirable and undesirable climate. As the playwright shows us, any distinctions made between ‘good’ and ‘bad’ weather are arbitrary and determined by the varied social and economic priorities of

⁶ Heywood, *The Play of the Wether*, pp. 455-478.

⁷ Candace Lines, “‘To Take on Them Judgemente’”: Absolutism and Debate in John Heywood’s Plays’, *Studies in Philology*, 97 (2000), pp. 401-432.

⁸ David M. Bevington, ‘Is John Heywood’s *Play of the Weather* Really about the Weather?’, *Renaissance Drama*, 7 (1964), pp. 11-19.

⁹ Jeniffer L. Ailles, ‘Ecocritical Heywood and *The Play of the Weather*’, *Early Theatre* 16 (2013), pp. 185–196.

a given individual or society, rather than any universal morality.

In the *Play of the Wether* the ideal climate is unattainable and ‘bad weather’ is inevitable. This is a truth self-evident throughout history. As Mike Hulme clarifies in *Why We Disagree About Climate Change*: ‘there may be “good” or “benign” climates and “bad” or dangerous climates, but only in the sense that climates acquire such moral categories through human judgements – judgements that suit our convenience or our capabilities’.¹⁰ Heywood’s drama remains a timeless reminder of this inalienable truth. It also reminds us of how distinctly ‘English’ this fascination with climate is. Objectively speaking, the English climate *is* interesting. Standing at the edge of the European continent, the British Isles are subject to an oceanic or ‘maritime’ climate which is moderated by the Gulf Jet Stream. This meteorological combination accounts for the famously changeable English weather. Countless historians, journalists, playwrights, and anthropologists have endlessly ruminated on the nation’s collective obsession with weather. These range from the pseudo-historical determinism of Jeremy Paxman, who claimed that the ‘mild and gentle climate [of the British Isles], rarely too hot and rarely extremely cold’ has ‘played a role in producing a moderate, pragmatic people’, to sophisticated scholarly insights into English behaviour.¹¹ For the anthropologist Kate Fox, a number of rules, taxonomies and hierarchies codify our responses to climate. The supposedly English ‘obsession’ with the weather is not based on the transmission of meteorological data, but a desire for consensus.¹² If the Eskimo people have

¹⁰ Mike Hulme, *Why We Disagree About Climate Change: Understanding Controversy, Inaction and Opportunity* (Cambridge, 2009), p. 3; see also Hulme, Suraje Dessai, et al. ‘Unstable Climates: Exploring the statistical and social constructions of “normal” climate’, *Geoforum*, 40 (2008), pp. 197-206.

¹¹ Jeremy Paxman, *The English, A Portrait of the People* (London, 1998), p. 105. Bizarrely, Paxman also attributes the history of English rock music to the climate (p.104). ‘It is a reasonable supposition that cold wet weather, which forced teenagers to stay indoors in winter instead of going to the beach or skiing, probably has something to do with the country’s capacity for inventive rock music.’ To this we might retort: The Beach Boys.

¹² Kate Fox, *Watching the English: The Hidden Rules of English Behaviour* (London, 2005), pp. 25-37.

fifty words for snow, the English possess just as many to describe a light drizzle.¹³ This is not owing to an unceasing sensitivity to atmospheric conditions, but an unconscious desire for social cohesion. In the otherwise turbulent political context of the late 2010s, we can at all agree that *at least it isn't raining*. Weather-speak greases the wheel of social interaction, Fox explains, easing a sense of reciprocity between strangers. This is why for Oscar Wilde talk of the weather engendered an acute paranoia. 'Whenever people talk to me about the weather,' he wrote in *The Importance of Being Earnest* (1895), 'I always feel quite certain that they mean something else. And that makes me quite nervous.'¹⁴ Wilde was right. We always mean something else. For the early moderns, the same was almost true. They could collectively agree that the Lord's divine providence was responsible for the changing seasons, England's beneficent summers and occasional extreme weather. However, beneath the consensus on providence was a fractured and incomplete idea of climatic influence. In early modern England, weather-talk was an arena for disagreement. As characterised by Heywood's belligerent band of complainants, our climatic preferences serve as a conduit for discussions around health and identity; economics and commerce; lifestyle and fashion, etc.

Before we hypothesise over the relativity of climate in early modern England, we should first consider what we *actually mean* by this elusive term. Heywood's drama, for example, makes no mention of 'climate'. Many of the treatises featured throughout this thesis do not refer to this word. What's more, the concept of aggregate weather conditions would have been inconceivable in the early modern period. Though the word was in circulation, its connotations were detached from the statistical definition of climate developed in the

¹³ Strictly speaking, speakers of Eskimo-Aleut languages (Yupuk, Inuit) do not have fifty-words for snow. This controversial theory was first forwarded by the anthropologist Franz Boas and is commonly used to support the linguistic-relativity hypothesis. Laura Martin, "'Eskimo Words for Snow": A Case Study in the Genesis and Decay of an Anthropological Example', *American Anthropologist*, 88 (1986), pp. 418-423.

¹⁴ Oscar Wilde, *The Importance of Being Earnest, A Trivial Comedy for Serious People* ed. Russell Jackson (London, 1980), p. 62.

nineteenth century. Deriving from the Greek *Klima*, literally ‘inclination’, the early modern etymology of ‘climate’ denoted the gradient of the sun’s rays on the surface of the earth. In the second century AD, Ptolemy elaborated on this model to include seven *klimata* of varying inhabitability.¹⁵ Specific to this understanding of ‘climate’ was the idea of an unchanging, stable, and localised dynamic between airs, places, and people. Before the integration of weather and climate, climate was interchangeable with latitude. The term was sparsely used in popular discourse during the late sixteenth and seventeenth centuries, except in reference to global politicking and the psychosocial character of continents, nations, and communities (see ch. 4).

This is not to mistake the physical significance of steady seasonal variation to the agrarian economy of early modern England but to highlight the tension between the physical effects of weather and the cultural idea of climate. At first glance, the inherent relativism of this study might be jarring. Surely, during the period in question, the ‘ideal climate’ is the one best suited to the annual rhythms of the harvest. To this, we may answer: what season? Which crop? Which region? Indeed, should the climate favour the Heywood’s water- or wind-miller? This is not to deny that extreme weather events and prolonged climatic fluctuations hurt the socio-economic livelihood of individuals, but to highlight that such effects exist within a cultural matrix. The physicality of weather is unquestionable. However, the subjectivities of climate should be interrogated by historians. The Romney Marshes are, for example, wetter than the Malvern Hills. However, these opposing airs, waters, and places were subject to significantly different cultural interpretations: whereas the marshes south of London were seen as veritable death-traps, laden with *mal-aria* (‘Bad Air’), physicians praised the hilly, open country airs north of London as being conducive to physical, mental, and spiritual

¹⁵ J. Lennart Berggren and Alexander Jones, *Ptolemy's Geography: An Annotated Translation of the Theoretical Chapters* (Oxford, 2000), pp. 9-11.

health.¹⁶ One person's deathly winter was another's frost fair, so to speak.

'Climate', in its post-instrumental, quantitative sense, would have been alien to the early moderns. To take the World Meteorological Organisation's (WMO) definition, 'climate' is 'the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years ... these quantities are most often surface variables such as temperature, precipitation, and wind.'¹⁷ Classically, this period is capped at around 30 years. Of course it is vitally important that climate is aggregated, measured and predicted by scientists; however, this cannot be the only context in which we discuss the history of 'climate' and 'climate change'. While today 'climate' denotes an index of average weather, this is a relatively modern idea. Though any attempt to reduce climate to a single definition is antithetical to the purpose of this thesis, it is also an opportune moment to distinguish between our historical understanding of 'weather' and 'climate'. For this thesis, 'weather' represents the momentary physical qualities of climate, whereas 'climate' is the linguistic and cultural manifestations of the 'weather'.

Though the notion of climate as 'average weather' is dominant in the environmental sciences and history, there exist exceptions. In a notable definition of the term, the famed climatologist Hubert Lamb described the word in *Climate, History and the Modern World* (1982) as the 'total experience of the weather at any place over some specific period of time.'¹⁸ However vague, this definition may be a useful starting point. What is unclear in Lamb's definition, however, is what constitutes this 'total experience'. What does it mean to

¹⁶ Mary Dobson, *Contours of Death and Disease in Early Modern England* (Cambridge, 1997), pp. 176-177.

¹⁷ Intergovernmental Panel on Climate Change, Working Group 1, *Climate Change 2007: The Physical Science Basis* (Cambridge, 2007), p. 942. The full definition reads: 'Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.'

¹⁸ Lamb, *Climate, History and the Modern World* (2nd edn., London, 1995), p. 8.

totally ‘experience’ weather? Presumably, this encompasses imaginative as well as physical manifestations of weather. To return to the work of Hulme, we can elaborate on this very important distinction. ‘Climate cannot be experienced directly through our senses,’ he states. ‘Unlike the wind which we feel on our face or a raindrop that wets our hair, climate is a constructed idea that takes these sensory encounters and builds them into something more abstract. Neither can climate be measured directly by our instruments. We can measure the temperature of a specific place at a given time, but no-one can directly measure the climate of Paris or the temperature of the planet.’¹⁹

During the early modern period, the gulf between physical weather and imaginary climates was much wider than today. This separation was enshrined by corpora of ancient climatology. As a result, most of the primary sources which make up this thesis lack concern for empirical rigour, as we understand the notion. Even with the mid-seventeenth century turn toward the Baconian method and the supposed ‘Scientific Revolution’, instrumentation was primitive, and a speculative and theoretical image of climate and environmental influence guided ‘empirical’ assumptions. To quote Alexandra Harris, early moderns ‘learnt more from Hippocrates and Aristotle than from the puddles in the street.’²⁰ The past understanding of climate was aphoristic, impressionistic and, resultantly, quite fickle. One health guide might suggest the native English climate suited a hot regimen, i.e. ‘hot’ food, ale and beef, while another might advocate a ‘cold’ regimen, i.e. cold bathing and a vegetarian diet (ch.1,4). A series of philosophers who had no first-hand impression of northern climates had concocted an enduring and ancient representation of England’s climate as cold, brutal and inhospitable. One notable exception was Caesar, who found the English air to be quite temperate.²¹

¹⁹ Hulme, *Why We Disagree About Climate Change*, pp. 3-4.

²⁰ Alexandra Harris, *Weatherland: Writers & Artists Under English Skies* (London, 2015), p. 73.

²¹ Julius Caesar, *The Commentaries of Caesar*, trans. William Duncan (St. Louis, 1856), p. 140. Of Britannia’s climate, Caesar wrote: ‘The country has a more temperate climate than Gaul, the cold being less intense.’

Misinformation over climate also guided many early colonial ventures. Richard Eburne, the famous colonial propagandist, featured in ch. 4, had never visited the New English climes he languished with praise.

Climate was unquantifiable in the early modern period. Without standardised instrumentation before the beginning of the eighteenth century, physicians and natural philosophers understood changes in climate in qualitative terms based on ancient wisdom. Specifically, three names had a definitive influence on the pre-instrumental concept of climate: Aristotle (384 – 322 BC), Hippocrates (c. 460 – 370 BC), and Galen (c. 129 – 280 AD). The first, Aristotle, postulated a general framework for understanding meteorological phenomena. His *Meteorologica*, the source of widespread influence during the Renaissance, is also foundational to this belief.²² Aristotelian geology imagined the earth as one great lung, inhaling and exhaling vapours from the ground. The sun draws much of this vapour from the ground to produce air. These exhalations may be hot, dry, cold, or moist, depending on the position of the sun in relation to the earth (hence seasonal change). When these vapour condensate, they turn to rain. When they are dry, wind originates. Amongst other natural phenomena covered in his compendious work, Aristotle also attributes earthquakes, shooting stars, and comets to these ‘exhalations’.

Though Hippocrates is foremost known as the patriarch of western medicine, he was also responsible for a major intervention in early climatology. Based on the enduring legacy of the Hippocratic corpus, climate – or ‘airs’ – were first subject to medical scrutiny and weariness. Climate was fundamental to the diagnostic methodology outlined in his *Airs, Waters and Places* thesis; a work that underpins every health regimen of the early modern period and the theories of environmental influence they espoused. ‘Whoever wishes to

²² Aristotle, *The Works of Aristotle*, trans. E.W. Webster (Oxford, 1923), vol. 3.

investigate medicine properly,' his work began, 'should proceed thus: in the first place to consider the seasons of the year, and what effects each of them produces for they are not at all alike, but differ much from themselves in regard to their changes ... From these things he can proceed to investigate everything else.'²³ Hippocrates understanding of 'climate' was highly intuitive, though entirely subjective. According to this theory, good health and character depended on a clear air, preferably in high-altitude, a local source of clean running water, and a situation free from putrid stenches. Each location gave way to a particular disposition. For the early moderns, this bred the popular idea of national temperaments and explained the supposedly diverse character traits between the inhabitants of Northern and Mediterranean Europe, as well as the Far East, Central Africa and the New World.

Finally, Galen's contribution, like that of Hippocrates, instituted the idea that bodies could physically acclimate to new weathers by adopting new lifestyles and diets.²⁴ For this reason, he is perhaps the most significant figure in early modern climatology. Along with Hippocrates, his influence gave way to an understanding of climate based on medical thought. Unlike his predecessor, he rejected the idea of environmental constancy. During a period of environmental change and new encounters with overseas habitations, his theories appealed to a population concerned with the effects of climatic change on humoral composition. After Galen, climates were categorised around extremes and balance. Out of this concern, the idea of a 'changeable' climate emerged. Bodies, as well as the climates they inhabited, were capable of adaptation. Through a rigorous dietetic regimen and exposure to new climates, ancient and medieval physicians argued that the body would mutate to suit its new environment.²⁵ In direct contradiction to Hippocrates' advice and Aristotle's geocentric theory

²³ Hippocrates, *On Airs, Waters, and Places*, trans. Francis Adams (London, 1849), p.1.

²⁴ Galen, *On Food and Diet*, trans. Mark Grant (London, 2000); Galen, *On the Usefulness of the Parts of the Body*, trans. Margaret Tallmadge May (Ithaca, NY, 1968).

²⁵ Marian J. Tooley, 'Bodin and the Mediaeval Theory of Climate', *Speculum* 28 (1953), pp. 64-83.

of climate, the early modern interpretation of Galen emphasised the permeability of the humoral form. Climate affected human change, rather than humans making climate change. Galen was instrumental in the development of this idea.

When we speak of *historicising climate*, the early modern interpretation of these three philosophical juggernauts is foundational to weather-talk across Europe. Until the emergence of empiricism during the mid-seventeenth century, the shadow of this troika loomed heavy over the minds of physicians, geographers, clerics and politicians. Aristotle's conception of *klima*, Hippocrates' model for living and Galen's dietetic recommendations may have all faced scrutiny, but their legacy coloured almost every facet of climatology in the period. At the same time, a further spectre haunts our perception of the past: climate change. The Little Ice Age has come to represent a specific Rorschach on which climate activists and deniers project their conflicting ideologies. For the former camp, the Little Ice Age was a period of climatic tumult which precipitated the collapse of civilisations, from Ming China to the English Civil War.²⁶ According to this narrative, the LIA features as a prophetic reminder of the power of climate to effect catastrophic change. For those on the opposite aisle of the 'debate', deniers claim the LIA as a chief reminder of the cyclical nature of climate change. Our climate is changing, they retort, but it always has. Clearly, this second position is the more politically unsavoury and dangerous. However, both assumptions are laden with misconceptions. The second is fuelled by misinformation, while the first is subject to a reductionist tendency evident throughout mainstream histories of climate. It is impossible to study the history of climate without acknowledging the unprecedented impact of climate change on conceptions of the future; however, historians must handle this responsibility with care.

²⁶ Geoffrey Parker, *Global Crisis: War, Climate Change and Catastrophe in the Seventeenth Century* (London, 2013).

The methodological direction of this thesis will reflect the urgent need in our histories to engage with climate without succumbing to fatalism. Our definition of climate should take into account this urgency, without neglecting or undermining the necessity for historicism. That is to say, this thesis should reflect the priorities of the early moderns, as they saw climate, rather than twenty-first century fears. Like the judicious ruling of Jupiter in Heywood's play, our working definition should reflect the prismatic idea of climate: both as a measurable and unquantifiable phenomenon, a subject of historical and contemporary import, and an idea with cultural and statistical histories.

'There is no such thing as bad weather, only bad clothing': Reducing the Past to Climate

The threat of climate change tends to represent a call-to-arms for historians. Intervening in a public conversation typically dominated by the physical sciences, they are the secular prophets of our age, using their powers of long-term hindsight to alert all to the future calamities that will arise from unmitigated anthropogenic global warming. Though the cumulative impact of quantitative studies can give a strong impression of long- and short-term changes, they cannot serve to explain the human impact of climate. Whether adopting doom or hope, then, our historical understanding of climate is usually forged in view of imminent danger – a fatalism that obscures the far less obvious, more complex and discursive connections that always exist between climate and people. While calamity attracts historical attention, it also smothers a forgotten narrative about how public and private conceptualisations of climate have emerged within the fraught and contested terms of the human body, domestic living, politics, colonialism and religion. The LIA was a period that witnessed an unprecedented number of climatic anomalies, but do such events inevitably

manifest in social and economic disorder? The early modern understanding of climate and climatic variance depended not only on disruption, but continuity: the interrelationship between people, places, and air determined character and health, gifted sustenance, influenced politics and revealed providence.

In history and society, climate has become synonymous with images of catastrophe and disaster. Just as our early-modern descendants would have interpreted an episode of freak weather as a sign of divine providence, today we invoke the omnipotent threat of climate change. Though society disavows the realities of our ongoing crisis, climate change has become the primary channel whereby we imagine present and past environments. Climatic vigilance defines our global epoch: from humanitarian efforts to rebuild Haiti (2010) and New Orleans (2005) to everyday banalities and behaviours. George Myerson terms the cumulative effects of these menial occurrences ‘The Ecopathology of Everyday Life’, using a phrase adapted from the seminal Freudian essay.²⁷ He describes this unconscious process using an equally prosaic metaphor, writing: ‘The Ecopathology of Everyday Life begins when you insist that there is no such thing as simply a blocked drain. This blocked drain is a symptom of global climate change, a mundane confirmation of a deeper meaning that has been discovered behind everyday life.’²⁸ Weather remains the subject of small talk, but now this small talk is imbued with catastrophic associations. Though Fox is right to acknowledge that weather has a discursive function beyond meteorological nitpicking, climate change has inspired our conversations with alarm and fright. In film, television and literature, we are reminded of our impending doom as a result of climate change, while enticed by human redemption. The most widely referenced example of this is the rising popularity of cli-fi: a sub-genre of science fiction which gained increased exposure after the release of Roland

²⁷ Freud’s original essay, ‘The Pathology of Everyday Life’ explored deviations in everyday life and associated stereotypes. It is best known for popularising the theory of parapraxis or the ‘Freudian Slip’

²⁸ George Myerson, *Ecology and the End of Postmodernity* (Reading, 2001), p. 52.

Emmerich's 2004 feature film *The Day After Tomorrow*. The results of these narratives are the proliferation of spurious metaphors and ideas that undermine the complexities of climate change to suit an elementary account of human 'progress'. As Wolfgang Behringer warns in the epilogue of his *Cultural History of Climate* (2010), the use, or over-use of metaphors in popular discourse: 'may lead us to wrong conclusions and involve illegitimate simplification... So care is needed with comparisons. This is also true of the "climatic illness" of planet earth. Although the image may make things easier to understand, the reality is undoubtedly more complex than the representation.'²⁹

The idea of 'climatic illness' is pervasive in modern history. The referral to climate change as a problem to be somehow 'fixed' or overcome has been interpreted as another manifestation of the 'Risk Society' coined by Ulrich Beck in 1995 to denote a society 'increasingly preoccupied with the future (and also with safety), which generates the notion of risk.'³⁰ In the sociology of both Anthony Giddens and Beck, a renewed modernity answered the nihilism of post modernity. Faced with the omnipresent threat of catastrophe as reproduced in mainstream media channels, the risk society is forced to adapt out of scepticism, creating and securing a future of human sustainability. Hulme strongly rejects the 'predictive authority' of contemporary social and political discourse on climate change, which he refers to as 'climate reductionism'. He uses the term to describe:

the hegemony exercised by the predictive natural sciences over contingent, imaginative and humanistic accounts of social life and visions for the future. It is a

²⁹ Wolfgang Behringer, *A Cultural History of Climate* (Cambridge, 2010), p. 208.

³⁰ Anthony Giddens, 'Risk and Responsibility', *Modern Law Review*, 62 (2003), pp. 1-110, p. 3.

hegemony which lends disproportionate power in political and social discourse to model-based descriptions of putative future climates.³¹

Consciously or unconsciously, historians perpetuate similar discursive functions surrounding climate change. The narrative is already written: the eschatological anxieties of the ‘Risk Society’ and this figurative ‘climatic illness’ is left uncontested.

Rather than reduce our understanding of climate to weather, this thesis will explore the holistic idea of climate: as a constructed reality based on competing medical, social, domestic, colonial and religious perspectives. This will mark a departure from existing histories of English climate, which instantaneously conflate ‘climate’ with ‘weather’, a position criticised by William Meyer as ‘meteorological fundamentalism’ (i.e.: the misguided belief that ‘the significance of the climate can be established purely from its physical characteristics without regard for cultural conditioning or human agency’).³² Elsewhere, Hulme has referred to this same tendency as ‘a form of analysis and prediction in which climate is first extracted from the matrix of interdependencies which shape human life within the physical world.’³³

By extracting climate from its social context, we risk reducing climate to a continuum of statistical averages devoid of cultural meaning. In Jan de Vries’ classic article from 1980, he uses a contemporary newspaper article to illustrate this reductionist tendency in history. He cites the effects of the severe and snowy winter of 1979 (England’s folkloric ‘Winter of Discontent’) on a highway along the Dutch-Belgian border; on the Dutch side the surface is clear of snow, yet, on the accompanying Belgian side, the road is ‘indistinguishable from the

³¹ Hulme, ‘Reducing the Future to Climate: A Story of Climatic Determinism and Reductionism’, *Osiris*, 26 (2011), pp. 245-266.

³² William Meyer, *The Americans and their Weather* (Oxford, 2000), as paraphrased by Hulme, *Why We Disagree About Climate Change*, p. 20.

³³ Hulme, ‘Reducing the future to climate’, p. 249.

snow covered landscape.’³⁴ In Dutch newspapers, the photograph of the roadway was accompanied by a description of how Belgian daily life had been brought to a halt, citing the ineptitude of Belgian policy to maintain salt supplies. For the Dutch, the photograph was a vindication of their superior snow-clearing equipment and bountiful salt inventories. As de Vries emphasises, the chaos caused on the Belgian side of the border was the result of the winter of 1979, but ‘it was not inevitably caused by it.’³⁵

To this end, one might invoke that famous Scandinavian motto, that ‘there is no such thing as bad weather, only bad clothing’.³⁶ While praising the work of Christian Pfister and John Post, de Vries’ expresses a similar scepticism toward the study of short-term climatic crises, infamously stating that such ‘crises stand in relation to economic history as bank robberies to the history of banking.’³⁷ De Vries’ article has since been misinterpreted as an attack on the credibility of climate history, with many using this contentious quote to detract from an otherwise sophisticated and poignant thesis. Rather than dismissing the relevance of climate on history, the article borrows from economic theory of ‘learning-by-doing’ to suggest alternate methodologies; moving away from the study of ‘crises’ and ‘harm done’ toward examining processes of technological, economic, and cultural adaptation. In the thirty years since de Vries’ appeal, historians of climate have, by-and-large, successfully substituted ‘crises’ with ‘coping strategies’.³⁸ Nevertheless, and perhaps in response to the mounting

³⁴ Jan De Vries, ‘Measuring the Impact of Climate on History: The Search for Appropriate Methodologies’, *Journal of Interdisciplinary History*, 10 (1980), pp. 599-630, p. 630. It is perhaps also worth noting that England’s experience of the ‘Winter of Discontent’ echoed many similar themes exposed by de Vries. Though not wholly attributed to ‘bad weather’, the series of industrial action taken by many workers from the public sector was deemed to be exasperated by deep snow and persistent blizzards.

³⁵ De Vries, ‘Measuring the Impact of Climate on History’, p. 630.

³⁶ The national origins of this phrase is much debated, Swedes argue it’s theirs (‘Det finns inget dåligt väder, bara dåliga kläder’) while Norwegians claim it as their own (‘Det finnes ikke dårlig vær, bare dårlige klær’)

³⁷ De Vries, ‘Measuring the Impact of Climate on History’, p. 630. John D. Post, *The Last Great Subsistence Crisis in the Western World* (Baltimore, 1977); Christian Pfister, *Agrarkonjunktur und Witterungsverlauf im Westlichen Schweizer Mittelland 1755-1797* (Bern, 1975).

³⁸ One recent example is found in John Emrys Morgan’s doctoral thesis *Flooding in early modern England: cultures of coping in Gloucestershire and Lincolnshire* (PhD thesis, University of Warwick, 2015).

pressures of anthropogenic climate change on the western consciousness, historians still attribute overwhelming explanatory power to climate.

‘History is Man and everything else’: Methodology in the Age of the Anthropocene

As the most ubiquitous global historical issue since the post-war nuclear threat, climate change also transcends discipline. As politicians prevaricate over the ethics of a fossil fuel-based economy and scientists summon utopian solutions, the impending catastrophe represented by climate change also implicates historians. Writing in 2014, Mark Levene, a leading scholar of genocide, questioned the role of history in the age of the Anthropocene, interrogating ‘the hearts, guts, and “ethical fire”’ of the historian ‘to grasp the enormity of what is now required of them.’³⁹ But what is ‘required’ of history? Hindsight offers scarce ‘solutions’ to our contemporary ecological crises. However, historians have the power to elucidate our perception of climate change and the origins of our current turmoil. This section surveys the impact of climate change on new historical methodologies, the re-emergence of the *Longue Durée*, the invention of ‘Big History’, and the growing relevance of non-human history, before arriving at the specific methodology and source-base championed by this thesis.

Climate change collapses the distinction between human and non-human history; it proposes a borderless view of the past; and an extended timeline of human interference with ‘nature’. In the face of anthropogenic climate change, Penny Cornfield suggests that

³⁹ Mark Levene, ‘Climate Blues: or How Awareness of the Human End might re-instil Ethical Purpose to the Writing of History’, *Environmental Humanities*, 2 (2013), pp. 147-167, p. 149.

historians are now not only encouraged to ‘think long’ but also to ‘think globally’.⁴⁰ The transnational effects of climate as a historical subject are self-evident: places and peoples usually divided by geography, culture and socio-economics are united by a common ecological threat. According to Cornfield, this ‘one-worldism is not just appropriate but unavoidable.’⁴¹ Other historians have taken climate change as a chance to return the grand narrative to the forefront of historical thought. The scientific consensus on climate change is used to justify a revival of the *Longue Dureé*. With the power of retrospective analysis, paleoclimatology, and the new methods of ‘Big History’, advocates of this approach claim that historians can affect public debates and policy on climate change. To the chagrin of many micro-historians, David Armitage and Jo Guldi’s *History Manifesto* (2014) criticised the ‘short-termism’ of contemporary historical academia and advocated a return to longer chronologies, expansive geographies and the use of ‘big data’.⁴² By incorporating new methodologies, they argue the historian can remove themselves from the confines of the academy to ‘speak truth to power’.⁴³

In an age of state-endorsed climate denial, the thought that an expert intervention by historians (let alone climatologists) would sway political opinion is optimistic to say the least. The *Manifesto* is filled with vague posturing, which in the context of 2019 appears naive and idealistic. Though climate change certainly warrants a perspective beyond micro-history, a swift return to a *Longue Dureé* approach does not provide the methodological ingenuity to reconcile the effects of climate change on historiography. Not only does it undermine the success and influence of micro-history, it also bestows an excessive emphasis on the virtue of

⁴⁰ Penny J. Cornfield, ‘Climate Reds: Responding to Global Warming with Relative Optimism’ *Rescue!History* (2011) [online] Available at: <http://www.penelopejcorfield.co.uk/PDF%27s/CorfieldPdf21_Climate%20Reds-Responding-to-ClimateChange-with-RelativeOptimism.pdf> [Accessed 11 April, 2019]

⁴¹ *Ibid.*

⁴² David Armitage and Joe Guldi, *The History Manifesto* (Cambridge, 2014), esp. ch. 4, ‘Big Questions, Big Data’.

⁴³ *Ibid.*, i.

traditional metanarratives. Armitage and Guldi can be read as a rebuttable of postmodernism, especially the work of Jean François Lyotard, who's *The Postmodern condition: A Report on Knowledge* (1979) offered a memorable reappraisal of metanarrative. In it, Lyotard famously stated: 'simplifying to the extreme, I define postmodernism as incredulity towards metanarratives.'⁴⁴ Lyotard's work instilled academia with a persistent distrust in established universal narratives. Many historians have since treated traditional metanarratives (e.g. Marxist utopianism, Christian redemptionism, bourgeois progressivism) with outright disdain. The threat of metanarrative, Lyotard argued, was based on its simultaneous ability to explain and legitimate institutional authority. The absence of a galvanising, universal narrative has allowed the proliferation of separate micro narratives. Separate academic disciplines have confined themselves to the realms of speculation, or 'language-games' to use postmodern lingo. Interdisciplinary research techniques have proposed to bridge this disciplinary gap, though their efficacy in the face of climate change is critiqued over the course of this thesis.

Without a unifying historical perspective, 'The End of History' had been theorised multiple times, and many historians abandoned ideas of linear progress.⁴⁵ Armitage and Guldi reject this notion, claiming that the Anthropocene represents the collaborative interface between scientists, politicians and historians that recent history has lacked. But their technocratic concept of history, used as 'shape a viable future in an era of multiple global challenges', should evoke suspicion.⁴⁶ Climate change might represent a unitary perspective between academic disciplines, though it should not be theorised so simply as a 'common enemy'. If historical methods are to reconcile the practical and ethical consequences of climate change, it is imperative that climate is not reduced to the status of a homogenous

⁴⁴Jean-François Lyotard, *The Postmodern condition: A Report on Knowledge*, trans. G. Bennington and B. Massumi (Manchester, 1984), xxiii.

⁴⁵ Francis Fukuyama, 'The End of History?', *The National Interest*, 16 (1989), pp. 3-18.

⁴⁶ Armitage and Guldi, *The History Manifesto*, p. 112.

‘global challenge’.

The distinctiveness of our ecological crises warrants the creative reappraisal of humankind’s historical relationship with the natural world. For many historians, the arrival of the Anthropocene as a term of use offers the creative space to explore the effects of climate on the academy. The Nobel Prize-winning atmospheric chemist Paul Crutzen coined the term, claiming that human influence on the Earth’s atmosphere had been so significant, that we can no longer refer to ‘natural’ geological epochs.⁴⁷ His declaration made fifteen years ago has had a radical effect on our concept of human history. Dipesh Chakrabarty, in a 2009 article on ‘The Climate of History’, elaborates on the consequences of the ‘Anthropocene’ for history writing. He suggests the convergence between natural and human histories: ‘for it is no longer a question simply of man having an interactive relation with nature. This humans have always had ... Now it is being claimed that humans are a force of nature in the geological sense.’⁴⁸

The fundamental ontological principles proposed by Chakrabarty’s theses, and his advocacy of a ‘non-human’ history is suggestive of a Deep Ecological visualisation of the past. Conceived by Norwegian philosopher Arne Næss, Deep Ecology holds that non-human living beings represent a fundamental worth beyond their practical purpose.⁴⁹ By breaking down the ethical distinction between human and non-human life, Deep Ecology offers an alternate narrative of global history. This critique of anthropocentrism is perhaps the most crucial lesson to take from climate change. For no longer is it the effort of the historian to provide an ‘understanding of ourselves in time’ as Peter Laslett once said, but instead to better understand the vast processes of time (be they geological, biological, etc.) in relation to ourselves, not as a superior humanity, but as another species of life on earth.⁵⁰ To quote the

⁴⁷ P. J Crutzen and E. F Stoermer, ‘The “Anthropocene”’, *Global Change Newsletter*, 41 (2000), pp. 17-18.

⁴⁸ Dipesh Chakrabarty, ‘The Climate of History: Four Theses’, *Critical Enquiry*, 35 (2009), pp. 197-222, p. 209.

⁴⁹ Arne Næss, ‘The Shallow and the Deep, Long-Range Ecology Movement’, *Inquiry*, 16 (1973), pp. 95-100.

⁵⁰ Peter Laslett, *The World We Have Lost: Further Explored* (London, 1966).

‘father’ of environmental history, Fernand Braudel, this involves the recognition that ‘history is man and everything else. Everything is history: soil, climate, geological movements.’⁵¹

‘Big History’, the brainchild of scientist-cum-historian David Christian, represents a prime example of this approach.⁵² Christian’s proposed return to macrohistorical processes dwarfs all semblance of ‘traditional’ history; his work acts instead as an expanded encyclopaedia of cosmological, geological and biological processes. With ‘Big History’, natural and human histories are virtually indistinct from one another. Contextually, we can see Christian’s revision of *Annalisté* concepts as a response to the centrality of climate change in contemporary science and policymaking. Extending the *Longue Dureé* to intergalactic proportions, his work suggests it is impossible to observe the major effects of climate change without taking an ultra-long term perspective. ‘Big History’ is a direct response to the epistemological turn represented by the Anthropocene. However, this is not to mention that Christian’s theory of a universal history is not without its shortcomings.

To Lyotard and others, such theorising would have been nothing short of an anathema. Christian’s method, an undoubted result of the existential nature of scientific question asking of our modern age (including climate change) is beset with troublesome theoretical implications. Christian forecasts the trajectory of Big History himself in a 2010 article, in which he claims: ‘Over the next fifty years we will see a return of the ancient tradition of “universal history”; but this will be a new form of universal history that is global in its practice and scientific in its spirit and methods.’⁵³ The whole conceptualisation of Big History is dangerously teleological, essentially establishing the Ultimate Grand Narrative; a practical nebula of disciplines united by a universal faith in Science. Climate history should not and

⁵¹ Fernand Braudel op. cit. J. A. Padua, ‘The Theoretical Foundations of Environmental History’, *Estudos Avançados*, 24 (2010), pp. 81-101.

⁵² David Christian’s major texts include the World History Association Book prizewinner, *Maps of Time: An Introduction to Big History* (London, 2005) and *Big History: Between Nothing and Everything* (London, 2013).

⁵³ David Christian, ‘The Return of Universal History’, *History and Theory*, 49 (2010), pp. 6-27.

cannot submit to these same epistemological criteria if it is to vie with serious ethical responsibilities. Though Christian's framework for 'Big History' is a commendable achievement in its adherence to some of the historio-philosophical principles suggested in Chakrabarty's article, it also falls into the trap of climate reductionism that Hulme describes.

The same tendencies plague recent histories of the LIA. Most recently, in the first page of Geoffrey Parker's prologue to *Global Crisis: War, Climate Change and Catastrophe in the Seventeenth Century*, de Vries' stance is repudiated, as well as Emmanuel Le Roy Laudrie's equally contentious claim that: 'in the long term, the human consequences of climate seem to be slight, perhaps negligible, and certainly difficult to detect'.⁵⁴ According to Parker, the effect of climate on the stability of civilisation is axiomatic; extreme fluctuations in climate result in lessened or ruined harvests, lessened harvests lead to inflated grain prices, inflated grain prices materialise in hunger, rioting, and general unrest. This 'fatal synergy' between human and natural factors, Parker concludes, culminated in the several revolutions, rebellions and wars that characterised the so-called 'General Crisis' of the seventeenth century.

Though undeniably well-researched, Parker falls victim to the fundamentalist tendencies warned against by Meyer and Hulme. Climate, he explains, represented the 'placenta of the crisis.' Though it did not 'constitute the catastrophe itself, an examination of the placenta explains why catastrophe lasted for two generations, why it killed up to one-third of the human population'.⁵⁵ Parker avoids the charge of climatic determinism; quoting the late Andrew Appleby he assures the reader that 'the crucial variable' was not the weather, but 'the

⁵⁴ Parker, *Global Crisis*, xviii; Emmanuel Le Roy Ladurie, *Times of Feast, Times of Famine: A History of Climate Since the Year 1000* (London, 1971), p. 119.

⁵⁵ Parker, *Global Crisis*, p. 2.

ability to adapt to the weather'.⁵⁶ Nevertheless, the sensational title and content of Parker's monograph instantly conflates climate change with themes of 'war', 'crisis', and 'catastrophe'. This approach might be savvy marketing, though it also perpetuates an idea of climate which is irredeemably pessimistic. There is palpable alarmism to Parker's claim that the climate was responsible for the death of one-third of the Eurasian population, a statement which recalls historiography on the Black Death as well as contemporary debates regarding civil wars in Darfur and Syria.⁵⁷ In the case of the LIA, Parker habitually credits falling temperatures with negative moral, economic, and social consequences. A chaotic climate is, therefore, a cold one, prone to volatile shifts in the atmosphere and sustained cold periods. Such an approach not only panders to the fatalist interpretations of contemporary climate change (which ironically conflate a rising temperature with negative moral, economic and social characteristics), but also reduces the issue of climatic change to the status of an impending crisis solvable by environmental scientists, politicians and, as it would seem, historians. Without doubt, discourses around climate-induced catastrophe have a definite role in the story of England's Little Ice Age; nonetheless, this thesis will supplement this existing narrative by examining the various other ways in which climate informed the political, cultural, and religious lives of early modern Englanders.

If historians are to appropriate metanarrative and teleology, it should be in a more sophisticated and experimental capacity. For many working in the environmental humanities, climate change has caused a move toward an ontological approach based on a Deep Ecological philosophy. The success of environmental history has been to displace the dominant anthropocentrism of traditional history writing. Following the tenets of 'deep ecology', the environmental humanities have given life to a world neglected by centuries of

⁵⁶ Andrew Appleby, 'Epidemics and Famine in the Little Ice Age', *Journal of Interdisciplinary History*, 10 (1980), pp. 643-663, p. 663.

⁵⁷ Parker, *Global Crisis*, p. 3.

rampant anthropocentrism. Their contribution was born from an open desire to revise this bias, to affect political action through historical revisionism.⁵⁸ In an article addressing the role of grand narrative in histories of the environment, Arran Gare suggests we make the distinction between a monologic and polyphonic approach to metanarrative: whereas the former ‘presupposes the unquestionable validity of one perspective’, the polyphonic variation ‘gives a place to rival perspectives’.⁵⁹ Borrowed from Mikhail Bakhtin’s theory of narrative, a ‘polyphonic narrative’ in literary terms refers to a story told from multiple perspectives, thus lacking a singular claim to truth. Typically, the phrase is applied to the narratology of modernist literature; with the work of Fyodor Dostoyevsky, Virginia Woolf and James Joyce often associated with the technique.

Gare suggests that a polyphonic narrative of ecology, based on the inclusion of non-human and non-sentient perspectives, offers the same potential as several historic grand-narratives (e.g. Christianity in Europe, the Enlightenment in France and the United States, Marxism in Russia and China).⁶⁰ He states: ‘only through these grand-narratives is it possible to understand how scattered, small groups of people were able eventually to engender major cultural, social, and political movements that transformed civilisations.’⁶¹ Though ‘Big History’ does involve an array of disciplinary perspectives, its ultimate directive is unashamedly monological, establishing a ‘scientific creation story, from the big bang to the

⁵⁸ This early school of environmental history is commonly associated with the work of Rachel Carson and her epoch defining *Silent Spring* (Cambridge, Mass., 1962). Other proponents of this style are referenced throughout this thesis, including William Cronon, *Changes in the Land: Indians, Colonists and the Ecology of New England* (New York, 1983); Alfred Crosby, *Ecological Imperialism: The Biological Expansion of Europe, 900-1900* (Cambridge, 1986); and Richard Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860* (Cambridge, 1995).

⁵⁹ Arran Gare, ‘The Postmodernism of Deep Ecology, the Deep Ecology of Postmodernism, and Grand Narratives’, in E. Katz, A. Light, and D. Rothenberg (ed.) *Beneath the Surface: Critical Essays in the Philosophy of Deep Ecology* (London, 2000), pp. 195-254, p. 208.

⁶⁰ Gare, ‘The Postmodernism of Deep Ecology’, p. 209.

⁶¹ *Ibid.*

present.’⁶² Surely, if climate change has proven anything, it is that we cannot rely on this notion of absolute progress.

The comprehension of Gare’s ‘polyphonic narrative’ depends on the de-legitimation of this existing narrative. Rather than encompassing a grand retelling of a ‘scientific creation story’ or endorsing the singular ambition of the political classes, the realisation of Gare’s philosophy depends on the inclusion of a multiplicity of theoretical perspectives. This involves the development of a ‘new metalanguage that would require reconciliation between human and natural sciences.’⁶³ As Gare contends: ‘there is no reason why the agents of narratives cannot be nonhuman or even inanimate; there can be natural histories as well as histories of human actors, and all living beings as actors can be represented as having their own perspectives on the world. Conceiving living beings in such terms inevitably changes our attitude towards them.’⁶⁴ This should result in a heterogeneous vision of the past, coloured by a series of micro-narrative that appreciates non-human or insentient agents beyond their practical value.

There is a third way, however, of negotiating the impact of climate change on history without abandoning the human subject or perpetuating deterministic thought. Though the perspective of this thesis is anthropocentric, the narrative approach taken is broadly polyphonic insofar that competing, often contradictory historiographies sit beside one and other throughout the work. Using the discursive themes I have outlined, emphasis will be on a plurality of independent voices and resists the temptation to characterise the Little Ice Age as an epochal shift in a lineal history of the Anthropocene. In the context of climate change, and the new metanarrative it has spawned, one challenge for this thesis has been to look beyond

⁶² Cynthia Stokes Brown, *Big History: From the Big Bang to the Present* (New York, 2012), x.

⁶³ Ewa Dowanska, ‘Beyond Anthropocentrism in Historical Studies’, *Historein*, 10 (2010), pp. 118-130, p. 126.

⁶⁴ Gare, ‘The Postmodernism of Deep Ecology’, p. 210. As an example. Gare cites ‘a fictional narrative of human history from the perspective of a rat’ in Günter Grass’ *The Rat*, trans. Ralph Manheim (London, 1988).

the narrow chronology of our contemporary crisis to illuminate a pre-modern understanding of our weathers. Contemporary measurements of wind, precipitation, humidity, temperature etc., can only reveal so much about our attitudes toward climate. ‘Documentary Evidence’ too, i.e. daily written observations on the weather, can only provide a one dimensional perspective of weather patterns. To understand the true meaning of climate or ‘total experience of weather’, it is necessary to look at alternative records of climate – to scrutinise sources which have been ignored by the canon of environmental history. At the risk of forwarding an anthropocentric idea of climate, this thesis relies on the essential belief that climates are imaginative constructions. As a result, it will serve as a channel for the diverse voices and conversations that characterised early modern attitudes around climate.

‘A History of Air as a whole, or in the Configuration of the World’: Sources and Perspectives

Climate permeates culture. It shapes our landscapes, architecture, and homes, schedules our daily lives and movements, and informs our mental and physical health. For these reasons, it is an unwieldy and inscrutable historical subject which cannot be corralled by one humble doctoral thesis. In response to the methodological quandary the subject represents, many of the primary and secondary sources which have inspired this thesis have come from a plethora of disparate perspectives on climate. To discover the early-modern ‘climate’, I traversed through a cavernous and interweaving warren of ideas and sources ranging from medical regimens, architectural blueprints, legal records, inventories, petitions, herbals, sermons, state-papers, travel diaries, weather diaries, and personal diaries. Originally, the intended project was to triangulate parish records, weather documentation, and contemporary climatology. This approach was designed to provide an accurate rendering of local attempts to

mitigate the social and economic effects of the extreme weather associated with The Little Ice Age. As it turned out, the intended project fell at its first epistemological hurdle: how, in a period before standardised weather measurements and when providence guided nature, was climate *understood*? What should have been a five-hundred-word definition of ‘climate’ became an 80,000-word thesis.

By utilising methods from the digital humanities, corpus linguistics, as well as traditional archives, I was able to choose from a sourcebase far broader than I had anticipated. With an index of selected words and phrases which were recurrent throughout secondary sources and early dictionaries from the early modern period, I was able to systematically analyse the manifold contexts in which these entrees appeared. Using software in conjunction with Early English Books Online, I performed elaborate proximity searches which indicated how closely two or more chosen words would appear. For example, I could use this method to determine how many sources mentioned the phrases ‘cold’, ‘english’, ‘climate’, within the space of ten words.⁶⁵ These searches were sometimes ill fated, and wrought inconsequential or random outputs, other times they uncovered sources in which the significance of climate, weather, and the environment had been rarely studied. Though this method only served as an initial phase in the identification of key texts, it informed the overall approach of the thesis, and the five themes which comprise the work. Simultaneously, this macro-perspective on source aggregation has prompted questions about spotlighting voices that are traditionally ‘marginalised in environmental historiography, and the extent to which a source can be truly ‘popular’ in an early modern sense. Chapter one grapples with these questions in greater detail, and chapter three considers the often-uncredited role of women’s labour in the configuration of indoor climates.

⁶⁵ These searches also account for contemporary spellings.

Naturally, there were self-imposed restrictions placed on the work's breadth from the beginning: firstly, the study was to be limited to England, including burgeoning colonial territories; secondly, the work was to be confined to the late-sixteenth and seventeenth centuries. To account for this first decision, England was originally chosen as a case study based on the availability of primary sources, the lack of existing secondary material, and the uniqueness of England's ideological, climatological and geographical situation in the seventeenth century. This point will be explored in greater detail throughout the thesis, specifically chapter four. Specifically, it was clear from primary and secondary accounts of the period that the English were not only maligned by continental neighbours – the Portuguese, Spanish, French, Italians, and Germans – for their weathers, but also by themselves.⁶⁶ This contributed to a self-consciousness throughout English medical, colonial and domestic sources which stressed the inherent instability of their native airs and, by proxy, their own bodies. This, in turn, impacted the configuration of changing climates and their ability to engender change in the English body. In the context of early colonialism, I argue that this accounted for a uniquely Anglocentric appraisal of foreign climates which were requiring of control and modification.

The second decision, based on chronology, was made with recourse to the traditional indicators of the early Little Ice Age: the Grindewald Fluctuation and the Maunder Minimum. This timeframe was chosen not so-much to confirm the existence of these temporal markers, but critique traditionally held assumptions about the effect of this period on human affairs. Simultaneously, this chronology was also chosen to relate to the traditional periodisation of the early modern English history (rather than a *longue duree* perspective) and to explore how the social and cultural changes of this period can be read in attitudes toward the climate – an

⁶⁶ Sara Migletti and John Morgan (eds.) *Governing the Environment in the Early Modern World* (London, 2017)

ambition which is neatly encapsulated in the five thematic priorities of the thesis.

From the beginning of the period under study, English scholars have vied with the question of how to write histories of climate. In 1620, Francis Bacon provided a list of subjects that one day might inspire historical writing. His catalogue of 130 titles includes natural and human history, with the forty-fifth suggestion dedicated to ‘A History of the Air as a whole, or in the Configuration of the World.’⁶⁷ A fraction of these works were attempted by Bacon himself, who set his posthumous agenda for the Royal Society. The first to take up the late philosopher’s challenge was, of course, Robert Boyle’s *General History of the Air* (1692), published after his death by his friend John Locke. These early attempts bear little resemblance to modern histories of climate (or ‘air’). That said, many contemporary climate historians have followed the tenets of empiricism first laid out by Francis Bacon in the *Advancement of Learning* (1605). Amongst those modern historians who have continued this tradition is Christian Pfister, the Swiss pioneer of historical climatology. Drawing on the insights of the Ladvocat and Lamb, Pfister experimented with climatological proxy data modelling in the late 1980s to explain the long-term economic effects of climate fluctuations during the LIA.⁶⁸

The influence of Pfister’s work stretched beyond early modern scholarship, though studies of the LIA have since been particularly indebted to his approach. Amongst Pfister’s followers and frequent collaborators are Franz Mauelshagen and Sam White, who together recently collaborated to produce the *Palgrave Handbook of Climate History* (2018).⁶⁹ Like Pfister, both Mauelshagen and White have utilised a mixed-method approach to climate

⁶⁷ Francis Bacon, ‘Parasceve ad historiam naturalem’, in J. Spedding, R. L. Ellis and D. D. Heath (eds.), *The Works of Francis Bacon*, 7 vols. (London, 1859), vol. 3, p. 267.

⁶⁸ Christian Pfister, ‘Fluctuations climatiques et prix céréalières en Europe du XVIe au XXe siècle’, *AESC*, 43 (1988), pp. 25-53.

⁶⁹ Sam White, Franz Mauelshagen, and Sam White (eds.), *Palgrave Handbook of Climate History* (Basingstoke, 2018).

history, straddling historical climatology and social history. White's *Climate of Rebellion in the Early Modern Ottoman Empire* (2011) and more recently *A Cold Welcome: The Little Ice Age and Europe's Encounter with North America* (2017) have articulated a need for the integration of climate science and the environmental humanities. In the latter work, he explicitly addresses this requirement. 'The written record provides only half of the truth,' White states, 'the other half literally buried in human and animal bones, sediment, and pollen.'⁷⁰ The work makes ground-breaking use of original data from zooarcheology, palynology, and bioarchaeology. White's work is the most recent iteration of a method which began with Pfister but is by no means the only approach taken by historians of climate.

As with many debates in the philosophy of science more generally, the ongoing clash between proponents of constructivism and objectivism has defined mainstream histories of climate. White, Mauelshagen, and Pfister are keen to stress that these approaches are not mutually exclusive – as White makes clear in the above quote. But the written record accounts for so much more than 'half of the truth', especially when historians have only analysed a fraction of written documents available. That is not to discredit the above works or the many other proponents of this methodology, but attempt to work from a source-base which have been previously marginalised by traditional environmental history. The 'written record', in the case of this thesis, not only encompasses contemporary weather observations but the diffuse ways in which climate integrated itself in early modern English culture. Continuing a tradition within environmental history that began with Clarence Glacken's classic *Traces on the Rhodian Shore* (1967) and continued in the sociological work of Mike Hulme, this method searches for the climate in cultural history.⁷¹ Glacken's work was one of unprecedented

⁷⁰ Sam White, *A Cold Welcome: The Little Ice Age and Europe's Encounter with North America* (London, 2017), p. 5.

⁷¹ Hulme, *Why We Disagree About Climate Change* (Cambridge, 2009); idem, *Weathered: Cultures of Climate* (London, 2017).

insight and originality and, unlike many contemporaneous histories of climate, explored the various entanglements between climate and culture throughout western history. His work is best known for defining three dominant themes through which we can understand the discursive evolution of the 'environment'. The first of his theses was the idea of the environment as manipulated by God; the second was the idea of environmental influence on people; the third was the idea of human impact on the environment.⁷² The next five chapters support the fundamentals of Glacken's theses. What is distinctive about the outcomes of this work, however, is based on the supposed chronology of this process. Glacken imposes teleology on the period which does not readily apply to the early modern period: a time characterised by competing ideas of environmental, human, and divine agency.

Several historians from various disciplinary backgrounds have previously sought to negotiate human, non-human and divine agency in reference to climate history. In the secondary material consulted throughout this thesis, an attempt has therefore been made to reflect the broad understanding of these competing schools of thought. In the first two chapters new materialist approaches are referenced extensively, notably Gail Kern Paster's *Humoring the Body* (2004) and Garrett A Sullivan's and Mary Floyd Wilson's *Environment and Embodiment in Early Modern England* (2007).⁷³ Both of these works emphasised a pre-Cartesian understanding of the humoral body: a form which was effectively the sum of its material environment. In the third chapter, domestic and architectural histories are referenced extensively. Dean Hawkes' *Architecture and Climate* (2012) and John E. Crowley's *The Invention of Comfort* (2001) acted as primary inspirations for the direction of this chapter, which explores a facet of climate history and air conditioning which has gone mostly

⁷² Clarence Glacken, *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century* (Berkeley, 1964).

⁷³ Gail Kern Paster, *Humoring the Body: Emotions and the Shakespearean Stage* (Chicago, 2004); Mary Floyd-Wilson and Garrett A. Sullivan, Jr. (eds.), *Environment and Embodiment in early modern England* (Basingstoke, 2007).

unnoticed in existing historiography.⁷⁴ The fourth chapter elaborates on the arguments made in Mary Floyd Wilson's *English Ethnicity in Early Modern Drama* (2003) and Joyce E Chaplin's treatment of early English racism in *Subject Matter: Technology, the Body, and Science* (2001).⁷⁵ Both articulate the lengths at which English attempts to confound their climatic destiny, through discursive and practical means. The final section considers the history of climate in a post-Reformation context. Religious historians, notably Alexandra Walsham and Keith Thomas, posit an image of the early modern English environment that was foremost dictated by the Lord's providence. Walsham's *Providence in Early Modern England* (1999) and *The Reformation of the Landscape* (2012), as well as Thomas' *Man and the Natural World* (1983) and *Religion and the Decline of Magic* (1971), have had a lasting legacy on how we view the post-Reformation understanding of climate.⁷⁶ Their conclusions continue to resonate through reformation historiography, including this work, though new evidence considered in this thesis casts light on the adaptability of providence as a template for understanding climatic change in early modern England.

Along with seminal treatments of the early modern environment listed above, a recent flurry of new scholarship has been published around the Little Ice Age and the cultural history of climate since the research for this thesis began. Among them are John Morgan and Sara Migletti's (ed.) *Governing the Environment in the Early Modern World* (2016), Anya Zilberstein's *A Temperate Empire: Making Climate in Early America* (2016), William Cavert's *The Smoke of London* (2016), Dagomar Dagroot's *The Frigid Golden Age: Climate Change, the Little Ice Age and the Dutch Republic* (2018) and Samuel White's

⁷⁴ Dean Hawkes, *Architecture and Climate: An Environmental History of British Architecture from 1600-2000* (Abingdon, 2012).

⁷⁵ Mary Floyd-Wilson, *English Ethnicity and Race in early modern Drama* (Cambridge, 2003); Joyce Chaplin, *Subject Matter: Technology, the Body, and Science on the Anglo-American Frontier, 1500 – 1676* (London, 2001).

⁷⁶ Alexandra Walsham, *The Reformation of the Landscape: Religion, Identity and Memory in Early Modern England* (Oxford, 2012); idem., *Providence in Early Modern England* (Oxford, 1999); Keith Thomas, *Religion and the Decline of Magic* (Oxford, 1971); idem, *Man and the Natural World* (Oxford, 1983).

aforementioned *A Cold Welcome* (2017).⁷⁷ Together with this thesis, these recent interventions can be said to represent a new vanguard in the pre-modern understanding of the idea of climate in theory and practice. Morgan and Migletti's edited collection, assembled from a conference at the University of Warwick in 2015, examined how climate became the subject of state governance and scientific debate in early modern Europe. Along with this thesis, it argued that cultural interpretations of climate had a tangible impact on political decision making. Featured in this work was William Cavert whose recent monograph, *The Smoke of London*, urged a revision of English histories of pollution. Situating his study around the turn of the seventeenth century, it argued that the early modern period has been underrepresented in environmental historiography. His intervention rendered a new understanding of coal and its early uses and abuses. Anya Zilberstein, who was also featured in Morgan and Migletti's collection, analysed nascent ideas of human-induced climate change in the context of the European colonisation of the New World. Finally, Dagomar Degroot's work on the Dutch Republic's experience of the LIA illuminated many misconceptions about the effects of Global Cooling on European society. Far from comprising the 'fatal synergy' discussed by Parker, Degroot argued that the Dutch Republic represents a notable outlier during the climatic tumult of the seventeenth century. In spite of the conditions of LIA, Degroot argued that the Republic thrived in its 'frigid golden age.' During the writing of this thesis, I imagined this thesis standing alongside these works: though each work is separated by geography, they collectively portray a history of climate which is reflexive, relative and, above all, cultural.

Primary sources were also chosen to reflect a broad understanding of my primary research questions. Though distinguishing between elite and popular culture in the early

⁷⁷ Sara Migletti and John Morgan (eds.) *Governing the Environment in the Early Modern World* (London, 2017); Anya Zilberstein, *A Temperate Empire: Making Climate in Early America* (Oxford, 2016); Dagomar Dagroot, *The Frigid Golden Age: Climate Change, the Little Ice Age and the Dutch Republic* (Cambridge, 2018).

modern period is fraught with many unanswerable demographic questions, the opening chapter attempts to penetrate this distinction by placing popular medicine at the heart of its inquiry, particularly the widely reproduced health regimen. While historical debates continue to question the efficacy of the regimen in reaching a wide demographic, we can accurately estimate that the vernacular style of these mainstream works was representative of medical practices and medico-environmental thinking. Estimated circulation figures illustrate a consistent demand for the format until the end of the period under investigation. The fundamental ideas that characterise early climatology are clearly expressed in the early-modern regimen: through God's watchful tutelage, each locality and its population were imbued with a particular constitution which defined their health and character. Being mindful of certain situational constraints, one might lead a healthy and happy life. Though based on common medical practice, these treatises pandered to their buying public. The same was true of the various colonial, domestic and religious literature that run throughout this thesis.

Based on their shared ancient source material, it might be assumed that these beliefs were widely held throughout society. That said, one must acknowledge that many of these sources would not have gone beyond the attention of the elite, urban-dwelling (specifically London-based) English male. Though chapter three describes the neglected influence of women's labour on domestic environments, many of these sources used would have represented the anxieties represented by this elite social stratum. We might interpret this as a restriction; however, the specificity of this readership can elucidate how many troublesome ideas and myths about climate emerged and was sustained. These narratives were produced in a crucial time in the history of meteorology: a period which straddled qualitative and quantitative definitions of climate, when providence was facing new challenges from the public, and new environments abroad destabilised an image of English masculinity.

Gatekeepers and institutions have always mediated our understanding of climatic change, whether represented by the Church of England or the Intergovernmental Panel on Climate Change (IPCC). In its treatment of source material, this thesis has revealed a history of climate characterised by institutional bias and power imbalance. It will therefore elucidate the destructive patterns of ecological thought that continue to define attitudes toward climate and climate change.

The context of ecological collapse and catastrophe frames our present historical moment. But ‘climate’ is not a malevolent, disembodied entity which occasionally wreaks havoc in human affairs. Historians treat the LIA as another ‘turning point’: the beginning of Gaia’s revenge. This thesis will explore the forgotten history of climate in this period: an early history of the many ideas and attitudes that shape present-day conversations. Instead of succumbing to the proselytising tendencies of the environmental humanities, *Changing Climate in Early Modern England* will distinguish the competing dialogues which informed England’s climatic culture. Early modern contemporaries were not the idle victims of ‘catastrophic’ environs, but in constant exchange with the challenges and opportunities they represented – as experiential phenomena rather than a continuum of statistical data.

CHAPTER ONE: ANATOMISING CLIMATE

The instinct to attribute one's physical and mental wellbeing to climate extends to the present day. In spite of the advancements made in modern medicine, humoral aphorisms fill the lexicon of common illness: we might 'catch cold' during winter, pine for a 'change of air' in a stifling summer, all the while complaining to be 'under the weather'.¹ We notionally accept the thermal properties of certain foods, attesting to the medicinal virtues of hot soup or whiskey and scorning the perversity of ice cream on a midwinter's day. Though we no longer attribute national characteristics to weather, our emotional investment in climate continues to serve as an illustrative basis for our various temperaments: we are hot-tempered, frosty, dull, cold-blooded, choleric, wet, etc. In an attempt to escape the city, urban-dwellers long for frequent retreats to higher altitudes, sultry climes abroad, or the salubrious local countryside. The early modern association between autumn and melancholy has since been supplanted by Seasonal Affective Disorder (or 'SAD') though the same recurrent anxieties colour our experience of climate. Seasonal bloodletting has ceased to exist (at least in mainstream western medical culture), and malaria is no longer attributed to 'bad-air', though our acute sensitivity to climatic change informs everything from daily habits and expressions, to legislative change. While empirical methods of weather prediction have superseded humoralism, the world-view of the early-moderns, like our own, was one similarly based on climatic vigilance. As with our ancestors, climate in the contemporary world is not only thought to predispose one to disease but also represents a proximate cause of - and antidote to

¹ Contrary to popular belief, you cannot 'catch cold' by exposure to cold air (nor is this process hastened by the wetness of one's hair). The association between winter weather and the common cold is explained by the tendency for bodies to group indoors during adverse weather conditions, naturally encouraging cross-contamination. Thomas Tryon, who is cited frequently during this chapter, makes reference to this centuries old misconception in his health regimen *The Way to Health* (London, 1691), p. 45. He admonished those who believed that '*they got Cold by leaving off a Coat, or by Accidental Sweating, or some other act of carelessness.*'

- many ailments.²

Given our present climate crisis, the serious examination of early climate theory might at first appear antiquated and irrelevant. This is perhaps to be expected. To many historians, as well as practitioners and beneficiaries of modern medicine, the above expressions seem little but the archaic remnants of a bygone age, or, at best, a convenient descriptor of one's wellbeing.³ For English climatologists and climate historians, the same can be said. Many have considered such enquiry with hostility, disregarding the relativism of cultural history in favour of narratives of civilizational unrest. In Lamb's landmark monograph, *Climate, History & the Modern World* (1982), he remarks that: 'by coincidence, many writers at the time of this Little Ice Age and some of the early scientists then living were much interested in what has become known as the "climate theory" of the "humors" and character tendencies of the various peoples of the world.' Lamb scoffs at the example of the English writer who 'justified the immorality of the Restoration theatre as needed to disperse the spleen and gloominess of the mind to which "the British climate, more than any other" made men liable!'⁴

Environmental historians have consigned humoral theory to a cabinet of historical curiosities; a 'nostalgic space of quaint, mistaken beliefs ... replaced by more efficacious, if less colourful truths' to quote Gail Kern Paster.⁵ The gradual decline and fall of humoralism as a template for climate theory was a long time coming and began after the foundation of the Royal Society in 1660. With the rise of the Baconian Method in the early century, a new idea of climate was forged around a selection of early weather instruments. The invention of the thermometer, in particular, encapsulated the developing rift between a quantitative and

² Alison Bashford and Sarah W. Tracy, 'Modern Airs, Waters, and Places', *Bulletin of the History of Medicine*, 86 (2012), pp. 495-514, p. 514.

³ Gail Kern Paster, *The Body Embarrassed: Drama and the Disciplines of Shame in Early Modern England* (New York, 1993), p. 6.

⁴ Hubert Lamb, *Climate, History & the Modern World*, p. 9.

⁵ Paster, *The Body Embarrassed*, p. 6.

qualitative theory of climate. As the first section of this chapter will demonstrate, the effects of the ‘Scientific Revolution’ on the idea of climate were not as immediate as one might expect. Humoral conceptions of environmental influence retained their power until the mid-seventeenth century and beyond. The enduring popularity of this medical template, in spite of new advancements in weather technology, was demonstrative of a subjective experience of climate decorated with aphorisms and untruths.

Though often ignored by climate historians, the ‘quaint, mistaken beliefs’ described by Paster can help elucidate the early modern experience of climatic change. What’s more, to undermine the intellectual framework of humoralism is also to stifle an avenue of historical enquiry that reveals eerily prescient implications for our current age of human induced climate change. While the causal machineries driving climatological studies have inverted since the early modern period - humans are now understood to affect their environment, whereas for our ancestors the opposite was manifest in their daily observations of ‘nature’ - our relationship with the natural environment remains defined by the same biophysical reciprocity.⁶ In our post-Cartesian understanding of the human brain, we recognise the cognitive and genetic impact of environmental stimuli.⁷ Contemporary biomedical research is increasingly devoted to exploring the reflexivity of the human body in relation to a change in environment; whether in the field of epigenetics (i.e. the adaptive capabilities of gene expressions in relation to changing environmental conditions) or neuroplasticity (i.e. the neural compensations made in response to change in environmental situation). In 2010’s *Bodily Natures: Science, Environment, and the Material Self*, Stacey Alaimo applies new

⁶ Bashford and Tracy, ‘Modern Airs, Waters, and Places’, p. 495.

⁷ In this way, Hippocrates cannot only be regarded as the hallowed patriarch of modern medicine, but ‘the forefather of neurology’. T. Breitenfeld, M. J. Jurasic, and D. Breitenfeld, ‘Hippocrates: the forefather of neurology’, *Neurological Sciences*, 35 (2014), pp. 1349-1352.

understandings of cognition to coin the idea of ‘transcorporealism’.⁸ By rejecting the Cartesian distinction between body and environment, Alaimo orients her analysis based on a fundamentally porous human subject. The study of transcorporeality offers a historical perspective which proposes to reconcile concern for non-human histories and a focus on the cultural impact of climate. Humoral theory, though primitive in its applications, was based on many of the same underlying assumptions about human environments that characterise cutting edge medical research. The objective of this opening chapter is thus to re-examine this forgotten interface between climate, medicine and culture in early modern England.

This chapter also offers an intervention in the historical application and understanding of climate analysis and measurement in a pre-modern, pre-instrumental world. Where traditional histories of the English climate have been oriented on the statistical analysis and corroboration of ‘proxy data’, this thesis will offer an original perspective on early modern climatic variance through the lens of medical history. In spite of the clear equivalences between humoral and climatic thought in the period, few historians have interrogated the overlap between humoralism, seasonality, and climate change. Other than Clarence Glacken’s work, which records the spiralling popularity of early modern climatology, the only significant English example of such scholarship is represented by Mary Floyd-Wilson’s 2003 monograph, *English Ethnicity and Race in Early Modern Drama*.⁹ As suggested by its title, this latter work is primarily a literary account of English race in the period concerned. It is also significant for coining ‘geohumoralism’: a word to describe the process whereby ‘variations in topography and climate produced variations in national characteristics.’¹⁰ In a

⁸ Stacey Alaimo, *Bodily Natures: Science, Environment, and the Material Self* (Indianapolis, 2010).

⁹ Glacken, *Traces on the Rhodian Shore*, p. 430; Mary Floyd-Wilson, *English Ethnicity and Race in early modern Drama* (Cambridge, 2003).

¹⁰ Mary Floyd-Wilson, *English Ethnicity and Race in early modern Drama*, p. 133.

global context, this word will come to explain early racial theories discussed in ch.4. During this chapter, we will consider the provincial application of this theory. For example, how did early modern Englishers and their physicians come to understand the external, physical features of weather (weather patterns, seasonal change, natural disasters and freak weather events) in relation to internal, bodily, and mental ‘climates’? And what was specific about the therapeutic relationship between the English and their turbulent, oceanic climate?

By rebuffing the climatological concept of *optimum/pessimum* environments, this chapter will depict ‘climate’ using the humoral language of excess and balance; evincing the manifold ways in which temperature, pollution, humidity, wind, and precipitation could directly impact one’s humoral constitution. Ultimately, this will postulate a representation of the early modern English climate according to the perceived pathological behaviour of its inhabitants: a capricious mentality dependent on the regulation of one’s ‘inner climate’. In response to recent and vital research by scholars such as Mary Floyd Wilson, Gail Kern Paster, and Garrett Sullivan Jr., this will consider man as the embodiment of climate; not only uncovering the story of how early modern Englishers inhabited their environment, but how their environment inhabited them.¹¹ Rather than attributing the physical attributes of certain weather events with absolute importance, this approach will interrogate the supposed contingency between body and climate with reference to a variety of popular medical, meteorological, and early ‘scientific’ sources. Beyond ‘good’ and ‘bad’ weather, we begin by examining the cultural practices, customs, and behaviours which shaped the experience of climatic variability during the ‘Little Ice Age’. Doing so, we can understand the process of climatic change on a hitherto neglected scale; discovering the supposed effects on mental and physical health; travel habits, exercise and diet; the coordination of architecture, domestic

¹¹ Paster, *Humoring the Body: Emotions and the Shakespearean Stage* (Chicago, 2004); Mary Floyd-Wilson and Garrett A. Sullivan, Jr. (eds.), *Environment and Embodiment in early modern England* (Basingstoke, 2007).

spaces and living; local, regional, and national identity; as well as the broader pathology, compulsions, and anxieties that coloured the experience of climate.

'A Method for Making a History of the Weather': Temperature and Early Thermometry

At the heart of this chapter is the question of how to truthfully represent historical climates prior to post-1700 weather documentation. In an attempt to reconfigure this debate, the opening chapter of this thesis proposes an original method of analysing the holistic impact of climatic change on early modern English society as experienced by its contemporaries. On account of its brazenly qualitative approach, this marks a departure from existing attempts to understand the early modern English climate according to statistical datasets.¹² Lacking reliable statistics before the beginning of Gordon Manley's Central English Temperature (CET) dataset in 1659, historians have depended on proxy data to retroactively construct climate datasets.¹³ Using dendrochronology, ice core data, and grape and grain harvest figures, historical climatologists are therefore able to provide an impression of the LIA's ebbs and flows. As dependable indicators of climatic conditions, these approaches are far from representing the gold standard of climatological data. Though dendrochronology (tree ring data) may accurately mirror annual weather conditions, this is restricted to areas where trees

¹² Traditionally, studies of English climate history have been oriented on statistical analysis of pre-instrumental 'proxy' data. Examples mentioned include Hubert Lamb's seminal *Climate, History & the Modern World* (London, 1982), Post's *The Last Great Subsistence Crisis in the Western World* (Baltimore, 1977), and Appleby's 'Epidemics and Famine in the Little Ice Age', *Journal of Interdisciplinary History*, 10 (1980), pp. 643-663. Toward the continent, a comparable methodology is followed. See Christian Pfister, 'Climatic Extremes, Recurrent Crises and Witch Hunts: Strategies in Coping with Exogenous Shocks in Late Sixteenth Century and Early Seventeenth Centuries', *The Medieval History Journal*, 10 (2006), pp. 33-73, 'Variations in the Spring-Summer Climate of Central Europe from the High Middle Ages to 1850' in H. Wanner and U. Siegenthaler (eds.), 'Long and Short Term Variability of Climate: Lecture Notes', *Earth Sciences*, 16 (1988), pp. 57-82.

¹³ Gordon Manley, 'Central England temperatures: monthly means 1659 to 1973', *Quarterly Journal of the Royal Meteorological Society*, 100 (1974), pp. 389-405.

occupy the periphery of a geographical space and experience climatic stress from coldness and/or aridity.¹⁴ Others have cast doubt on the combined accuracy of tree-ring data, lake sediment, and ice cores prior to 1850 in the Northern Hemisphere.¹⁵

Even where statistics are available, the complexity of this data resists accurate representation in basic modelling. The majority of historical climatological data for the LIA, Morgan Kelly and Cormac Ó Gráda argue, is subject to a process of ‘smoothing’ irregular or anomalous data according to twenty-five year moving averages, resulting in the so-called ‘Slutsky effect’.¹⁶ Even Manley’s series, which is taken to be the most accurate dataset relating to pre-modern English temperatures, is subject to some ‘heroic data splicing’ before the year 1700 according to Kelly and Ó Gráda. Harvest figures, whether grape or grain, were admittedly more sensitive to climatic changes in the Northern hemisphere, though these too came with their constrictions. Though readily obtainable, grain harvest figures were subject to a plethora of variables independent of climate: namely, political or economic trends. Wheat could also be stored for up to a year after its harvest date, limiting the impact of a single

¹⁴ Morgan Kelly and Cormac Ó Gráda , ‘Change Points and Temporal Dependence in Annual Weather Reconstructions: Did Europe Experience a Little Ice Age?’, *The Annals of Applied Statistics*, 8 (2014), pp. 1372-1394, p. 1375. See also, Kelly and Ó Gráda , ‘The Waning of the Little Ice Age: Climate Change in Early Modern Europe’, *Journal of Interdisciplinary History*, 44 (2014), pp. 301-325. Kelly and Ó Gráda ’s article, ignited a fiery debate within the field of historical climate studies. The article elicited responses from Samuel White, ‘The Real Little Ice Age’, *Journal of Interdisciplinary History*, 44 (2014), pp. 327-352, and Ulf Büntgen and Lena Hellmann, ‘The Little Ice Age in Scientific Perspective: Cold Spells and Caveats’, *Journal of Interdisciplinary History*, 44 (2014), pp. 353 - 368. These responses spurred a final response from Kelly and Ó Gráda , ‘Debating the Little Ice Age’, *Journal of Interdisciplinary History*, 45 (2014), pp. 57-68.

¹⁵ Blakeley McShane and Abraham Wyner, ‘A statistical analysis of multiple temperature proxies: Are reconstructions of surface temperatures over the last 1000 years reliable?’, *Annals of Applied Statistics*, 5 (2011), pp. 5-44. For an extensive analysis of contemporary methods of climatological research, see Rudolf Bràzdil, Christian Pfister, and Jürg Luterbacher, ‘Historical climatology in Europe—The state of the art’, *Climate Change*, 70 (2005), pp. 363-460.

¹⁶ The ‘Slutsky effect’, in the colloquial sense of the phrase, refers to the process of applying a statistical filter to a white noise series results in the appearance of irregular oscillation. Kelly and Ó Gráda provide a useful analogy to describe the effect: ‘just as tossing a fair coin leads to long sequences with an excess of heads or tails, so random sequences in general will occasionally throw up some unusually high or low values in close succession that will distort a smoothing filter’, Kelly and Ó Gráda , ‘Change Points and Temporal Dependence in Annual Weather Reconstructions: Did Europe Experience a Little Ice Age?’, p. 1388.

disastrous harvest.¹⁷ Viniculture documentation, though remarkably sensitive to sharp seasonal change, was virtually redundant in England by the seventeenth century with wine production dwindling after the climatic downturn of the mid-sixteenth century and the dissolution of the Monasteries under Henry VIII.

Documentary evidence from the period is also subject to a wide margin of error based on the lack of dependable barometric and thermometric instruments before the middle of the seventeenth century. Though the many exhaustive weather diaries and almanacs compiled during the early modern period provide accurate local accounts of weather events, they too are imprecise and lack the cultural context of medical sources. Other historians have offered alternate interpretations of these rich documentary sources. For example, Joyce Macadam's survey of the Reverend Ralph Josselin's weather observations between 1644 and 1683 was an attempt to corroborate documentary evidence with reference to Manley's CET dataset. The article grapples with many of the same considerations as this initial chapter: how is it possible to extrapolate quantitative or scientific meaning from early modern documentary sources? Macadam's attempt to reconstruct, or at least elucidate, climatological datasets through such an esoteric source is admirable; however, the work is limited by a narrow, rationalist understanding of climate and its effects. Concluding the article, she notes how 'Josselin did not make rational connections between the political/social upheaval of his time, which included the English Civil War, and the unusual weather conditions that he and his parishioners endured.'¹⁸

Not only is this a wildly ahistorical statement, it treats early modern observations as if driven by ignorance and superstition. According to the intellectual and cultural paradigm in

¹⁷ Kelly and Ó Gráda, 'Change Points and Temporal Dependence in Annual Weather Reconstructions: Did Europe Experience a Little Ice Age?', p. 1378.

¹⁸ Joyce Macadam, 'English Weather: The Seventeenth-Century Diary of Ralph Josselin', *Journal of Interdisciplinary History*, 43 (2012), pp. 221–246, p. 245.

which Josselin operated, it was wholly rational to assume that the changing weather reflected divine (mis)fortune. This will be explored in greater depth in chapter five. Before the eighteenth century, a ‘rational’ understanding of climate (i.e. a post-instrumental, quantitative understanding) was far from universally adopted. In the *longue durée* of western history our experience of climate is a notable anomaly. To quote Vladimir Jankovic and James Rodger Fleming, in modern history climate is ‘more often defined as what it *does* rather than what *it is*.’¹⁹ Though today climate is synonymous with meteorology and treated as an indicator of weather trends, early moderns interpreted climate ‘as a force – and a resource - informing social habits, economic welfare, health, diet, and even the “energy of nations.”’²⁰ Josselin and his contemporaries consciously struggled with the epistemological rupture between an Aristotelian concept of climate and a new, essentially Baconian idea.

The history of a discernibly modern ‘climate’ was born of this tension on Wednesday 7 October 1663, when Robert Hooke first proposed his own *Method for Making a History of the Weather*. Hooke was the first natural philosopher to articulate the need for a standard weather record that included the position of the sun and moon, humidity, atmospheric pressure, the strength of the wind and the temperature. From the outset, he acknowledged the glaring difficulties with this process. As he explained:

For the making a more accurate history of the changes of weather, It will be requisite to observe the severall winds, what quarters they blow in, how long in each quarter, and with what strength at severall times of the Day or in the severall parts of the time of their duration; as whether mild at first when the wind begins to blow, in such a

¹⁹ James Rodger Fleming and Vladimir Jankovic, ‘Revisiting *Klima*’, *Osiris* 26 (2011), pp. 1-16, p. 2. Italics pre-existing.

²⁰ Ibid.; see also Lamb, ‘An Approach to the Study of the Development of Climate and Its Impact in Human Affairs’, in T. M. L. Wigley, M. J. Ingram, and G. Farmer (eds.), *Climate and History: Studies in Past Climates and Their Impact on Man*, (Cambridge, 1981), pp. 291–309.

gravity stronger about the midst of its duration, and slow again at the changing, as we find in the currents or tides of ye Sea; or whether the wind, when blowing very stiff, does suddenly change into another quarter and blow as stiff as was observed in the last great wind; and this to be observed with a weather cock placed in some very high place with particular contrivances that may give a certaine estimate of the quarter and of the strength of ye wind ...²¹

Weathervanes and rain gauges provided some sense of this history, as had Robert Boyle's inquiries into atmospheric pressure. However, one quality of climate alluded Hooke and the Royal Society: temperature. To estimate an accurate history of climate, Hooke argued, it was necessary that 'the heat and cold of ye air with its degrees and continuances ... may be observ'd by a good thermometer seald up soe that it may serve for a constant standard both for Winter and Summer from year to year, as long as the Observations be made.'²² Two years later, at the beginning of January 1665, Hooke was commissioned 'to prepare a thermometer that might serve as a standard of heat and cold.'²³ The following week, 'Mr. Hooke produced his thermometrical standard for heat and cold, and gave an account how it had been made, viz. after the manner described in his *Micrographia*. This was looked upon, though not exact, yet better than the other ways hereto used.'²⁴ Though he may not have been the first to propose the necessity for a common standard, his thermometer – known as 'The Royal Society's Standard Thermoscope' – quickly replaced many imitators.²⁵ However, this matter was far from resolved.

The invention of the first thermometer is conventionally attributed to Galileo, who

²¹ See the Royal Society Library, London, *Royal Society Classified Papers, 1667- 1740*, vol. 20, no. 2, 'For the better making of a History of the Weather', no. 24, 'For more accurate History of Changes in the Weather'; and in Thomas Sprat, *The History of the Royal Society* ed. Jackson I. Cope (St. Louis, 1959), pp. 173-79.

²² Thomas Sprat, *The History of the Royal Society*, pp. 173-79.

²³ Thomas Birch, *History of the Royal Society*, 4 vols. (London, 1756-1757), vol. 2, p. 2.

²⁴ *Ibid.*, p. 5.

²⁵ Louis Patterson, 'The Royal Society's Standard Thermometer, 1663-1709', *Isis*, 44 (1953), pp. 51-64, p. 53

first conceived of an open-air ‘thermoscope’ in 1593.²⁶ Unlike Daniel Gabriel Fahrenheit’s mercury-in-glass thermometer developed in 1714, Galileo’s contraption utilised a glass bulb ‘the size of a hen’s egg’ with a stem ‘dipping into water, which was made to rise part way up the tube by previous warming of the bulb.’²⁷ As noted by Carl Boyer, while Galileo’s telescope became quickly used and reproduced, the application of the thermometer was comparatively slow.²⁸ While the telescope operated on qualitative description, the thermometer required quantitative measurement. For the instrument to be useful, a standard unit of analysis would have to be adopted. During the early seventeenth century, reaching this kind of consensus was a fraught process. In this period, the science of heat was primarily qualitative. Before the end of the sixteenth century, no attempt had yet to be made to make an accurate measure of heat and cold. The term ‘thermometer’ only gradually came into use after its first appearance in J. Leurechon’s *La Récréation Mathématique* (1624). Before this point, natural philosophers referred to early thermometers as either ‘weather-glasses’ or ‘thermoscopes’. These earlier instruments were subject to a wide margin of error based on the fact they were sensitive to both changes in temperature and barometric pressure. As a result, the ‘weather glass’ acted as weather-predicting and measuring apparatus.²⁹ In 1634, the English Craftsman John Bate expressed his bemusement at this new instrument, which represented both ‘the state and temper of the season, whether hot or cold’ and ‘forshew the change and alteration thereof.’³⁰ With this instrument, you could ‘be able certainly to foretell the alteration or uncertainty of the weather a good many hours before it comes to pass.’³¹

²⁶ Mattie Bell Fretwell, ‘The Development of the Thermometer’, *The Mathematics Teacher*, 30 (1937), pp. 80-83.

²⁷ *Ibid.*, p. 80.

²⁸ Carl Boyer, ‘Early Principles in the Calibration of Thermometers’, *American Journal of Physics*, 10 (1942), pp. 76-86.

²⁹ B. J. Sokol, *A Brave New World of Knowledge: Shakespeare's The Tempest and Early Modern Epistemology* (London, 2003), p. 106

³⁰ John Bate, *The Mysteries of Nature and Art* (London, 1634), pp. 34-44.

³¹ *Ibid.*

After the Italian physicist Evangelista Torricelli invented the first purpose-built barometer, English contemporaries realised that their earlier instruments had also measured air-pressure. This error was eventually overcome when new glass-manufacturing techniques led to the invention of the narrow-bore thermometers: a method which meant thermometers became hermetically sealed. Even so, philosophers faced the ostensibly insurmountable task of inventing a standard measurement of temperature.³²

Without a uniform definition of heat or cold, a range of measurements proliferated throughout Europe. The lack of a universal metric language gave way to several various understandings of temperature through to the end of the seventeenth century. For example, the Venetian professor Santorio Santorio had used a candle and snow to demonstrate the two extremes, while Carlo Renaldi ‘was the first to key the thermometer to the boiling and freezing of water in 1694.’³³ English philosophers suggested other metrics. Robert Boyle used the congealing of aniseed or freezing distilled water, and in 1701, Isaac Newton encouraged the temperature of melting snow and blood heat as two fixed points of measurement.³⁴ As late as 1693, Edmond Halley, famous for his comet, complained over the lack of a universal standard of degree or division of temperature. ‘I cannot learn that any of them ... were ever made or adjusted, so as it might be concluded, what the Degrees or Divisions ... did mean; neither were they ever otherwise graduated, but by Standards kept by each particular Workman, without any agreement or reference to one another.’³⁵ By 1665, Robert Boyle, Robert Hooke, and Christaan Huygens had all suggested that a *single* fixed point, e.g. the freezing or boiling temperature of water, would provide this standard. Yet the Royal Society could not agree on this methodology. Boyle expressed his dismay at the

³² Fretwell, ‘The Development of the Thermometer’, pp. 80-83.

³³ Vera Keller, ‘Re-entangling the Thermometer: Cornelis Drebbel’s Description of his Self-regulating Oven, the Regiment of Fire, and the Early History of Temperature’, *Nuncius*, 28 (2013), pp. 243–275, p. 261.

³⁴ Hasok Chang, *Inventing Temperature: Measurement and Scientific Progress* (Oxford, 2004), p. 10.

³⁵ *Ibid.*, p. 9.

process in 1665:

We are greatly at a loss for a standard whereby to measure cold. The common instruments show us no more than the relative coldness of the air, but leave us in the dark as to the positive degree thereof; whence we cannot communicate the idea of any such degree to another person.³⁶

Newton, amongst others, instead advocated *two* fixed points of measurement. The interval between these measurements, divided into subsections, he believed would provide a more consistent analysis. Both methods were serviceable, but consensus could not be reached.

One hundred years after Boyle's complaint, Henry Mills of the Royal Society expressed the same frustration with the seemingly glacial progress made by the thermometer. Referencing Boyle's unfinished tome, *The General History of the Air* (1693), Mills scoffed at the study of thermometry:

It has been often complained that the histories of the air and weather are so imperfect and that an unfinished one of Mr Boyle, published since his death, is the best we have yet. Perhaps there is equal reason for complaint, that the thermometer first introduced into use in England, by the same excellent philosopher, has been so little improved for more than half a century, that it serves little more than amusement.³⁷

For Mills, the thermometer was a unique instrument unsuited to macro-scale studies. That is not to say that it did not prove a success on a local level. Weather diaries and record-keeping became a popular pursuit amongst gentleman of a certain status during the late seventeenth

³⁶ Robert Boyle op. cit. Henry Carrington Bolton, *The Evolution of the Thermometer* (London, 1900), p. 43.

³⁷ Henry Mills, 'On Thermometers and the Weather', *Philosophical Transactions of the Royal Society*, 46 (1749-50), p. 223.

century.³⁸ The history of early weather watching and forecasting was mainly a dilettante's pursuit, improvising with esoteric instruments. The later work of Gilbert White, the celebrated 'parson-naturalist' and author of the *Natural History and Antiquities of Selborne* (1789), represented the culmination of this eccentric trend.³⁹ Indeed, the lack of a standard thermometric scale bemoaned by both Boyle and Mills presents a further methodological dilemma to the historian. Namely, how should we treat sources which aspire to quantitative precision but inevitably fall short of such aims? How do we move beyond these elite understandings of weather to understand the foundations of modern climatology? The most common thermometric scales to this day – Fahrenheit, Celsius, Reaumur and Absolute – were also defined by this same debate. Before the matter of standardisation was resolved in the early eighteenth century, operational and epistemological burdens plagued the early thermometer.

As well as assigning a fixed or standard point of measurement, the division of these measurements was also the source of early debate between proponents and inventors of the thermoscope. These complaints fell into two camps: those that advocated the metric division of eight degrees and the others who preferred four. Early in the seventeenth century, Bacon even talked of a 'heat-glass' which could be 'divided into as many degrees as you please.'⁴⁰ Naturally, practitioners of early thermometry based their questions on the transferability between the humoral system and the new experimental technique. To describe the rift between these rival perspectives, Martin Barnett refers to the difference between the 'philosophers scale' and the 'physicians scale.'⁴¹ One such advocate of the 'physician's scale'

³⁸ Jan Golinski, *British Weather and the Climate of Enlightenment* (London, 2011), esp. ch. 3.

³⁹ Gilbert White, *The Natural History and Antiquities of Selborne* (London, 1789).

⁴⁰ Francis Bacon, *The Advancement of Learning and Novum Organum* (1620), James Edwin Creighton ed. (London, 1900), p. 387.

⁴¹ Martin K. Barnett, 'The Development of Thermometry and the Temperature Concept', *Osiris*, 12 (1956), pp. 269-341, p.269.

was Robert Fludd, who used the metric of heat/cold most associated with Galenism. Designed to reflect the four temperaments, the centre of his thermometer represented balance and health. As stated by Vera Keller, this system of thermometry, based on Galenic physiology, ‘was centred for some around an idea of equilibrium rather than of extremes.’⁴²

In the western philosophical tradition, the study of thermometry dates to the Hellenistic period. Democritus and Heraclitus both recognised the vital role of thermodynamics in nature, as dictated by the Empedoclean theory of the four elements.⁴³ Of course, these were later bound up in the humoral pathology espoused by Hippocrates and later by Aristotle. Marked by a qualitative paradigm, the specifics of thermometry were not of considerable significance to the medical sciences. Temperament, rather than temperature, determined the condition of the human body. ‘Heat could not be seen or weighed,’ described Carl Boyer, ‘and the physiological sensation was far too unreliable to serve as a measure.’⁴⁴ Commenting on the development of the thermometer in 1620, Francis Bacon recognised the inability of the physical senses to accurately gauge cold and heat. ‘The sensibility of the air with regard to heat and cold is so delicate and exquisite, that it far exceeds the human touch.’⁴⁵ That is not to say that before the advent of the thermometer physicians and philosophers disregarded the idea of separate degrees of heat.

Before Galileo’s initial invention, temperature was gauged according to a system based on Aristotle’s interpretation of the four elements. According to his theory, every object in nature was made up of four qualities, namely hotness, coldness, dryness, and humidity. Of these four qualities, two are active (hotness, coldness), and two are passive (dryness, humidity). The balance between these qualities defined relative temperature in nature,

⁴² Vera Keller, ‘Re-entangling the Thermometer’, p. 261.

⁴³ Carl B. Boyer, ‘History of the Measurement of Heat I. Thermometry and Calorimetry’, *The Scientific Monthly*, 57 (1943), pp. 442-452, p. 442.

⁴⁴ *Ibid*, p. 442.

⁴⁵ Bacon, *The Advancement of Learning and Novum Organum*, p. 387.

specifically related to medicine and foodstuffs. For example, while pepper, garlic, and gunpowder were regarded as ‘hot’ objects; snow and opium were intrinsically ‘cold’.⁴⁶ According to Aristotelian metaphysics, temperature was governed by the theory of *antiperistasis*: the process whereby the increase of one quality produces an equal opposing reaction. In other words, when a ‘cold’ object is placed in a ‘hot’ environment, its ‘coldness’ is said to increase (and vice versa). In the Galenic tradition, the therapeutic value of medicines and foods were ranked according to their purported ability to engender heat or cold. Galen was the first to introduce the notion of ‘degrees’ of heat to indicate the relative temperature and ultimately the temperament of an individual. Cold and hot bodies were delegated into four classes each, the first, second, third and fourth degree. Based on the expertise of a physician or an astute self-diagnosis, these qualitative categories were at the basis of Galenic physiology and treatment.

Under the auspices of the early modern health regimen, sensory encounters with competing airs were effectively read in medical terms and imbued with diverse social meanings. This will approach early modern climate history from the ground up by surveying a wealth of practical medical knowledge informed the multiple responses to aerial environments in early modern England. If we are to talk of climate in a way that does not immediately lend itself to anachronism, we should begin by probing the fundamentals of early modern climate theory: namely, the four humours.

⁴⁶ JJ Mares, ‘On the Development of the Temperature Concept’, *Journal of Thermal Analysis and Calorimetry*, 60 (2000), pp. 1081-1091, p. 1083.

‘There is nothing in the World ... which is not found in Man’: Humours and Health

In a period before standardised thermometry and the invention of other meteorological instruments, the human body was effectively read and treated as a vessel of atmospheric change. To negotiate the methodological pitfalls of previous histories, the remainder of this chapter will give credence to early ideas of climatic influence as stipulated by prevailing medical belief. Based on the regulation of one’s internal ‘temperature’, humoral theory rendered many widely held and sophisticated conclusions regarding the interchange between the body and a wavering clime. With recourse to medical books, receipt books and recipes, this will reject convention by depicting an image of the early modern English climate as forged by popular medical belief. As described by Gail Kern Paster, the humours were much more than a medical template, but rather a ‘network of analogy’ which revealed a ‘set of correspondences between inner and outer worlds.’⁴⁷ Said ‘correspondences’ have been carefully studied, with ecocritical scholars noting the particular importance of humours to the lexicon of human expression and emotion during the period concerned. Leah Knight, in her 2014 monograph *Reading Green in Early Modern England*, extends this notion in her exploration of airs and their sensory dimension in early modern English Literature.⁴⁸ Others, like Joshua Scodel in *Excess and the Mean in Early Modern English Literature* (2002) and Ethan H. Shagan in *The Rule of Moderation* (2011), have argued that the prevalence of the humoral ideal – or ‘Golden Mean’ – had a far-reaching influence on the intellectual culture of Tudor-Stuart England. The new-fangled desire for temperance and moderation over extremism, Scodel argues, has basis in the long-held geographical and medical theories of

⁴⁷ Paster, ‘The Body and Its Passions’, *Shakespeare Studies*, 29 (2001), pp. 44-56, p. 44.

⁴⁸ Leah Knight, *Reading Green in Early Modern England*, (Abingdon, 2014).

Hippocrates and Galen who advocated humoral balance.⁴⁹ However, many historians of the natural environment have curiously overlooked the clear overlap between early climate theory and medicine in the early modern period.

During the early modern period, physicians understood the human body as both an indicator and an agent of climatic change. Rather than deriving from a statistical definition of average temperature, a consensual idea of ‘climate’ was forged in medical terms. The early modern physician’s duty, in any case, was to help fortify and strengthen ‘natural’ or ‘vital’ heat without draining the body of moisture. Particular diets, as well as lifestyle changes, were also prescribed seasonally. On this basis, they would know that best practice suggested bloodletting in the springtime, instead of a hearty helping of beef and mustard. The ultimate aim of early modern therapeutics was to achieve an enduring balance between the four humours, protected from the excesses of seasonal change. This interchange was also profoundly subjective: according to humoral theory, a sharp heat could be as dangerous as it could be lifesaving; a prolonged cold could induce an incapacitating melancholy but also mitigate the fatal consequences of plague. Though humoralism also engendered deterministic beliefs around climate, especially concerning ethnicity and race, physicians and writers alike used the theory of the four humours to develop astute correlations between what Aldous Huxley once called ‘the inward weather of the mind and the physical climate of the external world’.⁵⁰

The exchange between these two worlds, the macrocosmic climate and microcosmic body, is primary to our understanding of climatic variability from the late-medieval period through to the eighteenth century. If humans were intrinsically permeable, as stipulated by humoral theory, then they were subject to even the most delicate changes in the temperature,

⁴⁹ Joshua Scodel, *Excess and the Mean in Early Modern English Literature* (London, 2002); Ethan H. Shagan, *The Rule of Moderation* (Cambridge, 2011).

⁵⁰ Aldous Huxley, *Beyond the Mexican Bay* (London, 1934), pp. 300-301.

humidity, and overall quality of the air. The temperament of a population indicated the salubrity of a climate, and vica versa. ‘An acute wit, a sound and lively colour, a stable integritie of the head, quicke sight, breathing, or unlistinesse of the limnes,’ Tobias Venner explained, were direct ‘signes the wholesommnesse of the Air is approved’.⁵¹ As stated by the alchemist Oswald Croll, in his *Basilica Chymica* of 1608, ‘There is nothing in the World, the property of which is not found in Man the *Microcosme*’ and since he is the sum of his environment, he ‘transformes himself & imitates and invents whatsoever is found in them’.⁵² As a particular climate varied, so too did the very bodies of its inhabitants. Croll was not alone in his reasoning, and, as I will subsequently demonstrate, many popular English writers including Robert Burton, Thomas Walkington, William Vaughan, etc., shared a common belief that ‘the clime changes not so much customs, manners, wits ... as the constitutions of their bodies, and the temperature itself’.⁵³

Humoralism itself is an ancient theory, with a practical history spanning throughout antiquity and the medieval period. It was the dominant paradigm for interpreting the entirety of nature, not least climate. Since the fifth century BC onwards, the notion that climate (or ‘airs’) had a discernible impression on the character and constitution of the human body was well established. In the western tradition, Hippocrates’ *Airs, Waters, and Places* theory is cited by some as the original work of medical climatology.⁵⁴ His thesis found that: ‘as a general rule ... the constitutions and habits of a people follow the nature of the land where

⁵¹ Tobias Venner, *Via Recta ad Vitam Longam, or A plain Philosophical Demonstration of the Nature, Faculties, and Effects of all such things as by way of nourishments make for the preservation of health* (London, 1620), p. 4.

⁵² Oswald Croll, *A Treatise of Oswaldus Crollius of Signatures of Internal Things; or, a True and Lively Anatomy of the Greater and Lesser World* (London, 1670), p. 24.

⁵³ Robert Burton, *The Anatomy of Melancholy, What it is: With all the Kinds, Causes, Symptomes, Prognostickes, and Several Cures of it. In Three Maine Partitions with their severall Sections, Members, and Subsections. Philosophically, Medicinally, Historically, Opened and Cut Up* (6th edn. London, 1651), p. 61.

⁵⁴ On the early modern legacy of the ‘Airs, Waters, and Places’ theory consult Andrew Wear, ‘Place, Health, and Disease: The Airs, Waters, Places Tradition in Early Modern England and North America’, *Journal of Medieval and Early Modern Studies*, 38 (2008), pp. 443-465 and Bashford and Tracy, ‘Modern Airs, Waters, and Places’, *Bulletin of the History of Medicine*, 86 (2012), pp. 495-514.

they live.’⁵⁵ Of course, the ‘nature of the land’ comprised a wealth of factors aside from climate: topography, geology, agriculture, horticulture and botany to name but a few. However, for anyone privy to the rudiments of Galenism, it was clear to see how the body was susceptible to acute changes in the aerial environment.⁵⁶

Humoral theory functioned as a matrix between the elemental forces of nature, the changing seasons, and the human body. Unlike our post-instrumental, quantitative understanding of climate, humoralism depended on explicit reciprocity between the human body’s microclimate and the macroclimate of the world beyond. The altering seasons ushered changes in humoral balance, and thus the occurrence of varying ailments, behaviours and emotions. A cold and wet winter engendered phlegm; spring, known to be hot and moist, heartened blood; Summer stimulated cholera; and Autumn, the cold and dry season, was defined by a surplus of black bile. The tenets of humoralism, ubiquitous throughout the early modern period, informed medical decision well beyond the so-called ‘Scientific Revolution’. Every physician of any standing would have naturally taken into account the state of the climate, or ‘air’ when making a diagnosis. As temperatures fell, droughts became harsher, and extreme weather more frequent – as was often the case during the LIA – speculation on the effects of climate on one’s humoral equilibrium reoccurred throughout many of the health regimens featured in this chapter.

Epidemiological evidence suggests an empirical basis for some humoral thought, unbeknownst to its practitioners. Though compiling substantive data which supports a correlation between seasonal change and health is challenging, proxy studies have attempted

⁵⁵ Hippocrates op. cit. William A. R. Thomson, *A Change of Air: Climate and Health* (London, 1979), p. 3.

⁵⁶ Latin and Greek editions of the Hippocratic corpus were reprinted throughout the sixteenth and seventeenth centuries, with Hippocratic principles permeating a wider medical culture in the period via cheaply reproduced almanacs and cosmological pamphlets. On the early modern legacy of Hippocrates, see Vivian Nutton, ‘Hippocrates in the Renaissance’, *Sudhoffs Archive*, 27 (1989), pp. 420-430. On the influence of popular astrology in early modern England, see Bernard Capp, *Astrology and the Popular Press: English Almanacs 1500-1800* (London, 1979).

to plug this historiographical gap. Harvest figures, a natural corollary to seasonal variation, have been used by many climatologists to reconstruct early modern climate statistics. While this process is fraught with methodological difficulties previously covered, it is highly likely that harvest failure can be said to have a tangential effect on health and fostered a heightened sensitivity toward seasonal variance during the LIA.⁵⁷ As Lamb speculates, the radical shifts between seasons experienced throughout the most intense episode of the LIA, ‘must have badly upset harvest expectations and posed a need for storage of reserves of food stuffs beyond the resources of the community at that time.’⁵⁸ In specific cases, historical epidemiologists can substantiate these hypotheses with mortality figures. For example, the transitional seasons of late-summer and autumn can be seen to be genuinely more unhealthful, partially due to endemic bouts of malaria experienced throughout the south-east of England where infant mortality rates could range between 250-300 per thousand (over double the national average of 100).⁵⁹ Plague too has been said to follow patterns in seasonal change; major epidemics would usually run their course within six to eight months, peaking in the late-summer and early autumn.⁶⁰ Many historians have been understandably hesitant to make the controversial linkage between harvest fluctuations, climate, and disease, but there is strong evidence to suggest that climate was a contributing factor in several mortality crises of the sixteenth and seventeenth-centuries.

In Paul Slack’s examination of mortality crises and epidemics 1485-1610, he

⁵⁷ Though in reference to Japanese history, Thomas C Smith eloquently describes the import of agriculture to early modern family/ community structure: ‘Farming, with its allied tasks, was the principle occupation and nearly the sole income for most families, and its rhythms defined the annual cycle of work, rest and worship. Severe annual variations in the harvest would reverberate through family life, determining whether a family ate well or meagrely, whether the old might live another winter, whether a daughter could marry.’ Thomas C. Smith, *Nakahara, Family Farming and Population in a Japanese Village, 1713 – 1830* (Stanford, 1977), p.170.

⁵⁸ Lamb, *Climate, History and the modern world* (London, 1982), p. 220

⁵⁹ Andrew Appleby, ‘Epidemics and Famine in the Little Ice Age’, *Journal of Interdisciplinary History*, 10 (1980), pp. 643-663, p. 663.

⁶⁰ Paul Slack, ‘Mortality Crises and Epidemics 1485 – 1610’ in Charles Webster (ed.), *Health, Medicine and Mortality in the Sixteenth Century* (Cambridge, 1979), pp. 9-59, p. 43.

recognises a general pattern of mortality that broadly followed warm climatic conditions: weather that naturally encouraged a higher rodent/flea density. In the case of Norwich during the plague of 1579, when approximately 30% of the population died, more than 3,000 perished in the space of the three months between August and October – the period identified by Thomas Tryon as ‘most dangerous to contract Diseases in.’⁶¹ During Schofield and Wrigley’s reconstruction of child deaths in Banbury and Gainsborough, they establish a seasonal pattern of mortality amongst 1-9 year-olds which peaks in the late summer (August yielding highest mortality rate in the two categories analysed; 1-4 and 5-9 year-olds).⁶² While historians such as Andrew Appleby have convincingly argued that ‘human responses to climate were more important than the climate itself in both causing famine and eliminating it,’ the same logic suggests a heightened cultural sensitivity to the effects of climate in their attempts to alleviate the impact of adverse weather conditions on a regional, local, or familial level.⁶³

Though the cumulative impact of these epidemiological studies can give a strong impression of long-term climatic changes, they cannot serve to adequately explain the cultural understanding of climatic change. This is not to refute the effectiveness of the studies above, but to propose intervention in how we measure pre-modern climates: as experiential and cultural processes, rather than as a continuum of statistical data. In an age of anthropogenic climate change, this question is perhaps more pertinent than ever. As an alternative proxy of climatic change, medical interpretations of the English body can provide an insight into the perceived effects of climate on the individual. From the comparative warmth of one’s heart to the influence of sharp seasonal change on customs, behaviour and identity, the ‘symptoms’ of

⁶¹ Slack, ‘Mortality Crises and Epidemics 1485 – 1610’, p. 43.

⁶² Roger Schofield and E. A Wrigley, ‘Infant and Child Mortality in England in the late Tudor and early Stuart period’ in Charles Webster (ed.), *Health, Medicine and Mortality in the Sixteenth Century* (Cambridge, 1979), pp. 61-95, pp. 92-93.

⁶³ Appleby, ‘Epidemics and Famine in the Little Ice Age’, p. 663.

climatic change were evident throughout the early modern regimen and provided a handbook whereby individuals analysed this unique proxy.

‘Be their own Phisytion in time of neede’: Regimens and Readerships

Centuries before techniques of weather measurement became standardised the explanatory medical text-book devised a regulatory system of climatic measurement based on sensory encounters with nature. Of the various examples of English health literature published throughout the sixteenth and seventeenth centuries, the explanatory health regimen represented the most popular category.⁶⁴ Accessible to the modest income and intended for laypeople, the ‘regimen’ condensed the minutiae of Galenic medicine into a series of simple instructions. Some of the most enduring and popular works of literature in the early modern period are categorised as health regimens. Robert Burton’s *Anatomy of Melancholy* (1621), a sprawling, tangential treatment of English malady is based on another famous health regimen: Levinus Lemnius’ *Touchstone of Complexions* (translated into English, 1576).⁶⁵ Such was the diversity and malleability of the genre that individual physicians and generalists would project their idiosyncratic ideas of climatic influence while citing the same sources. Occasionally resembling a curative catechism, the regimen could be structured using a basic question and answer format, guiding its reader toward humoral moderation. William Vaughan’s *Directions*

⁶⁴ Slack, ‘Mirrors of health and treasures of poor men: the uses of vernacular medical literature of tudor England’ in Charles Webster (ed.), *Health, Medicine and Morality in the Sixteenth Century* (Cambridge, 1979), pp. 237-273. Slack (p. 289) calculates that editions of health regimens and textbooks accounted for 29.3% of vernacular medical literature published 1486-1604, the largest share of eight designated categories including: Explanatory textbooks and regimens; Anatomy and Surgery; Reflections on theory and practice; Herbals; Plague tracts; Other specific diseases; Single or specialised remedies; and Collections of remedies.

⁶⁵ During Burton’s lifetime (1577-1640), *The Anatomy of Melancholy* went through five expanded and revised editions in 1621, 1624, 1628, 1632, 1638. A further posthumous edition was published in 1651. Levinus Lemnius, *De habitu et constitutione corporis* (Antwerp, 1561) trans. Thomas Newton, *The Touchstone of Complexions* (London, 1576). Burton’s tome frequently cites Lemnius’ work.

for *Health* (1600), a notable instance of this style, was designed to be read, reread and remembered.⁶⁶

Owing to economic factors as well as their non-specialist vocabulary and format, the market for health regimens was particularly strong. Sir Thomas Elyot's *Castel of Helthe* (1536), the first recognisable regimen of the early-modern period, was reprinted sixteen times between c. 1536 and 1595. The price of a regimen such as Elyot's *Castel of Helthe* or Vaughan's *Directions* was also significantly lower than the average surgical or herbal work.⁶⁷ Circulation figures were strong, with Paul Slack reckoning that of the 400,000 copies of medical literature available between 1486 and 1604 the explanatory medical textbook or regimen comprised a third of these titles.⁶⁸ On this basis, he estimates that by 1604 there was one example of medical literature for every twenty people.⁶⁹ Moreover, if we combine Slack's estimate with John Sinclair's catalogue of fifty-four preventive medical works 'of real note and merit' published between 1600 and 1700, we can approximate that around 150 original titles were in circulation by the end of the period.⁷⁰

While 'traditional' medical textbooks were intellectually uncompromising and

⁶⁶ William Vaughan, *Natural and artificial directions for health derived from the best philosophers, as well as modern, as ancient* (3rd edn., London, 1612). Vaughan's work went through five editions in his lifetime (c. 1575 – 1641) in 1607, 1612, 1617, 1626 and 1633. Similar success was experienced by many of Vaughan's contemporaries, with the demand for popular medical guides continuing until the end of the seventeenth-century. Amongst the most popular of these were: Tobias Venner's *Via Recta ad Vitam Longam* (1st edn, 1620), and went through a further five editions in 1622, 1628, 1638, 1650, and 1660; Thomas Mouffet's *Healths Improvement: Or, Rules Comprizing and Discovering the Nature, Method, and Manner of Preparing all sorts of Food used in this Nation: Corrected and Enlarged by Christopher Bennett* (2nd edn, 1655); and Thomas Tryon's *The way to health, long Life and Happiness: Or, A Discourse of temperance, And the Particular Nature of all Things requisite for the Life of Man...* (originally published as *Health's Grand Preservative* (1681)), went through a further edition in the Author's lifetime in 1691 and is said to have later inspired a young Benjamin Franklin to become vegetarian. For a general account of these works see H. S. Bennett, *English Books and Readers 1475-1557* (2nd edn, Cambridge, 1970), pp. 97-109, and idem, *English Books and Readers 1558-1603* (Cambridge, 1965), pp. 179-89.

⁶⁷ Giovanni's da Vigo's popular surgical works cost four shillings, as opposed to the sixpence paid for a copy of Elyot's *Castel of Helthe*. Slack, 'Mirrors of health and treasures of poor men', p. 247.

⁶⁸ Slack, 'Mirrors of health and treasures of poor men', p. 289.

⁶⁹ Ibid.

⁷⁰ John Sinclair estimates a total fifty-four works published between 1600-1700 and 211 between 1700-1800, along with Slack's total of ninety-seven titles between 1486 and 1604. John Sinclair, *The Code of Health and Longevity: or, a Concise View of the Principles Calculated for the Preservation of Health and the Attainment of Long Life*, 2 vols (Edinburgh, 1807), vol. 2, pp. 301-303; 185-187.

physically unwieldy, the regimen was written for everyday use in the form of a pocketbook or pamphlet.⁷¹ Unlike major surgeries and anatomies, composed for and by experienced physicians, only a third of regimens published in this period were authored by an established physician with many written from the perspective of a non-specialist.⁷² Thomas Elyot, one of the first proponents of the genre, was a layman, later a diplomat known principally for his *Boke named the Governour* (1531); Burton was a scholar who dabbled in astrology; Vaughan is chiefly known as a colonialist; Thomas Tryon was a merchant; and Thomas Mouffet, though an established physician, was best known for his work with spiders. The contribution made by clergymen was particularly substantial, representing a tradition that extended back to the Middle Ages and included contemporaries like Thomas Moulton, a Dominican, and Andrew Boorde, a Carthusian.⁷³

As an example of medical literature, the diverse occupations of the above authors indicate that the regimen was highly adaptable, practical, and accessible. To an extent, this is accurate. In contrast to ‘traditional’ medical works, regimens *were* unconventional by borrowing from the ‘little’ and ‘great’ traditions of medical writing: classical geographies, ancient medical treatise and devotional practices are referenced, along with astrology, interpretation, recipes and remedies.⁷⁴ Whether their readership was equally diverse has been a subject of contention between historians. Slack, in his study of vernacular medical literature between 1480-1604, contends that any claim to a general readership ‘need not be taken at face

⁷¹ Slack, ‘Mirrors of health and treasures of poor men’, p. 247.

⁷² *Ibid.*

⁷³ Thomas Moulton *This is the Myroure of Glasse of Helth* (1530); Boorde, likewise a popular proponent of the genre, authored two regimens *A compendious regyment or a dyetary of healthe made in Mountpyllyer, by Andrew Boorde of physycke doctour, newly corrected and imprinted with dyuers addycyons dedycated to the armypotent Prynce and valyent Lorde Thomas Duke of Northfolke.* (London, 1542) and *Breviary Helthe* (London, 1547).

⁷⁴ Peter Burke defines the ‘great’ tradition as belong to the elite classes ‘while the “little” tradition was open to everyone, including elites’, *Popular culture in early modern Europe* (London, 1978), p. 28. Burke continues to explain that while noticeable divisions between ‘great’ and ‘little’ traditions of culture were beginning to take shape by the eighteenth century, it is dubious that such rigid cultural distinctions were made during the period the sixteenth and seventeenth centuries.

value. If writers seem to have felt the need to justify opening the secrets of the “noble science” of physic to the multitude, a large part of this was a calculated appeal for readers.⁷⁵ Somewhat cynically, Slack estimates that the substantial market constituted by sixteenth and early-seventeenth century health regimens amounted to little or no ‘major social or medical impact’ and ‘simply gave a few people more to talk about.’⁷⁶

Though designed for a non-specialist reader, Thomas Moulton’s stated claim to deliver ‘every man, woman and child’ the means to ‘be their own physician in time of need’ was, for Slack, a gross exaggeration of the format’s demographic appeal.⁷⁷ Read or heard, the regimen required a level of education usually unattainable by the ‘poorer’ or even ‘middling’ orders and presumed a degree of wealth and leisure on behalf of its reader.⁷⁸ Bearing in mind the sophistication of the regimen’s source material, often drawing upon a library of classical authors, to construe such knowledge as ‘common sense’ could also be regarded as naïve. Before health was branded a universal right, instructional medical works were considered the domain of the privileged: ‘a luxury for those spared the necessity of long hours of toil, poor living conditions and little choice in matters of food consumption’, explains David Gentilcore.⁷⁹ While the elite were burdened by culinary variety, lower orders were determined to withstand hunger and starvation. Judging by dedications and book titles, our authors invariably addressed an elite audience of scholars, magistrates, and princes.⁸⁰ The first, possibly only, regimen concentrating on countrymen was a German publication from the

⁷⁵ Slack, ‘Mirrors of Health’, pp. 246-7

⁷⁶ Ibid.

⁷⁷ Thomas Moulton, *Myroure or glasse of helthe* (1530), ch. 1. Many other authors reciprocated a similar goal: Elyot designed his work so ‘every manne may knowe the state of his owne body, the preservation of helth, and how to instructe welle his physytion in syckenes that he be not deceived.’ Elyot, *The Castel of Helth* (1534), iv.

⁷⁸ Slack, ‘Mirrors of health and treasures of poor men’, p. 258. ‘Only almanacs were available in large enough quantity to reach the lowest ranks of the literate, and even they contained medical advice which demanded a knowledge of dates and times, and assumed a choice of diet and exercise.’

⁷⁹ David Gentilcore, *Food and Health in Early Modern Europe: Diet, Medicine and Society c. 1450 – 1650* (London, 2015), p. 6.

⁸⁰ Gentilcore, *Food and Health in Early Modern Europe*, p. 6.

eighteenth century – a work immersed with Enlightenment idealism, concerning itself with the wellbeing of the poor.⁸¹

Conversely, the assumption that medicine and, by proxy, climatic awareness was the exclusive concern of the learned dilettante would be to take a distinctly narrow reading of circulation figures and the eclectic content of such literature. The sheer volume of editions to which many regimens ran in comparison to ‘conventional’ medical literature poses several challenges to Slack and Gentilcore’s calculation. Perhaps Moulton’s self-assessment was inflected with bombastic self-regard, yet this neither discounts the sincere aims of his regimen, nor its substantial circulation figures. Considering that the author’s *Myroure or glasse of helthe* (1530) went through seventeen editions (1530 – 1580), it seems implausible that all would have only reached the attention of the elite, city-dwelling male. Unless editions were stockpiled in vast quantities by the elite, it would be sensible to assume that the regimen was dispersed by alternate means. Indeed, the practice of medicine was by no means limited to those licensed by the Royal College of Physicians.⁸²

The sick were accustomed to receiving counsel from all manner of people: friends and family; local wise men and women; priests, apothecaries, and herbalists. It is conceivable that an intermediary of this kind disseminated the contents of the regimen; perhaps read aloud by practitioners and remembered by patients. Though recipients of medical advice may not have grasped the complexity of Galenic theory, the elemental polarity between cold/dry/warm/wet substances was innate to early European medical culture. Learned, unlearned, patient and practitioner alike subscribed to a humoral interpretation of illness and treatment; and

⁸¹ J. G. Reyher, *Anleitung zur Erhaltung der Gesundheit für den Landmann* [trans. Guidance on the maintenance of health for the Landmann] (Schwerin, 1790), cit. in K. Bergdolt, *Wellbeing: A Cultural History of Healthy Living* (Cambridge, 2008), p. 244.

⁸² Margaret Pelling, *The Common Lot: Sickness, Medical Occupations and the Urban Poor in Early Modern England* (London, 1998); *Medical Conflicts in Early Modern London: Patronage, Physicians and Irregular Practitioners 1550-1640* (Oxford, 2003); Andrew Wear, *Knowledge and Practice in English Medicine, 1550-1680* (Cambridge, 2000), pp. 21-8.

according to Paster, ‘every subject grew up with a common understanding of his or her body as a semipermeable, irrigated container in which humours moved sluggishly.’⁸³ To assume the regimen was the only way to understand Galenic theory misrepresents a tradition of preventative medicine beyond the learned physician. Slack’s work, vital for its quantitative reconstruction of circulation figures, critically underestimates the capacity of this pre-existing medical culture. Methodologically speaking, the very act of quantifying the diverse metaphysical beliefs and social practices which compounded the regimen tradition is a tricky task. The discrete nature of domestic self-care and its ‘invisibility’ to the historian does not necessarily correspond to its inefficacy; on the contrary, Ginnie Smith claims that ‘the very nature of a multitude of low-level, dispersed acts has meant that the processes of prevention have not been as ‘visible’ to historians as the processes of cure.’⁸⁴

Transmitted under the guise of folk and oral culture, we can view the regimen as an extension of pre-existing knowledge and practices associated with early modern medical literature, as well as older traditions of astrological medicine.⁸⁵ The regimen represented the proverbial ‘tip’ of a deeper, subliminal body of widespread medical knowledge and practices. This hypothesis finds traction when we consider the popularity of the regimen’s spiritual cousin: the astrological almanac. Unlike the regimen, the almanac’s widespread popularity is unambiguous. By the 1660s, detailed evidence suggests that sales averaged around 400,000 copies per annum, with Bernard Capp estimating that approximately one family bought three almanacs per year. Though the modern iterations of the almanac are renowned for their

⁸³ Paster, *The Body Embarrassed*, p. 8. See also Lucinda McCray Beier, *Sufferers and Healers: The Experience of Illness in Seventeenth-Century England* (London, 1987), p. 31.

⁸⁴ Ginnie Smith, ‘Prescribing the rules of health: Self-help and advice in the late eighteenth century’, Roy Porter (ed.), *Patients and Practitioners: Lay Perceptions of Medicine in Pre-industrial Society* (Cambridge, 1985), pp. 205-249, p. 205. For an analysis of the invisibility of self-care, see S. Levin, A. Katz and E. Holst (eds.), *Self-Care: Lay Initiatives in Health* (London, 1977), esp. ch. 2, ‘The social nature of self-care’.

⁸⁵ Louise Hill Curth, ‘The Medical Content of English Almanacs 1640–1700’, *Journal of the History of Medicine and Allied Sciences*, 60 (2005), pp. 255-282.

flagrant prophecies, its early modern forerunner suited a uniquely utilitarian purpose for lower orders.⁸⁶

At the heart of both regimen and almanac traditions was a curiosity toward the operations of the aerial environment and climate. Both publications endowed weather events with medical import and, resultantly, advocated a series of treatments based on seasonal change and climatic sensitivity. As proposed by Capp, whose foundational study of *Astrology & the Popular Press* remains the only comprehensive assessment of almanac culture in England, contemporary medicine ‘depended heavily on astrological assumptions’, and *vice versa*.⁸⁷ Not unlike the regimen, an almanac advocated a temporal regimentation of individual health; containing medical advice structured around knowledge of dates and times, as well as diet and exercise. Astrological medicine was also predicated on a humoral interpretation of the human form: precisely, ‘the belief that the four humours of the body corresponded to, and was influenced by, the qualities of planets and the signs of the zodiac.’⁸⁸ Most almanacs were prefaced with a calendar, cosmological maps, as well as a version of the ‘Zodiacal Man’: a diagram depicting the organs of the body as ordered by celestial motions.⁸⁹ Bloodletting, bathing, purging, diet and exercise were thus ordered around temporal distinctions, often in correspondence to the changing seasons or astrological events.

⁸⁶ Capp, *Astrology & the Popular Press* (London, 1979), pp. 23 - 24.

⁸⁷ *Ibid.*

⁸⁸ *Ibid.*, p. 204. Capp claims that the most widespread and important application of astrology lay in the field of medicine, citing W.S.C. Copeman, *Doctors and Diseases in Tudor Times* (London 1960), C. Camden, ‘Elizabethan astrological medicine’, *Annals of Medical History*, 2 (1930), pp. 26-73, and H.G. Dick, ‘Students of Physic and Astrology’, *Journal of the History of Medicine*, 1(1946), pp. 419-433; Keith Thomas, *Religion and the Decline of Magic* (Oxford, 1971). See also Lauren Kassell, Michael Hawkins, Robert Ralley, John Young, Joanne Edge, Janet Yvonne Martin-Portugues, and Natalie Kaoukji (eds.) ‘Casebooks’, *The casebooks of Simon Foreman and Richard Napier, 1596-1634: a digital edition*, <https://casebooks.lib.cam.ac.uk>, accessed 1 March 2020.

⁸⁹ Capp, *Astrology & the Popular Press*, pp. 29-30.

‘What is Ayre?’ Air and Embodiment in Early Modern Medicine

In the pre-instrumental weather-world of early modern England, human senses mediated climate. Previous to the intuitive techniques of weather measurement and prediction on which we now rely, physicians and patients alike understood the air was as a tangible, material entity teeming with smells, sights, tastes, feelings and sounds. Distinguishing an (in)salubrious climate depended on the analogue methods of olfaction, gustation, audition, vision and somatosensation. Through these experiences, regimen writers and their audiences forged an impression of the English atmosphere around the perceived dangers and benefits of the external world: from pestiferous smells and pleasant tastes, murky fogs and piercing sounds, down to the comparative sensation of warmth, cold, dryness or moisture. For better or worse, according to the central tenets of humoral medicine these qualities were said to directly influence one’s constitution.

With the popularity of the explanatory health regimen or textbook, the question of how seasonal variance, changes in air, and extreme weather events altered the body became an increasing priority in terms of individual health. Writers designed their works to mitigate many of these worries through the advocacy of a variety of lifestyle changes: restoring humoral balance via diet, travel and exercise. This process of mitigation was, however, subject to a range of often contradictory medical advice. In Wilson and Sullivan’s examination of early environmentalism, *Environment and Embodiment in Early Modern England* (2007), they posit three models whereby contemporaries attempted to resolve the more concerning implications of a changing environment. The first, the ‘similitude model’, stipulated that man – being a vessel of his surroundings – would adapt to any changing conditions; secondly, the ‘counteractive model’, presupposed that ‘the body’s complexion is formed in opposition or through resistance to the environment.’ Finally, the ‘exchange model’

emphasised that ‘which crosses the threshold of the body, from within and without.’⁹⁰

Each model, though distinct in their solution to the man-nature binary, all predicate a continuous relationship between the body and its aerial environment. Evidence of these retroactive models were often specific to each author. Robert Burton follows a distinctly Hippocratic interpretation of climates as they are reflected in the body (‘Such as is the air, such be our spirits; and as our spirits, such are our humours’) whereas Thomas Coghlan, author of *The Haven of Health* more often advocates a counteractive approach to his discussion of climate.⁹¹ Coghlan subverts the classical interpretation of Hippocratic similitude in his suggestion that English ‘stomacks for the more part, are hotter by reason of the coldnesse of the Clime.’⁹² As will be subsequently shown, specifically in chapter four, the inherent contradictions between several theories of embodiment theory were often manipulated to embolden the religious, political, or nationalistic agenda of their author.

Given the relative unpopularity of ‘climate’ as a term of use, our understanding of the early modern English ‘climate’ should incorporate the contemporary fascination with ‘air’. As one of the six Galenic ‘non-naturals’ along with diet, exercise, water, excretion, passions, and sleep, the quality of one’s air was considered to have a profound effect on the mind, body, and soul. Etymologically, climate and ‘air’ were cognates: the word derives from the old French *air* ‘atmosphere, breathe, weather’ from the Latin *aerum* ‘lower atmosphere; sky’. Airs were subject to a range of social and environmental factors: from extreme weather events, natural disasters and pollution, to immorality, sin, and sexual debauchery. By examining ‘airs’ we are provided with an idea of the early modern climate in a more intimate, microcosmic sense; a concept that allows the historian to understand how Englanders imagined, interacted and

⁹⁰ Floyd-Wilson and Sullivan (eds.), *Environment and Embodiment* (Basingstoke, 2007), pp. 3-5.

⁹¹ Robert Burton, *The Anatomy of Melancholy*, p. 149. Note that earlier editions do not include this line.

⁹² Thomas Coghlan, *The haven of health: chiefly gathered for the comfort of students, and consequently for all those that have a care of their health* (4th edn, London, 1636), p. 209.

manipulated their local environments.

Regardless of the medium through which Galenism was communicated – whether almanac or regimen; text-book or pamphlet; heard aloud or read – the early modern subject was acutely aware of their status as a humoral entity: a figure awash with competing passions, impulses and bodily fluids. Whether or not we interpret the regimen’s usage as a ‘holistic metaphysical paradigm or as a practical set of rules’, to quote Ginnie Smith, the principles that underpinned such literature, i.e. the polarities between hot/cold/wet/dry, remained an authoritative template for the study of individual health until comparatively recently.⁹³ Up until the beginning of the eighteenth century, Galenic theory postulated an understanding of personal hygiene and treatment according to *naturals*, *contra-naturals*, and *non-naturals*. The *naturals* included the humours, faculties, elements, and temperaments, i.e: the physical basis of our being; the *contra-naturals*, on the other hand, covered the threat of disease and sickness to be treated expertly by a physician. Regimen writers, however, were predominantly committed to studying the six *non-naturals*: airs, sleep, exercise, diet, evacuations and passions. Unlike the *naturals* and *contra-naturals*, the *non-naturals* appealed to authors of the regimen in their susceptibility to manipulation and control.

Like food and other non-naturals, Air, Andrew Wear reminds us, was not only ‘essential but also alterable and controllable.’⁹⁴ In the form of regimen or almanac, climate or ‘air’ entered into domestic dialogue as an object to be regulated, measured and controlled through the body. According to medical instruction, micro and macroclimatic changes are imperative to individual health and self-mastery. In his brief overview of ancient dietetics, Michel Foucault interprets the regimen as a careful ‘art of living’ whereby ‘exercises, foods,

⁹³ Ginnie Smith, ‘Prescribing the rules of health: Self-help and advice in the late eighteenth century’, p. 256. Smith also cites L. J Rather, ‘The six things non-natural: a note on the origins and fate of a doctrine and a phrase’, *Clio Medica*, 3 (1968), pp. 337-347; and Peter Niebyl, ‘The non-naturals’, *Bulletin for the History of medicine* (1971), pp. 486-492.

⁹⁴ Wear, *Knowledge and Practice in English Medicine*, p. 197.

drinks, sleep and sexual relations ... needed to be “measured”.⁹⁵ Once measured, the subject ‘had the proper, necessary and sufficient concern for his body: a concern that permeated everyday life, making the major or common activities of existence a matter of both health and ethics.’⁹⁶ Dietetics, as Foucault interpreted, represented less an instructional manual for health as they did a design for life: an all-encompassing regulatory system intended to cover physical, mental, and moral life. Climate, or ‘airs’, resultantly became the subject of a ‘serial reflexive vigilance’ in an effort toward self-mastery.⁹⁷ More specifically, Foucault refers to the process of climatic awareness as ‘circumstantial vigilance’: a heightened sensitivity to the external world, which comprised ‘the climate ... the seasons, the hours of the day, the degree of humidity and dryness, of heat or cold, the characteristics of a given region, the situation of a town.’⁹⁸ The regimen and associated knowledge, Foucault posits, advanced a ‘medical perception’ of the natural world in which every element embodied a positive or negative effect.

Most of the works referenced above would dedicate large sections or entire chapters of their writing to the study of the air. At the very opening of William Vaughan’s widely read *Directions of Health*, first published in 1600, the English priest-cum-physician asks his prospective reader: ‘What is Ayre?’⁹⁹ Like countless proponents of humoral physiology – from Hippocrates to Michael Servetus – Vaughan contended that the comprehension of this seemingly self-evident question was foundational to the study of individual health. Ahead of diet, sleep, exercise, infirmity, and ‘evacuations’, Vaughan first thought it necessary to clarify the significance of this element before continuing his popular treatise. ‘Aire by it selfe is an element,’ he asserted:

⁹⁵ Michel Foucault, *The History of Sexuality*, 4 vols. (London, 1987) vol. 1, p. 101.

⁹⁶ *Ibid.*, p.108.

⁹⁷ Wolfgang Detel, *Foucault and Classical Antiquity: Power, Ethics and Knowledge* (Cambridge, 2005), p. 93

⁹⁸ Foucault, *The History of Sexuality*, p. 138.

⁹⁹ William Vaughan, *Directions for health* (London, 1600), p. 2

wherupon the whole constitution of our lives dependeth. The attraction of this natural body is so necessarie unto us, that if any one of the instruments of our bodies be stopt, we cannot chuse but forthwith be strangled.¹⁰⁰

The centrality of air to physical wellbeing was by no means a revelatory thesis, Vaughan himself admitting that it was ‘by the Philosophers approved’ that his *Directions for Health* were authenticated.’ For Thomas Mouffet, the effects of air were also self-evident; he stated that ‘the aire altereth the body every way,’ questioning if ‘the aire be cloudy, how can the body be warm? Let it be hot, how can that be cold? let it be chilled with frost or snow, our skin (yea our inwards themselves) begin to shiver?’¹⁰¹ Despite significant and well-documented challenges to Hippocratic/Galenic medicine, these ideas displayed a remarkable staying power until the end of the seventeenth century. ‘It is unquestionably true’, claimed Stanford Wolsterstan in 1691, ‘that the Air, above all the other Non-naturals, is the great Cause of our Epidemick Fevers; the best way therefore to know the nature of such Fevers ... will be to consider the Nature of the Air we breathe in.’¹⁰² By the eighteenth century, Jan Golinski describes how susceptibility to one’s local atmosphere had become ‘diseases of modern life.’¹⁰³ Specifically, he regards personal record keeping as the root of a ‘new awareness of weather as a quotidian phenomenon was concentrating people’s attention on the often-rapid changes of conditions that were typical of the national climate.’¹⁰⁴

By examining the ‘Nature of the Air’, as Wolsterstan understood it, early moderns did not merely discuss the amalgamation of gaseous substances which form the breathable atmosphere, but also the social and cultural factors thought to engender a certain ‘air’. Listing

¹⁰⁰ Vaughan, *Directions for health* (London, 1600), p. 2

¹⁰¹ Thomas Mouffet, *Healths Improvement* (London, 1655), ch. 3 ‘Of Air’, p. 12.

¹⁰² Stanford Wolsterstan, *An enquiry into the causes of diseases in general and the disturbances of the humors in man's body* (London, 1691), pp. 13-14.

¹⁰³ Golinski, *British Weather and the Climate of Enlightenment*, p. 138. See also ch. 5. ‘Sensibility and Climatic Pathology’.

¹⁰⁴ Golinski, *British Weather and the Climate of Enlightenment*, p. 78.

the myriad ways in which an air was subject to change, Thomas Walkington notes ‘blazing comets’, ‘noysome vapours’, ‘disastrous constellations’, and ‘the inflammation of the air by the intense heate of the sunne.’¹⁰⁵ Air, in Ambrose Paré’s words, was equally subject to transformation by unsanitary urban conditions as it was atmospheric changes, like thunder and lightning, which ‘by their great noise and commotion, so violently disturb the air.’¹⁰⁶ Others, including Robert Burton, asserted that human immorality was a direct cause of climatic change: he notes that it was through a community’s ‘own nastiness, and sluttishness and sordid manner of life,’ that they ‘suffer their air to putrefy, and themselves to be chocked up.’¹⁰⁷ Through drunkenness and gluttony, William Clever added, ‘the elements become so offended in their naturall courses and poure downe a super aboundaunce of moisting showers, disseasoning the earthlie fruites of mans mortall estate.’¹⁰⁸ The definition of ‘air’ given by medical writers of the time is perhaps closer to our contemporary interpretation of climate, a term which today generally connotes the exchange between human and non-human actors. Indeed, in the period under examination, there was a broad ‘scientific’ or medical consensus extant since Hippocrates which attributed a degree of climatic change to human agency – a claim made more convincing in post-Reformation England and the universal belief in divine providence (see ch. 5). These intersecting discourses gave rise to a reflexive attitude to climate: a theory of differing ‘airs’ shaped by a series of medical, religious, and political events and beliefs.

Air came to be an object of fascination and fear for contemporary physicians and natural philosophers. As described by Carla Mazzia, ‘the haunt and power of the air itself as it

¹⁰⁵ Thomas Walkington, *The Optick Glasse of Humors. Or the Touchstone of a Golden Temperature* (London, 1621), pp. 14-16.

¹⁰⁶ Stephen Paget, *Ambroise Pare and His Times 1510-1590* (London, 1897), pp. 284-5.

¹⁰⁷ Burton, *The Anatomy of Melancholy*, p. 157.

¹⁰⁸ William Clever, *The flower of phisicke Wherein is perfectlie comprehended a true introduction and method for mans assured health* (2nd edn, London, 1590), pp. 11-12.

was understood to effect lives and souls, as it was during this time made “visible” through a range of medical treatises, natural histories, and cultural fictions, and as it was likewise subject to new modes of experimentation and observation.’¹⁰⁹ Five years after Robert Boyle published some of the most influential early works on atmospheric chemistry, including *New Experiments Physico-Mechanical: Touching the Spring of the Air and their Effects* (1660), London was to experience its most devastating plague since the Black Death. Whether as the object of philosophical scrutiny or fear, the air was the subject of intrigue and paranoia amongst a population predisposed to the effects of airborne diseases. Whatever constituted ‘air’, the element was understood in said literature to have a powerful impact over the English body. In Pare’s treatise on the subject, he makes clear his deterministic outlook on the ‘Air’, which being so ‘diverse and variable in its action ... produces a variety of affections and acts in several ways.’¹¹⁰ ‘In a word,’ he claimed ‘the air has dominion over all men and other animals, and over plants, trees, and shrubs.’¹¹¹ For Mouffet, air also maintained the balance between a healthful and unhealthful life. The English body, he said, ‘cannot abide impure airs or live long in health with infected airs’, but also described the nourishment of a ‘pure air’ as being ‘to the heart, as balm to the sinews ... it is both meat, drink, exercise, and Physick to the whole body.’¹¹² Air, in this sense, was a classic Platonic *pharmakon*; a medicine ‘which acts as both remedy and poison, already introduces itself into the body of the discourse with all its ambivalence.’¹¹³

If the condition of the body followed the state of the air, then the individual was also subject to the same wayward ambivalence. Mouffet used his work to embellish upon many

¹⁰⁹ Carla Mazzia, ‘The History of Air: *Hamlet* and the Trouble with Instruments’, *South Central Review*, 26 (2009), pp. 153-196, p.171.

¹¹⁰ Paget, *Ambroise Pare and His Times 1510-1590*, pp. 284-285.

¹¹¹ Paget, *Ambroise Pare and His Times 1510-1590*, pp. 284-285.

¹¹² Mouffet, *Healths improvement*, pp. 13, 15.

¹¹³ Jacques Derrida, *Dissemination* trans. Barbara Johnson (London, 2004), p. 75

observations made by the Dutch Galenist Levinus Lemnius. In the *Touchstone of Complexions*, Lemnius remarks of how the air was equivalent to diet, or food, concerning how it was ingested into the body. However, whereas unwholesome ‘meate may by vomite be cast up again’, once a bad air had been taken ‘in the vitall partes, and enter into the veynes, they settle so surelye and take suche strong possession, that hardlye it is to remedy and againe thence to dispossesse them.’¹¹⁴ For this reason, ‘unwholesome air’ was thought to do ‘more harme to sound health, then meate that is of venemous qualitey.’¹¹⁵ Towards the end of the seventeenth-century, many of the same Galenic beliefs were still commonly held, with Wolsterstan noting the ‘penetrating force’ of the element in his *Enquiry into the causes of diseases in general* (1691). In spite of Boyle’s new developments in atmospheric chemistry, Wolsterstan insists that the body ingests air ‘by Mixing its self with what we eat, and so is carried to the Stomach.’¹¹⁶

Despite the many challenges to early modern Galenism from Paracelsus and his followers, humoral physiology remained the dominant medical paradigm up until the end of the seventeenth century.¹¹⁷ By way of its enduring ubiquity and its comparative simplicity as a heuristic template for treatment, ancient humoral belief was primary to the understanding of climate in early modern Europe. The origins of humoral theory may have been largely hypothetical, however the conspicuous materialism of humoral belief permitted the body *and* climate to be ‘read’ and treated effectively.¹¹⁸ Before the advent of modern meteorological, the four humours retained crucial significance to how contemporaries measured and managed the effects of climate on society. This relationship also gave way to a conceptualisation of

¹¹⁴ Lemnius, *Touchstone of Complexions*, p. 46.

¹¹⁵ *Ibid.*

¹¹⁶ Stanford Wolsterstan, *An enquiry into the causes of diseases in general*, p. 21.

¹¹⁷ For an account of the decline of Galenism in the late-seventeenth century, see Lester S. King, ‘The Transformation of Galenism’, in Allen G. Debus (ed.) *Medicine in Seventeenth Century England* (Berkeley, 1974), pp. 7-31.

¹¹⁸ Nancy G. Siraisi, *Medieval and Early Renaissance Medicine: An Introduction to Knowledge and Practice* (Chicago, 1990), p. 105.

mental health and wellbeing that has persisted into the modern age. Namely, early climate and medical theory has also been taken to explain one peculiar disposition which seemed to exclusively affect the English at the turn of the sixteenth century: melancholy.

‘Through unseasonable weather, they are dul, drowsie, idle, and as heavy as lead’:

Sunlight, Seasonality, and Sadness

As Robert Burton first published his magnum opus, the *Anatomy of Melancholy* (1621), it was in the context of one of the coldest periods of the Little Ice Age and the beginning of the Maunder Minimum.¹¹⁹ This fact has not gone unnoticed by historians. Wolfgang Behringer, in his *Cultural History of Climate* (2010), goes as far to term Melancholia the ‘symptomatic illness of the Little Ice Age.’¹²⁰ For Erik Midelfort, author of the *History of Madness in Sixteenth Century Germany* (1999), Melancholy was naturally associated with the ‘the windy, cold, dry season of autumn, the time of sad storms’, but this connection should not be overstated.¹²¹ The temptation with these discussions would be to associate the English Melancholic ‘moment’ with the far more recent theory of Seasonal Affective Disorder (hereafter SAD).¹²² As well as being profoundly anachronistic, this narrative is completely reductive, more effective as a poetic device than an accurate reflection of climatic ideas. Despite the multitude of emotional states engendered by the national climate, prevailing

¹¹⁹ The ‘Maunder Minimum’ refers to a prolonged sunspot minimum between generally between 1645 and 1715, during which the occurrence of sunspots became exceptionally rare. The term was coined by John Eddy and has since been cited by some to account for the severity of the Little Ice Age. Dagomar Degroot, ‘Climate change and society in the 15th to 18th centuries’, *WIREs Climate Change*, 9 (2018), pp. 1-20; John A. Eddy, ‘The Maunder Minimum’, *Science*, 192 (1976), pp. 1189-1202.

¹²⁰ Wolfgang Behringer, *A Cultural History of Climate* (Cambridge, 2010), p. 119.

¹²¹ Erik Midelfort, *A History of Madness in Sixteenth Century Germany* (Stanford, 1999), p. 162.

¹²² Lawrence Babb ‘Melancholy and the Elizabethan Man of Letters’, *Huntington Library Quarterly* 4 (1941), pp. 247-261.

historical scholarship has overlooked the diverse emotional context of English seasonality in favour of a popular understanding of the ‘melancholic’ English. Even more, retrospective diagnoses of collective mood disorders amongst the English have ignored the cyclic comings and goings of various emotional states. England’s investment with climate was less so characterised by chronic malaise than a complex rubric of competing and contradictory sentiments. From the dog days of summer when cholera ran high under the late summer sun, to the dark, melancholy evenings of midwinter, the English climate was thought to breed a cycle of competing passions.

Taken together, Mary Floyd-Wilson designates these stereotypes as belonging to a tradition of ‘geohumoralism’: the widely held theory that natural variations in topography and climate bestowed a regionally specific temperament upon its inhabitants.¹²³ This provincial branch of humoralism was central to how contemporaries measured ‘good’ and ‘bad’ climates in the proverbial culture of early modern medicine. Echoing classical thought, it was upon the condition of the human body that a climate was chiefly judged; as Tobias Venner explains in *Via Recta*, those belonging to a favourable climate would naturally display positive symptoms: ‘an acute wit, a sound and lively colour, a stable integritie of the head, quicke sight, breathing, or unlistinesse of the limnes’ were all seen as ‘signes the wholesomnesse of the Air is approved, and by the contrary the offensive and noisome breath thereof is detected.’¹²⁴ Signs of a poor air were thought to invoke opposing symptoms, with the preeminent French physician Andre du Laurens notably attributing poor eyesight to windy, low-lying climates and long-life to mountainous, open-air:

It behoveth us for the better preservation of our sight to chuse an ayre which is temperate in his first qualities, as being neither too hot, too cold, too moyst or drie. It

¹²³ Floyd-Wilson, *English Ethnicity and Race in Early Modern Drama*, p. 1.

¹²⁴ Venner, *Via Recta*, p. 283.

is not good to abide in the heate of the Sunne, neither in the beames of the Moone, or in the open aire. The Southern and Northern windes are hurtfull to the eyes ... It is better a great deale to dwell in drie places, and such as are somewhat rising.¹²⁵

The plethora of health regimen and advice books published in the period, from Elyot's *The Castel of Helth* (1536) to Thomas Tryon's *The Way to Health* (1691), confirm the same aphoristic suggestions on how to 'correct' one's local air and their own constitution. In order to maintain a healthy complexion, Vaughan advises, one must abide by a simple humoral logic: 'Hee must use cold things to keepe away the heat, and hot things to expell the cold. He must adde dry things to moyst, and moyst to dry.'¹²⁶ If one were subject to an extreme heat, they would be expected to counter this by 'seasoning' their body with either a change of air, or diet (almond milk and oatmeal was thought to be particularly effective in the case of a heat-wave). Similarly, if one were to experience an icy cold, the English body was expected to counter this by consuming 'hot' and 'dry' foods, hence the English predilection for beef and mustard.

Physicians writing on climate were less concerned by extreme weather events or natural hazards than the boundaries between excess and balance. This is also owing to a political and religious culture which was gripped by the ancient virtue of moderation and the ideal of the golden mean.¹²⁷ To stray too far from this mean, whether toward excessive heat, cold, dryness, or moisture was to risk one's physical and mental health. As bluntly expressed by Mouffet, 'the nearer you come to their extremities, the nearer are you to death.'¹²⁸ A sharp heat could either resuscitate an ailing complexion, or alternately 'generate a grosse adust

¹²⁵ André du Laurens, *A Discourse of the Preservation of Sight: Of Melancholicke Diseases; of Rheumes; and of Old age ... Translated out of French into English ... by Richard Surphlet* (1599) op. cit. Elmer and Grell (eds.), *Health, Disease, and Society in Europe 1500-1800* (Manchester, 2003), pp. 282-284.

¹²⁶ Vaughan, *Directions for Health*, p. 3.

¹²⁷ Scodel, *Excess and the Mean in Early Modern English Literature*; Shagan, *The Rule of Moderation: Violence, Religion and the Politics of Restraint in Early Modern England*

¹²⁸ Mouffet, *Healths improvement*, p. 20.

cholera which comes to be mixed with the blood in the veins, and that brings a condensation and a coagulation to the blood.’¹²⁹ William Clever noted how ‘weather of frosts and snow approve and search the body either to great welfare of much health, or else to speedy death.’¹³⁰ A prolonged cold, dry winter could embolden the body, engender courage within a male but if cold and wet, a ‘phlegmatic’ climate was believed to inspire an inferior complexion: effeminate, ephobic and dim-witted. ‘The nature of women is waterish’, mused Thomas Cohan, ‘and Rue heateth and drieth, therefore ... it diminisheth the nature of men, which is of temperature like unto the aire, that is, hot and moist.’¹³¹

The early modern power of climatic change is none more so evident than considering the believed causes of melancholy. Perhaps the most famous proponent of this theory was Burton, who dedicated two large sub-sections of his most famous work to understanding the deleterious psychological effects of the English climate. His own ‘digression on air’ elaborated on the necessity of a well-earned holiday in the ‘ample fields of air’ where one might ‘freely expiate and exercise.’¹³² Citing Paulus Hentzerus, Burton identifies ‘bad air’ as a chief cause of melancholy; “‘If it be impure and foggy, it dejects the spirits, and causeth diseases by infection of the heart.’”¹³³ For Levinus Lemnius, a certain temperament could likewise depend on the direction of a gale. He described how:

in a thick and cloudy air ... men are tetric, sad, and peevish: And if the western winds blow, and that there be a calm, or a fair sunshine day, there is a kind of alacrity in men's minds; it cheers up men and beasts: but if it be a turbulent, rough, cloudy,

¹²⁹ Walkington, *The Optick Glasse of Humors*, p. 15

¹³⁰ Clever, *The flower of physicke*, p. 39

¹³¹ Cohan, *The Haven of Health*, p. 44. cf. Paster, ‘Unbearable Coldness of Female Being: Women's Imperfection and the Humoral Economy’, *English Literary Renaissance*, 28 (1998), pp. 416-440.

¹³² Burton, *The Anatomy of Melancholy*, p. 288.

¹³³ Paulus Hentzerus op. cit. Burton, *The Anatomy of Melancholy*, p. 288.

stormy weather, men are sad, lumpish, and much dejected, angry, waspish, dull, and melancholy.¹³⁴

The same is repeated by several writers of the period, with varying lyricism. Mouffet mused of how ‘our spirits are as jocund, pleasant, active, and ready as butterflies in Summer’ whereas ‘through unseasonable weather, they are dul, modern, idle, and as heavy as lead, working neither perfectly what they ought, nor chearfully what they would.’¹³⁵ Vaughan advocated a wholesale change of lifestyle during Autumn, when ‘the earth loseth her beautie, and melancholy is ingendred.’ He urges his reader to avoid an eclectic range of melancholia-inducing subjects: including ‘feare, beanes, old cheese, salt beefe,’ and ‘broath of colewoorts.’¹³⁶

Though the exact cause of SAD is not fully understood, symptoms of low mood, depression and lethargy are usually associated with sunlight deprivation during the late autumn and winter. During a period characterised by a series of ‘summerless years’, Behringer retrospectively diagnoses England with seasonal depression based on the advice of Robert Burton’s *Anatomy of Melancholy*. In recent studies, however, the empirical basis for Seasonal Affective Disorder has been questioned. In 2015, researchers from Auburn University at Montgomery collected data from a total of 35,000 participants ranging from age 18-99 who were asked how many had experienced symptoms of depression. Data was then cross-referenced according to geographical location and sunlight exposure for each respondent. The paper concluded that there existed no evidence to support the correlation between lack of sunlight and depressive symptoms. Instead, findings suggested that the notion of seasonal depression ‘may be strongly rooted in folk psychology, but it is not supported by

¹³⁴ Levinus Lemnius op. cit. Burton, p. 288.

¹³⁵ Mouffet, *Healths Improvement*, p.12.

¹³⁶ Vaughan, *Directions for Health*, p. 62.

objective data.’¹³⁷ The study seems to critique an entrenched confirmation bias in SAD studies, claiming – in no uncertain terms that - ‘merely being depressed during winter is not evidence that one is depressed because of winter.’¹³⁸ In spite of the common assumption that UV defines seasonal patterns of depression and associated light box treatment there lacks any scientific consensus on the exact causes of SAD. Fundamentally, the study in question refuted the idea that ‘sunlight exposure was the putative cause of seasonal depression,’ not least because such a methodology would ‘necessitate separating its effects from the effects of co-occurring stressors.’¹³⁹

This is in no way denying the lived experience of the many sufferers of SAD, but to interrogate the historical diagnosis of mood disorders amongst the early modern Melancholics. Though it is difficult to argue, as Behringer has, that Melancholy rose amongst the English as UV exposure declined, there is an irrefutable early modern ‘folk psychology’ which attributed melancholy to seasonal change and darkness. Seasonality was closely allied with the human life cycle. As well as defining one of the four seasons of the year, each bodily humour corresponded with one of the four Ages of Man. Blood presided over infancy and childhood; choler administered adolescence and summer; melancholy governed maturity and autumn; finally, phlegm ascended during old age and winter. This symbolic compatibility gave rise to seasonal ideas of transience and mortality, particularly during the transition between summer and winter. Decline, degeneration, and death characterised the shortening days of late-autumn. Burton regularly refers to melancholy as caused by gloomy, dark, or overcast weather. Yet, a further darkness is regularly referenced. Galen, amongst other classical physicians, refers to an internal darkness as governing mood: ‘As external darkness

¹³⁷ Megan K. Traffanstedt, Sheila Mehta, Steven G. LoBello, ‘Major Depression With Seasonal Variation: Is It a Valid Construct?’, *Clinical Psychological Science*, 4 (2016), pp. 825-834, p. 834.

¹³⁸ *Ibid.*, p. 834.

¹³⁹ *Ibid.*

renders almost all persons fearful ... thus the color of the black humor induces fear when its darkness throws a shadow over the area of thought.’¹⁴⁰

While the idea that winter heralds discontent features as an evocative, elegiac idea, the implication of causality between weather and psychology overlooks a far more interesting topic of historical study: the *illusion* of causality between these two subjects. In order to construct a more intellectually engaging study of climatic change, historical enquiry should be redirected from the endless hunt for causality and examine the enduring fascination with climatic change we share with our early modern antecedents. To be clear, this is not to deny that causality between environmental and human agents exists. However, lacking reliable data an effort should be made to distance scholarship from climatic reductionism by paying greater heed to periods of atmospheric (or humoral) transition as arbiters of climatic understanding.

Contemporary medical writers were notably hesitant when it came to demarcating ‘bad’ weather conditions; instead repeating the harmful effects of a rapidly changing climate. The worst symptoms of an ailing environment were not associated with atmospheric stasis, but periods of capricious and unpredictable change. It was during the ‘wavering seasons of the yeare, as when the body and the elementes are both corrupted together,’ William Clever argued, that ‘the most dangerous diseases fall out.’¹⁴¹ To change climate, whether by travel or abrupt seasonal change, was to leave oneself exposed to the elements. ‘Upon the Change of Weather,’ Tryon considers the body to be ‘indisposed and presently tired, and out of Breath, and troubled with an inward heat and drought, continually calling for Supplies of *Drink*, which does but promote Disorder, and swell the Body, and make the Exercise more burthensom.’¹⁴² Consequentially, medical writers would suggest advice on a seasonal basis; distinguishing between the more harmful, *transitional* seasons of spring and autumn and the

¹⁴⁰ Galen, *On the Affected Parts* trans. Rudolph Siegel (Basel, 1976), p. 93.

¹⁴¹ Clever, *The flower of physicke*, p. 20.

¹⁴² Tryon, *The Way to Health*, p. 241

continuity associated with summer and winter. Anxieties chiefly surrounded a period identified by Thomas Tryon between ‘the *middle of June* to the *last of October*’ as the ‘most dangerous to contract Diseases in.’¹⁴³ Autumn, in particular, was thought to be especially detrimental to one’s constitution ‘because the bloud discending, is overtaken with coldnesse.’¹⁴⁴ This wasn’t due to the essential qualities of these seasons as much as the climatic inconsistency associated with these months. It was ‘under which said times,’ that William Clever describes a ‘great changeableness in nature’:

for that not onely simple corruptions are then easily taken hold of, but all generall infections of pestilences are ouerspread, in swallowing vp the life of men, for which cause moystnesse and heat, and of most excelling quicknesse and full of life: and yet distemperance therewith hath full and large coniunction and corruption to doo harme herein.¹⁴⁵

There were widespread anxieties about the English body being unsuited to a changeable clime, whether home or abroad. However, in the case of early modern English bodies, it was not so much the condition of being ‘too hot’ or ‘too cold’ that threatened one’s complexion but the rate of this change. Scholars of early colonialism are quick to note how the change from the ‘temperate’ shores of England to the tempestuous and sometimes extreme weathers of North America presented an enduring challenge to the English explorer, but few consider that these violent adaptations were also made on a domestic level.

Though the degree of change was unquestionably weaker in England, as opposed to the intrepid voyages into North America, the same issues were often raised: i.e. how the body could be ‘seasoned’ to adapt to a changing clime, and whether a short, quick change in

¹⁴³ Tryon, *The Way to Health*, pp. 95-96. Italics pre-existing.

¹⁴⁴ Clever, *The flower of physicke*, p. 53.

¹⁴⁵ *Ibid.*, p. 55

climate can produce a lasting humoral imbalance. In Karen Kupperman's seminal article, 'The Puzzle of the American Climate in the Early Colonial Period', she cites the prevailing belief that the English body could 'thrive only in moderate circumstances, at the mean of heat and cold, high land and low.' If they were to jettison themselves into a 'foreign climate' (i.e. 'an area of tropical heat and humidity') their 'essential character would disintegrate.'¹⁴⁶ Few have challenged Kupperman's 1982 article, and rightly so – it remains a vital foundational text when considering the cultural history of the early modern climate. What the article does neglect, however, was the belief that these same pressures could apply to England. The pernicious threat of drought (and subsequent urban fires); large-scale floods; deep frosts and unending winters all contributed to the challenges facing English communities. As the next chapter will demonstrate, these challenges were also the product urban pollution in its many guises. Shakespeare's notion of England as 'this other Eden, demi-paradise' gradually deteriorated in the face of emerging environmental realities, not least the rapid urbanisation of metropolitan areas.¹⁴⁷ For the upper echelons of English society, London's infamous smog inspired many to habitually evacuate toward country-airs.

The pathological obsession with one's domestic climate was also paired with broader concerns over the humoral disposition of Englishmen. The English were often renowned for their tempestuous, inconstant temperament; 'the sea tumbleth perpetually about,' mocked James Howell, 'so their braines do fluctuat in their noddles, which makes [the English] so variable and unsteady.'¹⁴⁸ Tryon warns that the English weather, with its great variance, could 'openeth the Pores, causeth Sweating, and as it were a continual Evaporation of the Spirits,

¹⁴⁶ Karen Kupperman, 'The Puzzle of the American Climate in the Early Colonial Period', *The American Historical Review*, 87(1982), pp. 1262-1289, p. 1266.

¹⁴⁷ William Shakespeare, *Richard II* (Act 2; Scene 1)

¹⁴⁸ James Howell, *A German Diet: or, the Balance of Europe* (1653), p. 54.

which causeth a kind of fainty Indisposition to possess the whole Body.’¹⁴⁹ Between the summer and autumn, he describes the body being at its most vulnerable to the elements: pores open, weakened by the sun and ‘fainty’ in disposition. This transitional complexion, particularly associated with the English, is noted by medical writers of the period as ‘intemperance’: a humoral limbo between excessive exposures to heat or cold and temperate ‘balance’. Because of their fluctuating climate, the English were genuinely believed to be ‘excessively porous’.¹⁵⁰ According to the cognitive scientist John Hutton, the Englishman’s body was thought of as ‘overly vulnerable to the idiosyncratic impressions of a hostile world ... thus prone to “absorb foreign vice indiscriminately.”’¹⁵¹ Yet, behind these poetic interpretations lay an empirical truth. England was (and remains) unique in its susceptibility to several different weather fronts, leading Thomas Coghlan to believe that the British Isles encompassed five separate climates: ‘having on the South-East side *France*, on the North-East, *Norway*, on the South-West *Spaine*, on the West *Ireland*, on the North *Scotland*.’¹⁵² Certainly, the level of seasonal variability experienced throughout England at the time Coghlan was writing would have supported the classification of the English climate as prone to instability.

The enduring characterization of the English climate as inconstant is especially pertinent when considering the context of the LIA. Though the misnomer ‘Little Ice Age’ suggests a period of protracted cold, many historical climatologists since Hubert Lamb have been eager to indicate how ‘the difficulties imposed by the climate in the LIA were not only due to the lower temperatures’ but ‘an enhanced variability of the temperature level.’¹⁵³

¹⁴⁹ Tryon, *The Way To Health*, pp. 95-96.

¹⁵⁰ *Ibid.*, p. 54.

¹⁵¹ John Sutton, ‘Spongy Brains and Material Memories’, in Wilson and Sullivan (eds.) *Environment and Embodiment* (Basingstoke, 2007), pp. 14-34, p. 15.

¹⁵² Coghlan, *The Haven of Health* (London, 1636), iii.

¹⁵³ Lamb, *Climate, History and the modern world*, p. 220

Rather than picturing a vast, homogenous ‘deep freeze’, Brian Fagan imagines a ‘climatic seesaw’ upon which the British Isles (and much of the Northern Hemisphere) ebbed and flowed. As Fagan nonchalantly suggests, a modern European ‘would not find the climate very different, even if winters were sometimes colder than today and summers very warm.’¹⁵⁴ Fagan is possibly correct; to a modern observer, the LIA would have quite possibly felt similar in temperature. From a historicist perspective, this speculation distracts from a more sophisticated interpretation of climatic sensitivity. It is neither the intention of this thesis to project backwards a contemporary understanding of climate onto our early modern antecedents, nor to assume that this relationship is qualitatively indistinguishable. As alluded to, we may identify some hangover between early-modern humoral knowledge in our contemporary colloquialisms; however, the difference between the philosophical precepts upon which climate theory was based are so radically different as to not serve any academic value. The assumption that a modern observer may not detect much, or any, qualitative difference in climate is not only irrelevant, but presumes that early moderns equally lacked the capacity to distinguish between sensitive changes in their aerial environment. Even when the humoral subject was ostensibly stable, Paster reminds us, the language of Galenism constructed a bodily self-experience which was perpetually changing.¹⁵⁵

In the context of humoral maintenance, the individual will was depleted in favour of a vision of the body which ‘ascribes to the workings of the internal organs an aspect of agency, purposiveness, and plenitude to which the subject’s own will is often decidedly irrelevant.’¹⁵⁶ This, in turn, contributed to an understanding of climate in flux. Though early moderns lacked the rigour of contemporary meteorological analysis, through the tenets of humoralism as disseminated in oral and print culture, many relied on an astute awareness of the transference

¹⁵⁴ Brian Fagan, *The Little Ice Age: How Climate Made History, 1300-1850* (New York, 2001), p. 47

¹⁵⁵ Paster, *The Body Embarrassed*, p. 10

¹⁵⁶ *Ibid.*

between corporeal self and external world. Without advanced techniques of measurement, self-reliance on humoralism developed a delicate understanding of seasonal and atmospheric change. The timing of bodily events often reflected the changing of the seasons, with climatic vulnerability informing a calendar for purging, bleeding, eating, drinking, sleeping, exercising, and bathing.¹⁵⁷

Just as disease flourished in the changeable climate of early modern England, so too did a theory of healthiness which was often continuous with climatic variability. Albeit unknowingly, our early modern antecedents faced an epochal shift in the global climate. As temperatures dropped, droughts became harsher and natural disasters more frequent, attention was thus drawn to questions of how said anomalies were to impact daily life, and, specifically, the body. If we are to define climate as the ‘total experience of the weather at any place over some specific period of time’, as Hubert Lamb does, then our study of climate should reflect this supposed totality.¹⁵⁸ By limiting our study of climate to the catastrophic scenario, we privilege one facet of this ‘total experience’ over the habits, behaviour, and customs, which attribute such power to the idea of climate. Where traditional histories have treated climatic change on a macro-scale, the above has begun to develop an original treatment of the subject according to previously neglected source material.

Tempting as it is to denigrate humoralism as an esoteric curiosity, the fact remains that Galenic belief in its various formats constituted the dominant paradigm for explaining weather. According to a long tradition of western philosophy, the balance of nature was registered according to a cognitive awareness of temperature and humidity: a combination of cold/hot/dry/moist substance. This relationship was not wholly defined by recurrent providential chastisements (as some treatments of English climate history seem to suggest),

¹⁵⁷ Georges Vigarello, *Concepts of Cleanliness: Changing Attitudes in France since the Middle Ages*, trans. Jean Birrell (Cambridge, 1988), pp. 9-20.

¹⁵⁸ Lamb, *Climate and the Modern World*, p. 8.

but one based on the supposed contingency between body and climate as disseminated by a variety of popular medical, geographic and early 'scientific' sources. The result of these various medical discourses was a chronic sensitivity to differing 'airs', spaces, seasonal changes, and humoral balance. This sensitivity manifests itself in debates over the character of the English, their susceptibility to various mental and physical ailments and also their own effects on the constitution of the native air. As the subsequent chapter will analyse, these ideas also impacted how early moderns understood the negative consequences of their behaviours on the condition of their airs.

CHAPTER TWO: POLLUTING CLIMATE

In early modern England, ‘pollution’ was inescapable yet indefinable. Whether originating from sea-coal mined from Tyneside, organic vapours and miasmas, or the effluvia produced by swearing, flatulence and smoking, the idea of pollution was unrestricted to fuel emissions. ‘Pollution’ came from organic and inorganic origins to encompass a physical and moral concern. If the idea of climate in the early modern period originated from medical knowledge, the idea of pollution emerged within a paradigm that granted substantive agency to air, whether in a climatological, epidemiological, rhetorical or respiratory context.

Concerns over deteriorating air quality were framed with the language of environmental responsibility, moral respectability, and spiritual transgression. By the end of the seventeenth-century, ‘pollution’ was consistently used in technical definitions of ecological degradation by sea coal production, yet the term had held moral connotations since the beginning of the sixteenth century. The spiritual significance of ‘pollution’ was expedited by post-Reformation theology, particularly the work of John Calvin. Unlike present-day conceptions of pollution, the distinction between environmental and moral pollution was marginal in the early modern period. In its early modern usage, Bruce Boehrer describes how pollution ‘would refer simultaneously to spiritual and material conditions, to “sin” as well as to “uncleanness” in its physical or environmental dimension.’¹ In most historical treatments of early modern pollution, however, definitions reproduce contemporary concerns rather than the complex reality of England’s urban environments. Pollution acted as material and moral concern, as reflected in the etymology of the term. By examining the semantic evolution of pollution, from a Calvinist signifier of heterodoxy, sin and uncleanness, toward an

¹ Bruce Boehrer, *Environmental Degradation in Jacobean Drama* (Cambridge, 2013), p. 32.

exclusively environmental term, the beginning of this chapter will explain the long-standing cognate between forms of environmental and cultural pollution.

The second half of the chapter will examine medical opinion on the effects of undesirable chemical agents (namely sulphur dioxide) but also reflect on the early modern idea of moral toxicants. Though overlooked in modern historiography of energy, the late sixteenth and early seventeenth century represented a turning point (if not a tipping point) in coal consumption and fossil fuel usage. Domestic coal burning exploded in popularity, as nascent ‘environmentalists’ appealed for government restrictions on fuel usage.² Tracing the beginnings of England’s fossil fuel abuse, the chapter will examine the disproportionate blame levelled at the working poor for London’s progressively dirtier air. Simultaneously, richer inhabitants of the City would habitually vacate the smoggy metropolis toward cleaner country air. According to early modern medical opinion described above, the humoral subject could also act as a vessel of toxicity. As such, this will argue for a new definition of ‘organic pollution’: an acknowledgement of the varied human and non-human origins of pollution in early modern England. Regulating one’s own impact on air quality could involve burning less sea coal but also simply breathing sweetly, not swearing or smoking. Early modern sources of pollution stretched beyond sea-coal smoke to encompass the proliferation of pestilent airs and miasmas, as well as the effects of swearing, bad breath, oath-breaking and smoking on localised environments. As will be shown, these moral pollutants were subject to modes of social disciplining associated with the so-called ‘Reformation of Manners’ during the late-Elizabethan and Stuart Period.³ Revisiting the seminal work of Mary Douglas, the chapter argues for a new understanding of pre-modern pollution that acknowledges the significant

² Peter Brimblecombe, *The Big Smoke: A History of Air Pollution since Medieval Times* (Abingdon, 1987)

³ See Steve Hindle, *The State and Social Change in Early Modern England, 1550–1640* (Basingstoke, 2002), pp. 176-203.

overlap between definitions of technical and non-technical pollution.⁴

The ‘serial vigilance’ described in the previous chapter found expression concerning individual health, but also public health. The actions of others could produce significant harm to the collective, whether physically or spiritually. As a result, scapegoats were found, campaigns were launched and perceived ‘pollutants’ were chastised by the law. In early modern England, environmental pollution – taken as the contamination of air or water – signified moral depravity and decay in the same way that moral (or cultural) pollution – cursing, blaspheming, smoking and oath breaking – involved environmental effects. It is often considered axiomatic that early modern ‘pollution’, with its moral and theological connotations, was a distinctly separate idea. To mention ‘pollution’ in an early modern context was to commit the historian’s cardinal sin: anachronism. As noted by William Cavert, according to current scholarship ‘both the thing and the word ‘pollution’ were new in the nineteenth century.’⁵ According to this narrative, it was only after the industrial revolution and the effects of modern capitalism that the feedback of rapid fossil fuel consumption irreversibly harmed the ‘environment’. Yet as recent interventions by Cavert, Ken Hiltner as well as overlooked works by Peter Brimblecombe and other historical epidemiologists have shown, air pollution as both a material reality and idea has existed prior to the nineteenth century.

⁴ Mary Douglas and Aaron Wildavsky, *Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers* (Berkeley, 1982); Mary Douglas, *Purity and Danger: An Analysis of Concepts of Taboo and Pollution* (Abingdon, 1966).

⁵ William Cavert, *The Smoke of London: Energy and Environment in the Early Modern City* (Cambridge, 2016), p. 5.

‘Defile, or distaine, or make filthie’: Defining Early Modern Pollution

The turn of the seventeenth century in England represented a watershed moment in terms of domestic and global fossil fuel consumption. Despite this, historians of energy, fuel, and pollution rarely orient their studies around the early modern period. The historiography of pollution is indelibly tied to the late nineteenth and early twentieth century, revolving on the apex of the second industrial revolution. Works by Peter Thorseim, Stephen Mosley, David Stradling and Frank Uekotter perpetuate a singularly ‘modern’ understanding of energy consumption and pollution.⁶ Other historians have sought to extend the historical chronology of pollution beyond the nineteenth century. Peter Brimblecombe’s *The Big Smoke: A History of Air Pollution since Medieval Times* (1987) offers an essential analysis of changing patterns of consumption over five-hundred years, though his study lacks cultural context and fails to acknowledge the changing definition of pollution in early modern England.⁷ Peter Thorseim’s contribution to the historiography of pollution, though a significant treatment of the changing meanings of smoke, crucially neglects a pre-modern history of smoke.⁸ Recently, William Cavert’s *The Smoke of London: Energy and Environment in the early modern City* (2016), has made significant strides towards establishing the seventeenth century as a period of environmental change. However, where his study excels in giving a greater sense of the social

⁶ Nineteenth century historians often identify the second industrial revolution as the advent of ‘pollution’ as an environmental term. Cavert identifies a series of articles and monographs which adhere to this rule, including, but not limited to: Stephen Mosley, *The Chimney of the World: A History of Smoke Pollution in Victorian and Edwardian Manchester* (Cambridge, 2001); David Stradling, *Smokestacks and Progressives: Environmentalists, Engineers, and Air Quality in America, 1881–1951* (Baltimore, 2002); Melanie Dupuis (ed.), *Smoke and Mirrors: The Politics and Culture of Air Pollution* (New York, 2004); Angela Gugliotta, “Hell with the Lid Taken Off:” A Cultural History of Pollution – Pittsburgh’ (University of Notre Dame, PhD Dissertation, 2004); Frank Uekotter, *The Age of Smoke: Environmental Policy in Germany and the United States, 1880–1970* (Pittsburgh, 2009).

⁷ John Evelyn, *Fumifugium, or, The inconveniencie of the aer and smoak of London dissipated together with some remedies humbly proposed by J.E. esq. to His Sacred Majestie, and to the Parliament now assembled* (London, 1661). See also Mark Jenner, ‘The politics of London air: John Evelyn’s “Fumifugium” and the Restoration’, *The Historical Journal*, 38 (1995), pp. 535-551.

⁸ Peter Thorseim, *Inventing Pollution: Coal, Smoke, and Culture in Britain since 1800* (London, 2006)

and legal history of smoke, it neglects other pre-modern ideas of pollution. For Thorsheim, early modern pollution ‘came not from energy or industry, but from natural biological processes.’⁹ Reformers like John Evelyn were unrepresentative of the early moderns and ‘his position remained an isolated one for the following two hundred years’.¹⁰ Smoke, according to Thorsheim, was not ignored but praised for its prophylactic qualities. Only after the second industrial revolution was pollution considered a medical and environmental threat, or so we are told. According to Adam Rome’s 1996 article, Americans had very rarely used ‘pollution’ or ‘pollute’ to describe the human degradation of the natural environment until after the Civil War.¹¹ Before then, pollution retained its pre-modern connotations of ‘violation, perversion or corruption of moral standards.’¹²

In early modern England, ‘pollution’ was certainly more linguistically flexible than today. In Robert Cawdrey’s *A Table Alphabeticall* (1604), the writer associates the word ‘pollute’ with actions to ‘defile, or distaine, or make filthie’.¹³ From the Old French ‘polluere’ (‘to soil or defile’), the term in its early modern context most often referred to perceived threats to social order and collective sanctity. What is now referred to as air pollution was designated then with the Hippocratic terminology of ‘noxious vapours’ and ‘rotten airs’. Air was more often ‘contaminated’ or ‘tainted’, not polluted. Legal historians have noted the conspicuous absence of air and water pollution from political debate up until the end of the nineteenth century.¹⁴ In part, this is true. Throughout early modern politics, as well as the law,

⁹ Thorsheim, *Inventing Pollution*, p. 2

¹⁰ Thorsheim, *Inventing Pollution*, p. 3, 17.

¹¹ Adam W. Rome, ‘Coming to Terms with Pollution: The Language of Environmental Reform, 1865-1915’, *Environmental History*, 6 (1996), pp. 6-28, p. 6.

¹² *Ibid.*

¹³ Robert Cawdrey, *A Table Alphabeticall* (1604), fol. G5r.

¹⁴ John Copeland Nagle, ‘The Idea of Pollution’, *UC Davis Law Review* 43 (2009), pp. 1-78, p. 10; D.M. Provine, ‘Balancing Pollution and Property Rights: A Comparison of the Development of English and American Nuisance Law’, *Anglo-American Law Review*, 7 (1978), pp. 31-56; Joel Franklin Brenner, ‘Nuisance Law and the Industrial Revolution’, *Journal of Legal Studies*, 3 (1974), pp. 403-433; J.P.S. McLaren, ‘Nuisance Law and

statesmen rarely allude to environmental ‘pollution’. In a judicial context, the earliest mentions of pollution refer to a variety of threats to human environments and institutions: the Church, the family home and government. In 1616, the former speaker and Justice John Coke reprimanded an alleged murderer by claiming the spillage of blood as ‘a crying sin ... which doth pollute the land.’¹⁵ Croke’s judgment takes cue from biblical precedent, specifically Numbers 35:33: ‘So ye shall not pollute the land wherein ye *are*: for blood it defileth the land: and the land cannot be cleansed of the blood that is shed therein, but by the blood of him that shed it.’ A further case from 1626 was brought against a Minister who ‘took the cups and other vessels of the Church, consecrated to holy use, and employed them in his own house, and put barm in the cups, that they were so polluted, that the communicants of the parish were loath to drink out of them.’¹⁶

Though the law offered some protection from ‘bad air’ under nuisance legislation, this wasn’t referred to as ‘pollution’. By around the turn of the sixteenth century, one’s protected property easements included ‘wholesome air’ on the basis that nuisance or air pollution was legally identified as a form of trespass.¹⁷ Clean air was perceived as a common right: ‘light and sweet air’, clarified the soon-to-be Chief Justice Edward Croke in 1587, ‘were as necessary as pure and wholesome water’¹⁸ If restricted of such necessities, the Hales case of 1569 recognised that one could *technically* seek compensation.¹⁹ In practice, however, common law precedent was unclear when it came to identifying air quality standards.²⁰ A notable example of nuisance law in practice (or, at least, pollution materialising in

the Industrial Revolution - Some Lessons from Social History’, *Oxford Journal of Legal Studies*, 3 (1982), pp. 155-221.

¹⁵ King v. Taverner (1616), *The English Reports*, 174 vols. (Edinburgh, 1900-1930), vol. 81, pp.144, 146.

¹⁶ Smith v. Clay (1627) *The English Reports*, 174 vols. (Edinburgh, 1900-1930), vol. 124, p. 294.

¹⁷ Cavert has written extensively on the history of air pollution as nuisance, for reference see *The Smoke of London*, esp. pp. 64-78; Cavert, ‘A Right to Clean Air? Coal Smoke, Property, and Nuisance Law in early modern London’, Presented at the World Conference on Environmental History. Copenhagen. August 6, 2009.

¹⁸ Bland v. Moseley op. cit. Cavert, *The Smoke of London*, p. 64.

¹⁹ Cavert, *The Smoke of London*, p. 73.

²⁰ Ibid.

prosecution) was in 1578, when Elizabeth I had refused to enter London on the grounds she ‘findeth herself greatly greved and annoyed with the taste and smoke of sea cooles.’²¹ Consequently, a dyer and brewer who had recently established businesses in Westminster were imprisoned. As this case makes clear, complaints were subject to a considerable disparity in status and power between plaintiff and defendant. Smoke, and its explicit association with the urban poor, gave ammunition to later reformers, like Evelyn, who desired to prohibit ‘the farther exorbitant increase of Tenements.’²²

Here, it is necessary to distinguish between the competing meanings of pollution in a sociological, legal and historical context. In his analyses of the idea of pollution, the legal historian John Copeland Nagle identifies ‘a narrow view limited to effects on the air, water, and natural environment; and a broad view that incorporated the moral connotation similar to terms such as “defilement” that characterized a host of effects upon human environments.’²³ The latter definition has experienced resurgence in recent legal history: in complaints against pornography, graphic violence and hostile work environments, other forms of cultural pollution are legislated against.²⁴ Referring to the pioneering work of Mary Douglas, Nagle’s work urges a reconstitution of pollution, examining the legal construction of what can be considered a pollutant and an effected environment. Indeed, it would be sacrilegious to mention the sociological definition of pollution without referring to Douglas’ *Purity and*

²¹ Robert L. Galloway, *A History of Coal Mining in Great Britain* (London, 1889), p. 24.

²² John Evelyn, *Fumifugium*, p. 25

²³ Nagle, ‘The Idea of Pollution’, p. 10

²⁴ Perhaps the most famous legal example of moral or cultural pollution was decided by the US Supreme Court in 1971, in *Rogers v. EEOC*. Under the Civil Rights Act, Josephine Chavez argued that their employer segregated patients on the basis of race. Judging in favour of Chavez, Judge Irving Loeb Goldberg used the supposedly antiquated definition of pollution to reprimand Chavez’ employer: ‘One can readily envision working environments so heavily polluted with discrimination as to destroy completely the emotional and psychological stability of minority group workers, and I think Section 703 of Title VII was aimed at the eradication of such noxious practices.’ Since *Rogers v. EEOC*, the same definition of pollution has been referenced by the Supreme Court, most recently in 1998. In the USA, more than one hundred other cases of hostile work environments have went to court which refer to sexism, racism and other forms of discrimination as potential pollutants.

Danger: An Analysis of Concepts of Taboo and Pollution (1966) and her famous description of dirt as ‘matter out of place’.²⁵ As an anthropological study into the social construction of pollution, Douglas’ work has been overwhelmingly influential. Any academic discussion of pollution, whether historical or contemporary, is incomplete without casual mention of Douglas’ maxim. However, its application to early modern historiography is fraught with several methodological considerations. Early modernists, such as Mark Jenner, have taken exception with the structuralism associated with Douglas’ work which can be considered at odds with a tradition of medical materialism in early modern public health studies. Cavert takes up this point in *The Smoke of London*, claiming ‘while “matter out of place” is a memorable formulation, it is not at all clear that her ideas are easily compatible with the concern for medicine and science that has informed most early modern and modern historians’ studies of environmental pollution.’²⁶

By privileging discussions of structure and social order over contemporary sanitary practices and perceptions of cleanliness, certain historians would claim that Douglas’ understands historical environments without regard for material realities. This is not to say that Douglas’ work is of no use to the early modern historian. On the contrary, the distinction her work draws between ‘technical’ and ‘non-technical’ meanings of pollution can elucidate the powerful moral connotations of early pollution ideas. As Jenner and Cavert explain, the kind of structuralism peddled by Douglas ‘must incorporate medical thought and professional practice in order to understand how and why early modern English people cleaned their streets, buried their dead, emptied their cesspits, and assessed their smoky capital.’²⁷ It should

²⁵ Mary Douglas, *Purity and Danger: An Analysis of Concepts of Taboo and Pollution* (Abingdon, 1966), p. 36.

²⁶ Cavert, *The Smoke of London*, p. 9.

²⁷ Ibid., p. 9. Mark Jenner, ‘Early Modern Conceptions of Cleanliness and Dirt as Reflected in the Environmental Regulation of London, c. 1530-1700’ (Oxford: D Phil Thesis, 1992); ‘Death, Decomposition and Dechristianisation? Public Health and Church Burial in Eighteenth-Century England’, *English Historical*

also incorporate the kinds of non-technical forms of pollutions discussed by Douglas and interrogate the significant intersections between medical thought and moral authority within discussions of cleanliness and environmental practices. Foremost, this means acknowledging the certain linkages between medico-environmental definitions and an etymology of pollution in post-Reformation England as a signifier of sin, heterodoxy and moral disorder.

To consider the diverse applications of early modern 'pollution', it is useful to consult Douglas' other definition of the term in the follow up to *Purity and Danger*, co-written with Aaron Wildavsky. At its basis, they state, 'pollution, defilement, contagion, or impurity implies some harmful interference with natural process.'²⁸ Beneath this broader definition, the pair identify a recurrent double meaning of pollution in popular rhetoric. Firstly, they consider a 'technical' definition of pollution: i.e. 'when the physical adulteration of an earlier state can be precisely measured'. A secondary, 'nontechnical' sense denotes moral or cultural contamination in which 'pollution is a contagious state, harmful, caused by outside intervention, but mysterious in its origins.'²⁹ To demonstrate these differences, Douglas and Wildavsky use the analogy of a muddied river: 'A river that flows over muddy ground may be always thick; but if that is taken as its natural state, it is not necessarily said to be polluted.' Whereas a technical definition of pollution requires the precise measurement of contamination, particularly the moment of physical adulteration, the non-technical definition requires no such specificity. For this reason, non-technical (or cultural) pollution is not only ambiguous in origin but morally loaded and politically useful.

Throughout the remainder of this chapter, this second definition will be integral to our discussion of early modern pollutants. This interpretation is particularly significant in the

Review, 120 (2005), pp. 615-632; 'Follow Your Nose? Smell, Smelling, and Their Histories', *American Historical Review*, 116 (2011), pp. 335-351.

²⁸ Mary Douglas and Aaron Wildavsky, *Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers* (Berkeley, 1982), p. 36.

²⁹ Douglas and Wildavsky, *Risk and Culture*, p. 36.

context of early modern England, a time when attributing causation to pollution was shrouded in the mysteries of providence and the ambiguities of 'air'. As described, it was a period in which pollution was used to legislate against a diverse set of socially unacceptable behaviours. Douglas and Wildavsky's definition begs a further question: if all pollution 'implies some harmful interference with the natural process', who - or what - constituted an 'interference' and 'natural process' in early modern England? In a religious context, scholars have long recognised the significance of non-technical 'pollution' in the discursive arena of post-Reformation Europe. Perhaps the most noteworthy starting point when considering the semantic evolution of pollution is found in John Calvin's *Institutes of the Christian Religion* (1536). An obsession with the imagery of pollution pervades Calvin's magnum opus, which mentions the term approximately one hundred times in various contexts.³⁰ Calvin uses the word as a by-word for sin, explaining in his commentary on Psalms that: 'sins resemble filth or uncleanness as they pollute us and make us loathsome in the sight of God, and the remission of it is therefore aptly compared to *washing*.'³¹ Categorically speaking, Calvin's use of the term belongs to a tradition of moral pollutants and desire to preserve the boundaries between the sacred and profane. However, Calvin's definition also speaks to the materiality of sin, frequently using the language of contagion, quarantine and sanitation.

The post-Reformation application of 'pollution' was socially divisive, weaponised by a confessional majority against religious minorities. Early modern 'pollution', to quote again from Douglas and Wildavsky, was invoked to 'uphold conceptual categories dividing the moral from the immoral and so sustain the vision of the good society.'³² This was most certainly the case in the context of the most violent episodes of the sixteenth and seventeenth-

³⁰ John Calvin, *Institutes of the Christian Religion* (1536) trans. Henry Beveridge (London, 1854).

³¹ John Calvin, *Commentary on The Book of Psalms*, trans. Rev. James Anderson, 4 vols. (Edinburgh, 1846) vol. 2, p. 284.

³² Douglas and Wildavsky, *Risk and Culture*, p. 36.

centuries. In Natalie Zemon Davis' epoch-making 1973 article, 'The Rites of Violence: Religious Riot in Sixteenth-Century France', 'pollution' is referenced on many occasions as a by-word for the confessional 'other'.³³ Referencing Douglas' *Purity and Danger*, her thesis stresses the centrality of 'pollution' to the mission of religious rioters who sought to quarantine and destroy the contamination of heretical belief. 'The word "pollution" is often on the lips of the violent,' Zemon Davis confers, 'and the concept serves well to sum up the dangers which rioters saw in the dirty and diabolic enemy.'³⁴ Though lacking contemporary connotations of environmental degradation, the word continued to illicit images of uncleanness and transgression. More often, these connotations were bound up with lascivious rumours of moral depravity: during the Wars of Religion, Zemon Davis describes how Protestants' sense of Catholic pollution revolved around the infidelities of the clergy, whereas Catholics cited conspiracies of clandestine orgies amongst demons, witches and Huguenots.

Using Calvin's soteriology as an example, Zemon Davis identifies 'pollution' with a desire for moral order. To a religious *mentalité* inclined to oppositional thought, 'pollution' served as a threat to confessional homogeneity. In John Stachniewski's monograph of the same name, he describes the 'persecutory imagination' of English Protestantism as being 'captured by the questions of whether or not they were members of the elect, and how the life of the elect (and of the elect community), in contradistinction to that of the reprobate should be ordered.'³⁵ This same necessity for soteriological 'order' was, I argue, reflected in the post-Reformation etymology of pollution. In William Bouwsma's biography of the reformer, he

³³ Natalie Zemon Davis, 'The Rites of Violence: Religious Riot in Sixteenth-Century France', *Past & Present*, 59 (1973), pp. 51-91. Zemon Davis herself references Douglas' *Purity and Danger*, commenting: 'for the theory in this paragraph, I have found helpful Mary Douglas's remarks on the relation between pollution fears and concern for social boundaries.' Her work specifically references ch. 7.

³⁴ Zemon Davis, 'The Rites of Violence', p. 57.

³⁵ John Stachniewski, *The Persecutory Imagination: English Puritanism and the Literature of Religious Despair* (Oxford, 1991), p. 11.

relates Calvin's obsession with pollution to 'a numinous horror of mixture, of failure to maintain the discrete identities of things by preserving their boundaries; mixture, for him, was again tantamount to a descent into chaos, non-being, the abyss.'³⁶ The fear of 'mixture' is abound in the writings of Calvin, with *sola scriptura* itself designed to impede any possibility of ideological impurity.³⁷ Referencing Douglas's famous maxim, Bouwsma demonstrates how 'excrement, for Calvin, was not simply matter out of place; as an image of formlessness that is of chaos, it summoned up his deepest apprehensions of the void.'³⁸ It is no coincidence that such ideas arose in a culture predisposed to contagious disease, whether by polluted waterways or imagined fears of atmospheric contamination. The olfactory world of early modern England was teeming with danger and these fears were compounded by the arrival of further airborne contaminant: smoke.

'Eclipsed in such a cloud of sulphur': John Evelyn, Coal, and London's New Pollution

Coal's conquest over London had been both rapid and unique. On the eve of the Restoration, nowhere else in Europe mined the same quantities of coal during the early modern period, with perhaps three to four times more produced in Britain than the whole of the continent combined.³⁹ This was, in part, driven by a mass shortage of timber by the late-sixteenth century. Though the Black Death had brought an abundance of wood during a period of reforestation, this was to be met by the exceptional rate of timber consumption in the late-sixteenth century. The massive shortfall in timber by the mid-century had triggered a huge

³⁶ William J. Bouwsma, 'John Calvin's Anxiety', *Proceedings of the American Philosophical Society*, 128 (1984), pp. 252-256, p. 255.

³⁷ *Ibid.*

³⁸ *Ibid.*

³⁹ Eleanora M. Carus-Wilson, *Essays in Economic History* (London, 1954), p. 98.

inflation in price that, by some estimates, had increased cost by around 700% between 1550-1630.⁴⁰ Simultaneously, London in particular experienced a well-documented population boom. From 1565 to the end of the century, historical demographers have estimated that the population of London increased from 80,000 to 180,000.⁴¹ And, by 1700, an estimated 11 percent of England's population resided in the Capital.⁴² Wood scarcity, coupled with the pressure of urbanisation, led John Stowe to describe how 'in all haven-towns and in very many parts within the land, the inhabitants in general are constrained to make their fires of sea-coal.'⁴³

By the end of the sixteenth century, coal had spread beyond the capital; William Cecil observed that 'London and all other towns near the sea ... are mostly driven to burn coal ... for most of the woods are consumed.'⁴⁴ Sea-coal, primarily mined from the North Sea shores of Newcastle, provided a cheap, reliable and effective solution to the nation's timber crisis. Conceived as short-term relief, England's love affair with sea coal went on to flourish with time: though consumption was a mere 12,000 tonnes from 1575 onward, by 1651-60 usage inflated to 275,000 and at the end of the century amounted to an astounding 455,000 tons.⁴⁵ By the early decades of the seventeenth century, sea-coal was ubiquitous: used by glassmakers, masons, brewers, dyers, lime-burners, sugar-refiners, hat-makers and so forth.⁴⁶

⁴⁰ John E. Neff, *The Rise of the British Coal Industry* (New York, 1932), p. 158.

⁴¹ Vanessa Harding, 'The population of London 1550-1700: a review of the published evidence', *London Journal*, 15 (1990), p. 11-28.

⁴² *Ibid.*

⁴³ John Stowe and Edmund Howes, *The Annales, or, Generall Chronicle of England* (London, 1615), p.33.

⁴⁴ William Cecil, op. cit. J. Perlin's *A Forest Journey: The Role of Wood in the Development of Civilization* (New York, 1989), p. 186. Earlier, William Harrison had predicted in 1580 that 'if woods go so fast to decay in the next hundred year of grace as they had done and are likely to do in this ... it is feared that' wood would no longer be available for fuel. William Harrison, *The Description of England: The Classic Contemporary Account of Tudor Social Life*, ed. Georges Edelen (Washington, 1994), pp. 180-181. At the time, Harrison described how one could travel for ten to twenty miles without spotted a tree 'except where the inhabitants have planted a few elms, oaks, hazels, or ashes about their dwellings.' *Ibid.*, p. 275.

⁴⁵ Over the course of one-hundred years, this totals an approximate increase of around 3,800 percent. Neff, *The Rise of the British Coal Industry*, p. 80.

⁴⁶ Neff, 'Coal Mining and Utilization' in Charles Joseph Singer (ed.), *A History of Technology* (Oxford, 1956), pp. 76-77.

Along with industry, England's fuel *a la mode* became most popular at home; not only within the domestic hearth but for cooking and laundry. As a consequence of sea-coal and its smoky detritus, as well as changing fashions associated with the 'Great Rebuilding', the English gradually abandoned the habit of keeping fires within the centre of the room and began to erect chimneys to ventilate previously confined airs.⁴⁷ The change in tradition led William Harrison to remark of the 'multitude of chimneys lately erected, whereas in their young days there were not above two or three, if so many, in most uplandish towns of the realm ... but each one made his fire against a reredos [back of a hearth] in the hall.'⁴⁸

The arrival of sea-coal into the home had transformed domestic life, as well as the air Englanders breathed. Lamenting the effects of smoke on the London climate, in 1661 the diarist John Evelyn petitioned King Charles II to propose several solutions to an as yet unidentified environmental problem. Though 'pollution' is not once used by Evelyn to describe the 'fuliginous and filthy vapor' of London's atmosphere, the author's *Fumifugium* is today roundly acknowledged to be the inaugural critique of urban air quality and a forerunner to modern environmentalism.⁴⁹ Though commonly regarded as a recent (or post-1800) dilemma, at the time of writing his famous complaint Evelyn's London had already become enveloped within a thick, sulphurous haze. Poisoning homes and infecting bodies, England's hasty turn to coal as its fuel of fashion had materialised in endemic respiratory issues and widespread ecological devastation: the smog, Evelyn complained, affected 'Fowl, and kills our Bees and Flowers abroad, suffering nothing in our Gardens to bud, display themselves, or ripen...'⁵⁰

Though the situation of London was thought by many to be naturally salubrious,

⁴⁷ Neff, *Rise of the British Coal Industry*, p. 199.

⁴⁸ Harrison, *Description of England*, pp. 200-201.

⁴⁹ Evelyn, *Fumifugium*, p. 5.

⁵⁰ *Ibid.*, p. 7.

standing upon a promontory nearby a major river, Evelyn found the burning of sea-coal so abundant that it corrupted ‘the otherwise wholesome and excellent Aer, that her Inhabitants breathe nothing but an impure and thick Mist ... disordering the entire habit of their Bodies so that *Catharrs, Phthisicks, Coughs* and *Consumptions* rage more in this one City than in the whole Earth beside.’⁵¹ Smoke had corrupted the capital, invaded the home, penetrated the lungs, assaulted the nose and palate, obscured vision and interrupted clerical service with ‘*Coughing* and *Snuffing* ... in the *London Churches* and *Assemblies of People*.’⁵² Mineral coal, as rightly indicated by the author, was a profoundly dirty fuel. Unlike its new emissions, which are higher in toxicity (especially in their concentration of Carbon Monoxide and Nitrogen Oxide) though largely invisible and scentless, the high-density sulphur dioxide content of sea-coal introduced a thick, blackened and sulphurous cloud to the cityscape.⁵³

While London would have been comparatively smoke-free during the spring and summer months, air quality significantly worsened as social elites, sailors and workers returned to the City in winter.⁵⁴ During the colder spells of England’s Little Ice Age, amplified use was said to have ‘eclipsed [London] with such a Cloud of Sulfure, as the Sun itself ... is hardly able to penetrate.’⁵⁵ To this end, Evelyn proposed several measures to restore ‘this Glorious and Ancient City’, by purifying it’s air and creating a citizenry ‘the most happy upon Earth.’⁵⁶ For Evelyn, along with countless adherents of Hippocratic/Galenic

⁵¹ Evelyn, *Fumifugium*, p. 5.

⁵² *Ibid.*, p. 10.

⁵³ Peter Brimblecombe and Carlotta M. Grossi, ‘Millennium-long damage to building materials in London’, *Science of The Total Environment*, 407 (2009), pp.1354-1361. Brimblecombe and Grossi’s work estimated levels of sulphur dioxide (SO₂), nitrogen dioxide (NO₂), and particulate matter of ten micrometers or less in diameter (PM₁₀). Their analysis shows a particular hike in SO₂ throughout the early modern period. During the middle ages they identify around 5–7 micrograms per cubic metre (µg/m³) of sulphur dioxide (SO₂), which increases to 20 µg/m³ in 1575, 40 in 1625, 120 in 1675, 260 in 1725, and 280 by 1775. Current UK standards stipulate that levels of SO₂ should not annually exceed 20 µg/m³ a year.

⁵⁴ Cavert, *The Smoke of London*, p. 39.

⁵⁵ Evelyn, *Fumifugium*, p. 6.

⁵⁶ *Ibid.*, iv.

medicine detailed in the previous chapters, pure, unconfined air was equivalent to mental, physical and spiritual health:

as the Lucid and noble Aer, clarifies the Blood, subtilizes and excites it, cheering the spirits and promoting digestion; so the dark, and grosse (on the Contrary) perturbs the Body, prohibits necessary Transpiration for the resolution and dissipation of ill Vapours, even to disturbance of the very Rational faculties, which the purer Aer does so far illuminate.⁵⁷

A change of air, Evelyn believed, would render London ‘one of the sweetest, and most delicious Habitations in the World.’⁵⁸

Three hundred years before the United Kingdom’s first Clean Air Act in 1956 and multiple endeavours since to clean the capital’s air, Evelyn had proposed a radical solution to the smoke of London. His recommendations, which today appear unusually prescient compared to contemporary policy, involved ‘the offending industries [tanners, brewers and lime-burners, in Evelyn’s judgement] be removed several miles out of the city, and that bands of trees, shrubs, and flowers be planted in the environs of the city to perfume the air.’ Advocating a proto-green belt of 10 feet wide ‘kept and supply’d, with such *Shrubs*, as yield the most fragrant and odoriferous *Flowers*, and are aptest to tinge the *Aer* upon every gentle emission at a great distance ... the most fragrant & odiferous *Flowers*,’ Evelyn’s work predicts current trends within forestry research concerned with the effects of plant life on urban air quality.⁵⁹

For the inhabitants of early modern London, the effects of sea-coal on health were self-evident. Unlike the insidious effects of carbon monoxide and nitrogen dioxide today,

⁵⁷ Evelyn, *Fumifugium*, p. 3.

⁵⁸ *Ibid.*, iv.

⁵⁹ T. A. M. Pugh, J. D. Whyatt, and C. N. Hewitt ‘The effectiveness of green infrastructure for improvement of air quality in urban street canyons’, *Environmental Science & Technology*, 46 (2012), pp. 7692-7699.

which are mostly scentless and tasteless, the impact of sulphur dioxide on both body and climate were palpable. In substance, Smoky air was treated no different from other miasmas, including malaria and plague. In a notable excerpt from *Fumifugium*, Evelyn describes the effects of sea-coal as tantamount to pestilence, if not worse: ‘because it kills not at once, but always, since still to languish, is worse then even Death itself’, disrupting Church service with an ‘incessant and most inopportune ... barking and spitting.’⁶⁰ Such was the sensual onslaught of sea-coal that travellers from ‘many miles distance ... sooner smell[s], than sees the city’, which itself was submerged ‘in a hellish and dismal cloud of sea-coal.’⁶¹ Taking into account the distinctive attributes of smoky air – its foul smell, taste, and effect on visibility – it is conceivable that sea-coal rather easily fell into a set of lay assumptions about ‘good’ and ‘bad’ air.

However aware early moderns were of this threat, it was only the pioneering technique of the haberdasher-cum-demographer John Graunt who proposed to *quantify* the effects of smoke on health. Taking cue from Hippocrates’ *Airs, Waters, Places* thesis, Graunt’s *Bills of Mortality* (1662) stressed the disparity in health between the suburban inhabitants of London’s ‘country parishes’ like Hackney and the ‘the most smoky and stinking parts of the city.’⁶² Graunt was one of the first major voices to attribute endemic respiratory problems to London’s air, concluding that the City was ‘more *unhealthful* ... partly for that it is more from, but chiefly because ... *Sea-Coles* [are] ... universally used.’⁶³ Beyond its simple ‘unpleasantness’, Graunt identified a causal pattern between sea-coal useage and respiratory illness, noting how some ‘cannot at all endure the smoak of London ... for the suffocations it

⁶⁰ Evelyn, *Fumifugium*, p. 10.

⁶¹ *Ibid.*, p. 6.

⁶² John Graunt, *Natural and Political Observations ... with reference to the Government, Religion, Trade, Growth, Air, Diseases, and the several Changes of the said City* (5th rev. edn., London, 1676) in Charles Henry Hull (ed.), *The Economic Writings of Sir William Petty* (Cambridge, 1899) vo. 2., pp. 393-394.

⁶³ John Graunt, *Natural and Political Observations*, p. 394.

causes.’⁶⁴ On the whole, Graunt’s findings were not revelatory: many before (including Evelyn) had warned of the health risks of smoky air. To quote Cavert, Graunt’s demography had, however, ‘said with new precision and new claims to expertise some of the same things that other, non-learned voices also said in simpler ways.’⁶⁵

Toward the end of the period concerned, there was a growing concern with demarcating technical causes of air pollution in the early modern City. Pollution began to emerge as an environmental term in its own right, even if the causes of pollution were vaguely understood. The foundation of the Royal Society in 1660 gave particular weight to the study of atmospheric chemistry, or ‘atomism’, as a field of scientific enquiry. Boyle, the preeminent scientific mind of his generation, was particularly aware of the effects of coal and other pollutants on atmospheric composition. He suggested several measures of air quality, including advice to ‘hang up clothes or silks died with colours’ and observe a possible change in colour which may indicate a concentration of sulphurous or nitrous agents.⁶⁶ The issue of keeping clothes clean throughout the city smog was first raised by society member Sir Kenelm Digby in 1658.⁶⁷ The same principle was used around a century ago when the discolouration of the lead based used in Parisian advertisements suggested a concentration of sulphur dioxide.⁶⁸ Interest in the composition of the air was also expedited by a growing interest in the causes of consumption in the late seventeenth century. Richard Morton, the English physician, famed for his landmark work on tuberculosis and his diagnosis of ‘nervous consumption’ (anorexia nervosa), advises in his *Phthisiologia* (1694) to:

⁶⁴ John Graunt, *Natural and Political Observations*, p. 394.

⁶⁵ Cavert, *The Smoke of London*, pp. 98-99.

⁶⁶ Boyle had also described the discolouration of certain metals, particularly copper, when exposed to the same trace components. *A General History of the Air* (London, 1692)

⁶⁷ Kenelm Digby, *A Late Discourse made in a solemne assembly of nobles and learned men at Montpellier in France* (London, 1658)

⁶⁸ Peter Brimblecombe, ‘air pollution in industrializing England’, *Journal of the Air Pollution Control Association*, 28 (1978), pp. 115-118.

choose an Air that is moderately hot and dry, and likewise somewhat thin. For that which is foggy, moist, or polluted with the smoak of Coals, by continually filling the Blood with unwholsome Particles, and causing a Commotion in it, does keep it in its Colliquative state, whereby it comes to pass, that a Catarrhus Flux of Rheum does perpetually fall upon the Lungs, and upon the Glandulous Coat of the Wind-pipe.⁶⁹

Drawing on the work of the mid-century Royal Society members who first speculated as to the density of particulate matter in the London air, Morton suggests that the ‘unwholesome particles’ produced by sea-coal formed a ‘glandulous coat’ around the oesophageal tracts of those who inhaled nasty air. Predating modern concerns over exposure to PM_{2.5} (fine particulate matter), Morton’s text is one of the first to refer to ‘pollution’ in a contemporary sense. He is followed by Thomas Nevett, who’s own *Treatise of Consumption* (1697) advises those suffering from tuberculosis to avoid places ‘polluted with store of nasty black Particles, from the smoak of Coals.’⁷⁰

Reliance on sea coal represented a double-edged sword: by all accounts, early-modern Londoners were acutely aware of the health risks of ‘bad air’ long before Evelyn’s publication; however, whether this outweighed the threat of pneumonia and flu during the sharp English winter remained a separate question entirely. Early-modern London would have been the first populace to experience the ethical conundrum which today spates environmental and political discourse: i.e. ‘How can we live without burning the fossil fuels that we know are wreaking havoc with the environment ... when the energy that they supply is paradoxically essential for our life and health?’⁷¹ Predictably, the solution came down to

⁶⁹ Richard Morton, *Phthisiologia, or a Treatise of Consumptions: Wherein the Difference, Nature, Causes, Signs, and Cure of All Sorts of Consumptions Are Explained* (London, 1694), p. 152.

⁷⁰ Thomas Nevett, *A treatise of consumptions : in which their nature, causes and symptoms are briefly explained, and a new and extraordinary method by specifick medicines is proposed for the cure of consumptions, even such as proceed from ulcers of the lungs* (London, 1697), pp. 71-72.

⁷¹ Ken Hiltner, *What Else Is Pastoral? Renaissance Literature and the Environment* (Cornell, 2011), p. 122.

short-term pragmatism over long-term urban and environmental planning. The King's response to *Fumigufium* had initially enthused Evelyn, who wrote in his diary:

He [Charles II] was pleased to discourse to me about my book inveighing against the nuisance of the smoke of London, and proposing expedients how, by removing those particulars I mentioned, it might be reformed; commanding me to prepare a Bill against the next session of Parliament, being, as he said, resolved to have something done in it.⁷²

And yet nothing came of Evelyn's petition. A necessity for warmth, food and industry outweighed the potential threat to health and environment, with Evelyn's elaborate plans shelved during a costly naval war and plague epidemic. Like many environmentalists, political inaction disillusioned Evelyn. During the Great Frost of 1684, he complained that he could hardly breathe because of the smoke and admitted to Samuel Pepys that he believed his 1661 petition was a failure.⁷³

Fumifugium remains a work of outstanding foresight; to quote William Cavert, it is 'the most extensive, sophisticated, and ambitious analysis of urban air pollution produced anywhere during the early modern period.'⁷⁴ Its author, however, is too often subject to misrepresentation. Though his text represents a literary landmark, the idea of pollution and proposed solutions were suggested long before its publication. Sixty years previous, Hugh Plat conceived of a method of cheap, clean fuel that he believed could provide a solution to London's poor air quality. By using briquettes of coal dust, Plat hoped to create 'a purer and less smoky fuel suitable for the capital.'⁷⁵ In a private exchange between Samuel Hartlib and

⁷² E. S. De Beer, (ed.) *The Diary of John Evelyn*, 6 vols. (Oxford, 1955) vol. 3, p.296.

⁷³ *Ibid.*, vol. 4, p. 363.

⁷⁴ Cavert, *The Smoke of London*, p. 74.

⁷⁵ Hugh Plat, *A new, cheape and delicate Fire of Cole-balles, wherein Seacole is by the mixture of other combustible bodies, both sweetened and multiplied* (1603) op. cit. Jenner, 'The Politics of London Air', p. 548.

Robert Child, the latter expressed his enthusiasm for Plat's project, hoping in 1650: 'that Sir H. Plats Inv[ention] might bee p[er]fected and introduced for the taking away of the noisome smoake from the City of Lond[on], which would make it far the healthier, and the fewel cheaper.'⁷⁶

Owing to Evelyn's elegant prose and his regal audience, his text transcended the period it came from to symbolise a 'what if' moment in environmental history. *What if* Charles II had followed Evelyn's advice? To paraphrase much existing scholarship, Evelyn was a fleeting genius unrecognised in his own time: a modern environmentalist born in an age of unfettered fossil fuel abuse.⁷⁷ As recently as 2011, Environmental Protection UK saw fit to translate *Fumifugium* into modern English in an attempt to identify current policy with a historical 'battle that Evelyn began, both in London and across the rest of the UK.'⁷⁸ In the historiography of pollution, Evelyn hence occupies the revered post as the 'father' of environmentalism. As politically useful as this distinction is, it is also predictably misleading. Recently, scholars including Cavert and Mark Jenner have sought to revise Evelyn's monolithic reputation as 'proto-environmentalist', by reflecting on his position within a consortium of social, political and environmental concerns. For Jenner, citing the work of sociologist Mary Douglas, Evelyn's pamphlet was entangled with a range of ongoing political debates during the Restoration on the nature of the ideal society.⁷⁹

Evelyn's environmental mission, far encompassing the altruistic virtues today associated with all things 'green', represented a concerted effort to gentrify (literally, to make habitable for the landed gentry) the dirty city air. Historians have generally characterised

⁷⁶ Sheffield University Library, Hartlib MS 28,1,j3B.

⁷⁷ Cavert suggests that the following works take this position: Gillian Darley *John Evelyn: Living for Ingenuity* (London, 2014), pp. 176, 339; Thorsheim, *Inventing Pollution*, pp. 5, 17; Joachim Radkau, *Nature and Power: A Global History of the Environment* trans. Thomas Dunlap (Cambridge, 2008), p. 143.

⁷⁸ James Grugeon, 'Foreword to John Evelyn's *Fumifugium MMXI*' in *Fumifugium MMXI* trans. ed. Anna Gross and Justine Shaw (London, 2011), p. 7.

⁷⁹ Douglas and Wildavsky, *Risk and Culture*, p. 36.

Evelyn as a progressive, and rightly so; yet, his famous tract is also a reactionary indictment of the urban poor. The legacy of Evelyn's work is an idea of pollution couched in exclusionary, socially divisive language. His work is one of the first significant publications to recognise the physical effects of fossil fuels on air quality, though it also highlights the boundaries between a physical and cultural pollutant. To paraphrase Douglas and Wildavsky, every pollutant needs a polluter. Of course, Evelyn's tract was born out of concern for air quality and health, but it also served to castigate a social class that had progressively contaminated the capital. In Evelyn's case, these polluters belonged to the 'poor and nasty cottages' which distract from London's beauty. Evelyn squarely blamed industry, claiming 'one of whose spiracles [industrial vents] alone, does manifestly infect the air more than all the chimneys of London put together', domestic and 'culinary fires' were by far the greater pollutant.⁸⁰ While a City brewery might annually consume around 400 tonnes of coal, Westminster's domestic hearths burned close to one hundred times that amount.⁸¹ After the turn to coal, Englanders were left with the unwanted by-product of fossil-fuel abuse and a grievance that soon found a likely scapegoat. Rather than treat the cause of pollution, Cavert explains, social elites 'chose to remove themselves from it.'⁸²

'Poor and Nasty Cottages': Travel, Citizens, and Responsibility

By the mid-seventeenth century, the rate of sea-coal consumption in major metropolitan areas showed no signs of slowing, and it was doubtful that England was to revert to timber as their

⁸⁰ Evelyn, *Fumifugium*, p. 6

⁸¹ Cavert, 'Industrial coal consumption in early modern London', *Urban History*, 44 (2017), pp. 424-443. Londoners burned something close to 1 ton of coal per capita, and Westminster's population exceeding 40,000 by mid-century. J.F. Merritt, *The Social World of Early Modern Westminster* (Manchester, 2005), p. 262.

⁸² Cavert, *The Smoke of London*, p. 175.

primary energy supply. England's urban inhabitants were pressed to establish several mitigation strategies against smoke: a process that involved the law, travel, medicine, gardening and domestic creativity (see ch. 3). In theory, alleviating the nuisance of coal smoke was simple. Like 'Bad-Air', smoke pollution was the product of distinct climatic features: i.e. a temperature inversion when the lowest level of the atmosphere (troposphere) is colder than air above, reversing average atmospheric conditions. The smoke said to eclipse London in sulphur was therefore subject to distinct seasonal changes; omitting the possibility of an unseasonably cold springtime, endemic smoke was a winter phenomenon. Escaping the smog meant fleeing the city. Paradoxically, as the urban fabric of the metropolis had gradually begun to encroach upon former green spaces, the availability of 'good', country air was conceded by increasing sea-coal emissions.

Movements between the city and country have long been the source of literary and artistic imagination.⁸³ While the City represents a beacon of modernity, corruption and, in our case, unhealthfulness, the Country symbolises a new Eden: traditional, innocent and salubrious. In his analysis of the city-country binary, Raymond Williams describes 'the contrast of the country and city [to be] one of the major forms in which we become conscious of a central part of our experience and of the crises of our society.'⁸⁴ In urban air pollution, we discover a forgotten motif of this 'crisis': an object capable of transgressing the imagined boundaries of city and country, bringing into focus the social, economic and environmental tensions which colour William's interpretation of the urban-rural binary. None more so is this thinking evident than during Evelyn's *Fumifuigum*: a work that revelled in the virtues of the pastoralism, scorning against the industrial perversion of London's delicate air. Evelyn's work perpetuated many of the clichés identified by Williams' seminal *The Country and City*

⁸³ Hiltner, *What Else Is Pastoral?*, pp. 19-34.

⁸⁴ Raymond Williams, *The Country and the City* (Oxford, 1972), p. 289.

(1973). While ‘the city of London resembled the face of *Mount Etna*, the *Court of Vulcan*, Stromboli, or the Suburbs of Hell,’ country air is depicted as a relative paradise replete with ‘the most fragrant and odoriferous Flowers, and are aptest to tinge the Aer upon every gentle emission at a great distance.’⁸⁵ Evelyn was not alone in his thinking. Measures to promote green-space around the city would, John Beale suggested, constitute a ‘flaming sword’ against the depravity of industry and prevent further rebellion against nature and God.⁸⁶

The comparison between hell and the smoky metropolis was by no means exclusive to the Hartlib circle either; John Milton’s hell ‘belch’d fire and rowling smoke’ and Edmund Spencer used ‘a cloud of smothering smoke and sulfure seare’ to evoke the demonic.⁸⁷ The frequent collocation between smoke, sulphur, brimstone and Hell often repeated in texts such as *Paradise Lost*, Hiltner argues, was an exclusively English elicitation.⁸⁸ In continental Europe, which burned a fraction of sea-coal compared to early modern England’s, literature rarely alludes to Hell as a smoky, sulphurous metropolis.⁸⁹ For instance, the most enduring literary representation of Hell, *The Divine Comedy* (c.1320), bares no mention of this place.⁹⁰ That said, however illusory the distinction between the urban and rural, it possessed a real influence on the movement of people, their dwelling, and the orientation of green-space. This is not to refute Williams’ thesis but highlight that the urban-rural divide functioned beyond the rhetorical. Contrary to a modern conflation between healthiness and wealth, during the sixteenth and seventeenth-centuries practice and tradition held that the countryside was the

⁸⁵ Edmund Spencer, *The Faerie Queene* ed. Richard Field (London, 1596), p. 158; John Milton, *Paradise lost a poem written in ten books* ed. Peter Parker (London, 1667), bk. I. 670-671.

⁸⁶ BL Add MS 78,312, f. 43 op. cit. Cavert, *The Smoke of London*, p. 187.

⁸⁷ In *Milton and the Natural World* (Oxford, 1999), Karen Edwards suggested that ‘the assumptions behind Evelyn’s plan for a vast, odiferous hedge around London are similar to those behind Milton’s representation of the garden of Eden.’ p. 196.

⁸⁸ Whereas ‘Sulphur’ emerged in English from the Latin *Sulphur* (‘to burn’) during the fourteenth century, ‘Brimstone’ derives from the Old English *brynstan*, a word that not only meant sulphur, but literally ‘burning place’.

⁸⁹ Hiltner, *What Else Is Pastoral?*, p. 102.

⁹⁰ *Ibid.*

healthiest place to reside and native labourers the healthiest people.⁹¹ The sedentary life of a townsman was, according to regimen writers, discernible by its relative inertia and poor digestion, whereas country folk were considered to have superior constitutions by their exposure to manual labour.⁹²

Lacking the physical exercise necessary for the production of ‘vital heat’, townsmen were considered most vulnerable to climatic change. Regimen writers and physicians frequently raised the benefits of country labour: Galen himself, Thomas Coghlan reminded his reader, indulged in ‘rusticall labours’ such as woodchopping.⁹³ The same tradition insisted on the benefits of fresh country-air, a deficiency of which lead the wealthy inhabitants of England’s towns and cities to regularly abscond to better airs to ‘correct’ their temper. Most medical practitioners and writers praised the benefits of travel to varying degrees, with Robert Burton recommending ‘no better physic for a melancholy man than a change of air, and variety of places, to travel abroad and see fashions.’⁹⁴ For physical ailments too, a change of air was rapidly sought to revive a sickly complexion. If an air was corrupt William Vaughan foremost recommended departing very quickly, ‘for oftentimes it is seene, that sicke folkes doe recure their former health only by change of aire.’⁹⁵ Thomas Mouffet attributed specific medicinal qualities to various overseas climates. According to his treatise, ‘the aire in *Cyprus* cureth any ulcers of the lungs,’ while ‘the air of *Sardinia* makes and enlargeth them’. To visit Antikyra would be to ‘helpeth madness’, though brief sojourn northward to

⁹¹ Wear, *Knowledge and Practice in English Medicine*, p. 161.

⁹² Wear, *Knowledge and Practice in English Medicine*, p. 160.

⁹³ Thomas Coghlan, *The haven of health: chiefly gathered for the comfort of students, and consequently for all those that have a care of their health* (4th edn, London, 1636), p. 3.

⁹⁴ Robert Burton, *The Anatomy of Melancholy, What it is: With all the Kinds, Causes, Symptomes, Prognostickes, and Several Cures of it. In Three Maine Partitions with their several Sections, Members, and Subsections. Philosophically, Medicinally, Historically, Opened and Cut Up* (6th edn, London, 1651), p. 306.

⁹⁵ William Vaughan, *Natural and aritifical directions for health derived from the best philosophers, as well as modern, as ancient* (3rd edn., London, 1612), pp. 2-4.

Thasos during a hot and dry summer ‘brought almost all the inhabitants into a lunacy.’⁹⁶ By the seventeenth century, early colonists and the aristocratic classes co-opted the medical benefits of leisurely travel: a tradition which later evolved into the classical Grand Tour.⁹⁷

The majority of London’s middling sort, unable to afford the luxury of international travel, found refuge from the smoky metropolis in the suburbs. During the early modern period these were distinctive spaces, clearly outside of the metropolis and yet accessible by foot, carriage, or short boat trip for those wishing, in John Stow’s words, ‘to recreate and refresh their dulled spirits in the sweet and wholesome air.’⁹⁸ At the time of Stow’s publication, much of the space between the City and Westminster remained open fields, except for a perimeter of country houses and formal gardens along the Strand.⁹⁹ For those lacking the wealth to settle on this desired land, the suburbs were the source of frequent respite from London’s air. What now is the area around zone two of the London Underground would have been prime land for the Capital’s wealthy merchants and artisans as well as members of the working poor who desired relief from the suffocation of the City.

While much of the City would have been uninhabitable by contemporary standards, the prosperous West-End was made unique by its excellent air.¹⁰⁰ On account of the British Isles’ prevailing westerly winds, which William Petty described as ‘blowing near $\frac{3}{4}$ of the year from the west’, the ‘dwellings of the West End are so much the more free from the

⁹⁶ Thomas Mouffet, *Healths Improvement: Or, Rules Comprizing and Discovering the Nature, Method, and Manner of Preparing all sorts of Food used in this Nation: Corrected and Enlarged by Christopher Bennett* (2nd edn, 1655), p. 14.

⁹⁷ On the health benefits of the Grand Tour see Rosemary Sweet, ‘British Perceptions of Florence in the Long Eighteenth Century’, *The Historical Journal*, 50 (2007), pp. 837-859.

⁹⁸ Charles Lethbridge Kingsford (ed.), *A Survey of London by John Stow* (Oxford, 1908), p. 127, op. cit. Laura Williams, ‘“To Recreate and Refresh Their Dulled Spirites in the Sweet and Wholesome Ayre”: Green Space and the Growth of the City’, in Julia Merritt (ed.) *Imagining Early Modern London: Perceptions and Portrayals of the City from Stow to Strype, 1598–1720* (Cambridge, 2001), pp. 185 – 213 .

⁹⁹ Justice Monson, *A Brief Declaration for what Manner of Speciall Nusance Concerning Private Dwelling Houses* (London, 1639), p. 5; also J. H. Baker and S. F. C. Milsom, *Sources of English Legal History: Private Law to 1750* (London, 1986), pp. 592-597.

¹⁰⁰ On Europe’s prevailing westerly winds, Emily Cockayne establishes ‘As a general rule, the western side of any town or city was (and still is) the most salubrious part, and therefore home to the most desirable and fashionable areas.’ *Hubbub: Filth, Noise and Stench in England* (London, 2007), p. 208.

fumes, steams, and stinks of the whole easterly pile; where sea coal is burnt is a great matter.’¹⁰¹ By the end of the sixteenth century, a pronounced social and economic disparity also emerged between West and East London. As M. J. Power demonstrated, although ‘in distance Aldermanbury and Aldgate were not a mile apart; in character they were different worlds.’¹⁰² Emission patterns reflected this divide: while brewers, dyers, printers, millers, founders and glassmakers etc. inhabited the Eastern perimeter of the city, the West of the City resembled a professional suburb, inhabited mainly by lawyers. In his attack on industry Evelyn had made a determined effort to separate the latter from the ‘poor and nasty cottages’ which ‘disgrace and take off from the sweetness and amoneity of the Environs of London’ and thus obstruct their capacity for ‘Health, Profit, and Beauty’.¹⁰³

While the poor were naturally accustomed to the filthy airs of the east, their bodies ‘seasoned’ and sealed from the harmful effects of this smoky miasma, those of more refined constitution could not bear to suffer such filthy vapours. Those reared in the City, Graunt explains, could become acclimated to London’s air ‘yet newcomers and children do not, for the smokes, stinks and close air are less healthful then that of the country.’¹⁰⁴ A little-known comedy of the early eighteenth century, *St James’ Park* (1733), alludes to the fear of contamination amongst the gentry. In her objection to common workmen taking the titular park’s superior air, one Mrs Straddle suggests they ‘ought to be sent to Kensington Gravel-Pits, Hampstead, or Highgate, and not be suffer’d among the polite World, to infect our Gaiety by looking on their Langour.’¹⁰⁵ The same class-based antipathy was reflected in the legislative history of air pollution, which, as one might expect, targeted emissions produced

¹⁰¹ Hull (ed.), *Economic Writings*, p. 41.

¹⁰² M. J. Power, ‘The East and West in early modern London’, in E. W. Ives, R. J. Knecht, and J. J. Scarisbrick (eds), *Wealth and Power in Tudor and Stuart England: Essays presented to S. T. Bindoff* (London, 1978), pp. 167-185.

¹⁰³ John Evelyn, *Sylva, or A Discourse of Forest-Trees* (London, 1664), p. 112; Evelyn, *Fumifigium*, pp. 25-26.

¹⁰⁴ John Graunt, *Natural and Political Observations* (1662), p. 46.

¹⁰⁵ P. Q., *St James’s Park* (London, 1733), p. 32.

by the working poor.

Though the early history of pollution is perforated with ambiguities, this is not to say that contemporaries did not apportion blame for their bad airs. What complicated this issue was the question of agency in a world that privileged ideas of ecological constancy and divine providence. Was an air made ‘bad’ by the excesses of its inhabitants, or was the atmosphere, in the case of ‘airborne’ diseases, manipulated by divine order? In discussions of the Anthropocene, it is custom to refer to humankind as a geological agent capable of manipulating, or at least interfering, with their natural environment. According to the fundamentals of providential belief, this kind of agency was unavailable to humanity. During The Fall they had sacrificed this privilege. Neither did providential belief necessarily negate human agency in managing the effects of violent climatic change. ‘Bad Air’, according to Thomas Lodge, was a secondary instrument of His punishment, for the first cause was ‘the rode of [God’s] rigor and justice ... for the amendment of our sinnes.’¹⁰⁶ Given what we may refer to as the ‘mysterious origins’ of early pollution, it became imperative to the understandings of bad air that a polluter was identified. When it came to defining ‘pollution’, both definitions used by Douglas and Wildavsky illicit the scrutiny of the same four questions: who is the polluter? What is considered pollution? Who is the victim of the pollution? How can pollution be removed? Smoke was just one in a series of environmental pollutants which affected English air quality, along with other anthropogenic emissions. Fears of pollution became fear of the Other and was articulated in debates over the origins of disease, pestilence and organic pollution.

¹⁰⁶ Thomas Lodge, *Treatise of the Plague: Containing the nature, signes, and accidents of the same, with the certaine and absolute cure of the Feuers, Botches and Carbuncles that raigne in these times* (London, 1603). Biiir.

‘I have polluted the Air by my sinful words’: Organic Pollution in the Early Modern City

Early modern ideas of pollution did not arise within a hyper-sanitised society, but one in which smells and stenches seriously informed the practical and spatial configuration of daily life. Lucien Febvre once claimed that sixteenth century Europe ‘did not see first’ but relied foremost on olfaction; ‘it sniffed the air.’¹⁰⁷ In the pre-Cartesian context of early modern Europe, sensory interactions with air carried considerable danger. Dominant physiological models since antiquity ascribed good and bad odours with material properties, with olfaction seen as a mode of ingestion. In the Galenic theory of contagion - largely determined by non-human agents (air, water etc.) – a conceptual framework existed to exculpate the sick from the guilt of illness. According to this schema, endemic diseases were caused by ‘miasma’: the corruption of air by putrefaction, stagnant waters, astrological alignment, and human exhalations. This final category introduces a significant complication to early modern concepts of pollution and the boundaries between cultural and environmental pollution.

While a set of medical assumptions based around the Hippocratic-Galenic corpus largely alleviated one from the guilt of infection, the simultaneous link between disease and sin throughout post-Reformation theology was consistent. ‘Sickness comes ordinarily and usually of sinne,’ said the Puritan William Perkins.¹⁰⁸ Plagues and other supposedly airborne diseases were believed to be the product of collective transgression: theatre-going, blasphemy, Sabbath-breaking and covetousness. ‘We came into the world with sin,’ the Presbyterian minister William Bates preached, ‘and as soon as we did breath in the air, we infected it: there

¹⁰⁷ Lucien Febvre, *The Problem of Unbelief in the Sixteenth Century: The Religion of Rabelais*, trans. Beatrice Gottlieb (Cambridge, Mass., 1982), pp. 431-2.

¹⁰⁸ William Perkins op. cit. Keith Thomas ‘Health and Morality in Early Modern England’, in Allan M. Brandt and Paul Rozin (eds.), *Morality and Health: An Interdisciplinary Perspective* (Abingdon, 1997), p. 17.

is an infection and pollution in all our faculties.’¹⁰⁹ For Robert Burton, a pleasant air could become corrupted by all manner of sins. Though possessing ‘a pleasant air, and all that nature can afford ... through their own nastiness, and sluttishness, immund and sordid manner of life, suffer their air to putrefy, and themselves to be chocked up.’¹¹⁰ In Madrid, usually ‘a most excellent site’ and ‘pleasant air’, Burton described how the behaviour of the locals had debased the King’s seat: ‘the inhabitants are slovens, and the streets uncleanly kept.’¹¹¹ During times of turbulent weather, Burton claimed evil was at work, as: ‘the devil many times takes his opportunity of such storms, and when the humours by the air be stirred, he goes in with them, exagitates our spirits, and vexeth our souls; as the sea waves, so are the spirits and humours in our bodies tossed with tempestuous winds and storms.’¹¹²

In the collective imagination of early modern England, it was entirely feasible that breath could act as a pollutant. According to contemporary medical advice, ‘air’ did not solely exist as a disembodied force which possessed a malignant tendency to alter the body, but rather as a substance that was embodied and transmitted by humans. This point is made with precision by Thomas Walkington in his deeply influential *The Optick Glasse of Humors* (1631). At the very beginning of his treatise on air, he chooses to deconstruct the etymology of the word. ‘Air’, he claims, ‘hath his etymologie from the greeke worde $\acute{\alpha}\omega$ to breath, it consists of $\acute{\alpha}\lambda\phi\alpha$ and $\omega\mu\acute{\epsilon}\gamma\alpha$, because the learned say, that it is the beginning and ending of mans life: for when wee begin to liue, wee are sayd to inspire, when we die, to expire.’¹¹³ For Walkington, the very word ‘air’ had its origin in the notion of an eternal, cyclical exchange between body and environment: ingestion, digestion, expulsion, *ad infinitum*. From the

¹⁰⁹ William Bates, op. cit. Edmund Calamy, et al., *A Compleat collection of farewel sermons preached by Mr. Calamy, Dr. Manton, Mr. Caryl ... [et al.]; together with Mr. Ash his funeral sermon, Mr. Nalton's funeral sermon, Mr. Lye's rehearsal ... with their several prayers* (London, 1663)

¹¹⁰ Burton, *The Anatomy of Melancholy*, p. 110.

¹¹¹ Burton, *The Anatomy of Melancholy*, p. 110.

¹¹² Ibid.

¹¹³ Thomas Walkington, *The Optick Glasse of Humors. Or the Touchstone of a Golden Temperature* (London, 1621), pp. 14-16.

effluvia and blasphemy of the ale-house to pestilent airs of the east end, the remainder of this chapter will study hitherto unacknowledged efforts to police the breathable atmosphere of early modern London. Marrying a history of moral reform and the medical materialism referred to throughout chapter one, this will offer an ecocritical reading of blasphemy, swearing, oath-breaking and smoking.

As discussed in chapter one, Wilson and Sullivan's *Environment and Embodiment in Early Modern England* (2007) presents three models of embodiment theory. The first, the 'similitude model', stipulated that man – being a vessel of his surroundings – would adapt to any changing conditions; secondly, the 'counteractive model', presupposed that 'the body's complexion is formed in opposition or through resistance to the environment.' Finally, the 'exchange model' gave emphasis to that 'which crosses the threshold of the body, from within and without.'¹¹⁴ With the re-emergence of Aristotelian natural philosophy and newer schools of Neo-Platonism, during the Renaissance scholars started to invest in the transformative effects of human exhalations and the 'spirits' they produced. Breath, often through voice or song, was specifically afforded greater material vitality and agency. On the power of words when sung, the philosopher Marsilio Ficino once compared the spoken word to that of a 'rational animal':

For this too is air, hot or warm, still breathing and somehow living; like an animal it is composed of certain parts and limbs of its own and not only possess motion and displays passion but even carries meaning like a mind, so that it can be said to be a kind of airy and rational animal.¹¹⁵

¹¹⁴ Mary Floyd-Wilson and Garret Sullivan, Jr., (eds.) *Environment and Embodiment in Early Modern England* (Basingstoke, 2007), pp. 3-5.

¹¹⁵ Marsilio Ficino, *Three Books On Life* trans. ed. Carol V. Kaske and John R. Clark (Binghamton, 1989), pp. 259, 363.

Spoken aloud words are literally brought to life, according to Ficino. Given they directly originate from the humoral body, possessing vital heat, ‘words become not only animate but *animal*, a physical force with motion, passion, and meaning.’¹¹⁶ What’s more, this is not some disruptive, chaotic beast, but a measured ‘rational animal’ which ‘carries meaning like a mind.’ Other Renaissance scholars, like Cornelius Agrippa, endowed ‘the corporeal voice’ with the power to transmit ‘the virtue of a speaker with a certain efficacy unto the hearers, and this oftentimes with so great a power, that ... they change not only hearers, but also other bodies, and things that have no life.’¹¹⁷ As with Ficino, Pollard describes how Agrippa attributed words with corporeal effects, ‘built of voice, breath, mouth, and tongue.’¹¹⁸ Speech, for Agrippa, is not only animate but corporal, and capable of transforming virtue in a listener. The same logic begs the question: was sin also communicable and therefore contagious?

From the very beginning of the period under study, it was well regarded in medical textbooks that infection spread via human exhalations, specifically rotten breath. Thomas Paynell, in his *Much Profitable Treatise Against the Pestilence* (1534), argued as much, claiming: ‘from such infected bodies commeth infectious and venomous fumes and vapours, the which do infect and corrupt the air ... [hence] great multitude and congregation of people [should be avoided as] the breath of one infected person may infect a whole.’¹¹⁹ Such ideas were widely held and reproduced in popular and scholarly medical texts. As described by Gail Kern Paster, it was unanimously believed during the sixteenth and seventeenth centuries that the humoral body was capable of such noxious emissions. Paster suggests that ‘all parts of the human body were [believed to be] capable of containing fumes and smoky “fuliginous”

¹¹⁶ Tanya Pollard, ‘Spelling the Body’ in Wilson and Sullivan (eds.) *Environment and Embodiment* (Basingstoke, 2007), pp. 171-186, p. 180.

¹¹⁷ Cornelius Agrippa, *Three Books of Occult Philosophy* trans. J.F, 3 vols. (London, 1651) vol. 1, p. 152.

¹¹⁸ Tanya Pollard, ‘Spelling the Body’, p. 180.

¹¹⁹ Thomas Paynell, *A Much Profitable Treatise against the Pestilence* (1534), viii.

vapours ... winds that roared and rumbled ... fluids that putrefied and stank.’¹²⁰ What’s more, it was necessary for the physical health of the humoral form to regulate these winds through certain methods of purgation: flatulence, eructation and excretion. Paster continues: ‘the humoral body’s ability to regulate and release these vapours was critical to its solubility ... release of internal winds was thought so important that well after the advent of powerful excretory disciplines [it] was governed by rules of health rather than behaviour.’¹²¹ The same applied to the macrocosm. According to Aristotelian geology, the world was envisaged with pockets and channels of air which were occasionally emitted as earthquakes. Hence in Shakespeare’s *Henry VI*, Hotspur compares the earth to a flatulent woman:

the teeming earth,
Is with a kind of colic pinched and vexed
By the imprisoning of unruly wind
Within her womb.¹²²

Yet, in spite of the supposed permissiveness attached to these behaviours in a medical context, in the late Elizabethan and Jacobean imagination such stenches often signalled moral corruption. Within the bustle of the early modern City, Simon Kellywaye contended that ‘our odours stink because the imaginations of our hearts be evil continually.’¹²³

Physically necessary though socially intolerable, respiratory and flatulent behaviours were scrutinised in a culture predisposed to anxieties of *miasma* and contagion. Since the plague epidemic of 1603, most famously depicted by Thomas Dekker’s *Newes from Graves*

¹²⁰ Gail Kern Paster, *The Body Embarrassed: Drama and the Disciplines of Shame in Early Modern England* (New York, 1993), p. 11.

¹²¹ *Ibid.*, p. 12.

¹²² *Henry VI*, Part I, Act 3 Scene 1; For more flatulence in English culture see Keith Thomas, ‘Bodily Control and Social Unease: The Fart in Seventeenth Century England’, in Angela Mcshane and Garthine Walker (eds), *The Extraordinary and the Everyday in Early Modern England* (London, 2010), pp. 9-30.

¹²³ Simon Kellywaye, *Defensative against the Plague* (1593) op. cit. Nat Hardy, *Anatomy of Pestilence: The Satiric Disgust of Plague in Early Modern London (1563-1625)* (Diss., University of Alberta, Canada, 2000), p. 215.

End (1603), writers had used ‘pollution’ to describe the process of corrupting natural airs. Whether the pestilence was triggered by moral depravity or poor sanitation, commentators and physicians alike pinpointed the effects of effluence on the atmosphere. Dekker’s *The Wonderfull Yeare* (1603) contains one particular reference to ‘sinfully-polluted Suburbs’ of London being overtaken by plague.¹²⁴ In Henry Holland’s *Spirituall preseruatiues against the pestilence* (1603), the Calvinist blamed the excesses of Elizabethan drama on the miasma that contaminated London’s air in the same year. His complaint was by no means original. Since Stephen Gosson’s *The Schoole of Abuse* was first published in 1579, pamphleteers had railed against the ‘Wooden O’ as a place of contagion, be that physical or moral.¹²⁵ Theatres were, in the words of Holland’s sermon, ‘the nurceries of whoredome and uncleanesse’ which contributed to the ‘venimous pollution which is spred in the ayre.’¹²⁶ ‘Whereas some deeme the scorching heate of Summer to be some cause of this evill,’ Holland claimed that the plague was not restricted by seasonality and that ‘the hottest Summers have bin without all manner of plagues, and that sometimes it hath begun in Winter, and ceased in Summer or Autumne.’¹²⁷ Instead, blame is directed toward the ‘rotten exhalations, which abound in unsauourie places of great cities.’¹²⁸ As with Dekker’s description of ‘the rotten air’, Holland’s account reflects the ambiguous sources of plague in the city. ‘Pollution’, in the early seventeenth century, remained tied to earlier definitions of profanity, heterodoxy and blasphemy.

According to physicians of the time, airs stood at the precipice between spiritual and physical health. Replicating the advice of the multiple health regimens surveyed in chapter one, the puritan John Downname commends his reader to ‘preserve our bodies and soules,

¹²⁴ Dekker, *The Wonderfull Yeare* (London, 1603), D1r.

¹²⁵ Carolyn Sale, ‘Eating Air; Feeling Smells’, *Renaissance Drama*, 35 (2006), pp. 145-168, p. 146.

¹²⁶ Henry Holland, *Spirituall preseruatiues against the pestilence* (London, 1603), p. 36

¹²⁷ *Ibid.*

¹²⁸ *Ibid.*

which are his temples, in their cleanness and puritie from all pollution of sinne and wickednesse' by choosing a 'good ayre and sweete habitation' which 'doeth much refresh and strengthen our naturall and vitall spirits, and preserue our bodies in health.'¹²⁹ Here, the overlaps between devotional and environmental practices are palpable. As with the claims made by Vaughan, Tryon, et al. a pure air – free from 'all pollution of sinne and wickedness' – is not only paramount to physical health, but spiritual nourishment.¹³⁰ Whereas today a 'polluted' environment signifies an area of concentrated toxicity, usually the result of emission patterns, the early moderns invoked a far broader idea of toxicity in their multiple health regimens. It is unclear in the work of Dekker and Holland's sermon whether the air is corrupted by sin or the lifestyles of London inhabitants, or whether these two are even separable.

But these involuntary exhalations only form a fraction of practices lambasted by physicians and reformers alike. In the next chapter, I will detail several means by which inhabitants of early modern England sought to rectify their air by 'artificial' means. What is omitted from this discussion, however, were references to rhetorical methods of aerial correction. Leah Knight describes 'the extraordinary power of words spoken aloud', with the recitation of lyric poetry a distinctive method of cultivating 'artificial air.'¹³¹ While scholars like Carolyn Sale have described the process of theatre-going as 'the exchange between actor and playgoer in terms of the actual infusion of one body with the materials of another, through breath', Knight explains that outside this dramatic context 'many early modern words were similarly inspired and respired by reciters and their audiences.'¹³² As many recent studies into early modern reading practices have shown, breath amplified and animated knowledge

¹²⁹ John Downname, *The Conflict between the Flesh and the Spirit* (London, 1618), p. 391.

¹³⁰ *Ibid.*

¹³¹ Leah Knight, *Reading Green in early modern England* (Abingdon, 2014), p. 53.

¹³² Carolyn Sale, 'Eating Air; Feeling Smells', p. 151; Knight, *Reading Green in early modern England*, p. 53.

otherwise preserved on a page.

To return to early modern London and the series of devastating plagues experienced throughout the early to mid-seventeenth century, we may reflect on the air's role as an object of scholarly interest but also mortal dread. As demonstrated by literary scholars, including Eric Mallin and Keir Elam, plague was widely understood to be a 'communicable disease'. 'In a pestilent culture,' describes Mallin, 'all conversation carries risk: intimate spaces of encounter hold the greater dangers.'¹³³ Air, specifically exhaled breath, was teeming with an agency beyond the influence of metaphor and simple cultural pollution. Every communication involved transference of matter. While the primary vehicle of exhaled air was language, an excess of air (be that healthful or unhealthful) was produced in moments of verbal communication.¹³⁴ Yet, as Carolyn Sale reminds us, air was not thought of as a 'medium, carrier, or agent of sounds and words' but a 'propulsive force' in and of itself. Such exhalations were deemed especially dangerous during plague outbreaks and were thought to be inseparable from the offending 'voices'. It would naturally follow that concerns over airborne diseases, pollution and air quality were also concerns over the rhetorical practices of some citizens.

The minister Matthew Mead, writing at the time of the Great Plague, goes further to admonish the blasphemies and swearing of London's reprobate. 'Oh the horrid Oaths that have daily belch'd out by the black-mouth'd Sons of *Belial!*,' decries Mead, 'Who almost could walk the streets of the City without stopping his ears?'¹³⁵ The profanity of London's inhabitants, 'their hellish Exhaltations streaming from their hearts', had corrupted their air to the extent that 'they have assaulted even Heaven itself' and 'might justly have been kindled

¹³³ Eric S. Mallin, *Inscribing the Time: Shakespeare and the End of Elizabethan England* (Berkeley, 1995), esp. 'Word and Plague in the Second Quarto Hamlet', esp. ch. 2., pp. 62-105.

¹³⁴ Gina Bloom, *Voice in Motion: Staging Gender, Shaping Sound in Early Modern England* (Philadelphia, 2007), p. 66.

¹³⁵ Matthew Mead, *Solomon's Prescription for the removal of the pestilence* (1655), p. 25

by the wrath of God.’¹³⁶ Had the miasma of blasphemy infected the air with plague? Mead is convinced:

If the polluted breath of these kind of wretches, have infected the very Air we breath in, 'tis not to be thought strange in the least. Could those volleys of Blasphemies which have been discharg'd against the glorious Majesty, do any other than turn to a black cloud, which should light heavily upon us?¹³⁷

Not only had ‘those volleys of Blasphemies’ corrupted the moral sanctity of ‘the glorious Majesty’ and the kingdom, but also the very air they breathe. The hellish, ‘black cloud’ cast over the city was the direct result of profanity. Here, the power of breath should not be underestimated. While it may be tempting to read Mead’s proselytizing as rhetorical hyperbole, we should cast our minds to the medical and scientific context of the early seventeenth century. Mead’s use of pollution in this context is no longer restricted to the rhetorical, figurative definition above but articulates the physical degradation of air quality. This idea was not entirely inconceivable in the period in question, as the Swiss physician Felix Platter notes in 1664: ‘Exhalations stinking and venemous coming from the Earth, Ditches or Pools, and the excrements of living Creatures formerly infected, as sweat, breath, bodies, pollute the Air to infect the body, and cause these Fevers, most common to them that live in the place from whence the seed of the infection sprang.’¹³⁸

Also writing at the time of the Great Plague, Thomas Willis (minister of Shadwell, not to be confused with the founding member of the Royal Society) expressed his dismay over what he considered ‘corrupt communications’. Beginning the second half of his *Help for the*

¹³⁶ Mead, *Solomon’s Prescription for the removal of the pestilence*, p. 26

¹³⁷ Ibid.

¹³⁸ Felix Platter, *Platerus golden practice of physick: fully and plainly discovering, I. All the kinds. II. The several causes of every disease. III. Their most proper cures, in respect to the kinds, and several causes, from whence they come* (London, 1664), p. 201.

Poor who are visited by the Plague (1666), Willis offers a ‘meditation suited to the state and condition of one that is shut up in a house visited with the Plague’:

I have polluted the *Air* by my sinful words, and am not worthy to breath in it. How justly is the benefit of the pure and free Air denied me, who have so polluted it by my impure speeches, *corrupt Communications!* How justly is the Air, which was polluted by my sins, insected with the *Plague!* Have I not polluted it with Oaths and Curses, at least stained it with many vain and *idle words*, for which I must give *account at the Day of Judgement!*¹³⁹

The same concerns straddle a period of scientific endeavour and progress. In Robert Leighton’s *Commentary upon the first Epistle*, published posthumously in 1693, the Scottish prelate scolds similar behaviour.¹⁴⁰ He designates profanity as a public nuisance, with ‘the whole Land overspread and defiled with it, the common noise that meets a man in Streets, and Houses, and almost all places where he comes.’¹⁴¹ Whether or not the profanity described by Leighton comprised the same threat as those ‘pollutions’ described by Mead and Willis, the ‘Impure or filthy speaking’ he described was equally pervasive and: ‘pollutes or offends those that hear them, and are the noisom breath of a rotten polluted heart.’¹⁴²

To state that ‘pollution’ emerged as an exclusively environmental term not only ignores other forms of organic pollution, but also undermines the multidimensional issue of early modern air quality. To conclude this point we turn to the ever-cantankerous Thomas Tryon, whose *Country-Man's Companion* railed against the diverse causes of England’s pestiferous airs at the end of the century. Listing a number of ‘fulsom Vapours, Scents and

¹³⁹ Thomas Willis, *A Help for the Poor Who are visited with the Plague* (London, 1666), p. 30

¹⁴⁰ Robert Leighton, *A practical commentary upon the first epistle general of St. Peter* 2 vols. (London, 1693) vol. 2, p. 59.

¹⁴¹ *Ibid.*

¹⁴² *Ibid.*

gross Smells which cities are subject to', Tryon includes: 'those varieties of *Cursing*, *Swearing*, and Multitudes of vain and impious Discourses which all places are liable unto'; the '*stabbing of Heaven* with dreadful *Oathes*, horrid *Curses* and frightful *Execrations*'; the '*viler Steams* of detestable *Brothel-houses*' which 'infect the chaste Air'; and the 'no clattering of *Coaches*, *Drums*, *Fools*, *Fidlers*, &c. that make such a continual *Din*, that a Man can hardly call his *Ears* his own.'¹⁴³ In *The Country-Man's Companion* Tryon continues his campaign against these 'fulsome vapours': 'let not our pure *Air* be disturbed with their ungrateful *Noises*, *Clashings*, *Rattlings* and *bouncings*, nor polluted with the Sulpherous Steams they send forth.'¹⁴⁴ Though disregarded in environmental historiography, a further source of 'fulsom fumes' is identified in Tryon's attack: tobacco.

'Work for Chimney sweepers': Tobacco, Sociability, and Race

Alongside the rapid rise in demand for sea-coal described in the previous chapter, in the early seventeenth century tobacco found a mass market. Between 1621 and 1638, the success of a number of American plantations meant that tobacco imports grew from 60,000 to 2,000,000lbs per annum.¹⁴⁵ A commodity once exclusive to the wealthy had now become considerably cheaper, if still an icon of aspiration. In the next chapter, the influence of perfumes and other botanical effluence on the air will be considered; however, at the opposite end of this olfactory scale was tobacco, a scent which proliferated throughout the city on a

¹⁴³ Thomas Tryon, *The Way to Health* (London, 1691), pp. 191-192.

¹⁴⁴ Tryon, *The Country-Man's Companion: OR, A New Method Of Ordering Horses & Sheep* (London, 1684), p. 174.

¹⁴⁵ Keith Wrightson, *Earthly Necessities: Economic Lives in Early Modern Britain* (London, 2000), p. 180.

similar scale to perfume and sea-coal.¹⁴⁶ Remarkably, however, little attention has been paid to smoking practices in an environmental context. This is perhaps owing to the perception of a medical consensus which up until the beginning of the seventeenth century agreed on the prophylactic qualities of tobacco smoke.¹⁴⁷ However, as this chapter will evidence, tobacco use was simultaneously justified and disparaged using the language of popular climatology. Examining tobacco as a case study, the following shows how climate and concerns of moral and air pollution became entangled. The clear parallels between tobacco and sea-coal abuse did not go unnoticed by contemporaries. Their complaints against the herb were born from a concern over social and ethnic degeneration; however, they also portray nascent concerns over deteriorating air quality.

Following the translation of Nicolas Mondardes' *Historia medicinal de las cosas* (translated by John Frampton in 1577 under the new title: *Joyfull newes out of a newfound world*) a number of health regimens celebrated the diverse therapeutic use of tobacco. Amongst other benefits, Mondares claimed use could act as an antidote for asthma and breast ailments.¹⁴⁸ Using the Galenic paradigm, tobacco was considered by many of the regimen authors to possess a revivifying quality. As argued by William Vaughan in his *Directions for Health*, Tobacco 'well dried, and taken in a silver pipe ... cures the migraine, the toothache, obstructions proceeding of cold, and helps the fits of the cholera.' Against the soggy climate of England, tobacco – unanimously considered hot and dry in the first degree - was conceived by medical authors as treatment against the phlegmatic complaints levelled against their native airs. Tobias Venner, the celebrated physician, advocated the drug on the basis that it

¹⁴⁶ Andrew Gurr describes tobacco as 'the most distinctive smell at the indoor playhouses ... apart from perfume' in *Playgoing in Shakespeare's London* (2nd edn., London, 1995), p. 38.

¹⁴⁷ Paul Slack, *The Impact of the Plague in Tudor and Stuart England* (London, 1985), pp. 30, 45.

¹⁴⁸ Nicolas Mondares, *Primera y segunda y tercera partes de la historia medicinal: de las cosas que se traen de nuestras Indias Occidentales, que sirven en medicina* (2d edn. Seville, 1580) trans. John Frampton, *Joyfull Newes out of the newfound world* (London, 1577), pp. 32-39,

naturally counteracted the effects of the English climate. Smoking tobacco, he claimed, ‘helpeth the braine that is over moist ... it preventeth putrefaction of humours, by drying up crudities of the body, and is very profitable upoin taking of colde, and for all colde and moist effects of the stomake, breast, and lungs.’¹⁴⁹ While smoking was regarded by many, including the eminent Francis Bacon, to be a natural prophylactic against melancholy and plague, a number of dissenting voices – not least King James I – expressed distaste for smoking and its effects on public health. Historians have tended to treat these voices as symptomatic of broader desires within Puritanism for moral reform, often neglecting the significant medico-in which they emerged.¹⁵⁰ Smoking and its association with breath, air and situation has also been suspended in favour of a narrative which privileges a medical teleology which has systematically ignored pre-modern concerns with tobacco abuse.

Since the publication of King James’ *Counterblaste to Tobacco* (1604), passive smoking had been treated as a potential nuisance. For His Majesty, smoking represented ‘a custome loathsome to the eye, hatefull to the Nose, harmefull to the braine, dangerous to the lungs, and in the blacke stinking fume thereof, neerest resembling the horrible Stygian smoke of the pit that is bottomelesse’. Though tobacco was thought by many to be beneficial to restoring the Englishman’s natural heat, smoking involved secondary concerns surrounding the ‘pollution’ or corruption of the air.¹⁵¹ Accounts against tobacco were diverse in the period, however *Counterblaste* is exceptional in its attack on what we would refer to today as passive smoking. Upon his succession to the throne, the King was eager to distance himself from the Presbyrtarianism of his native Scotland, extinguishing Puritan expectations at the Hampton

¹⁴⁹ Tobias Venner, *A Briefe and Accurate Treatise, Concerning The taking of the fume of Tobacco* (London, 1621), sigs B3r-v.

¹⁵⁰ David Harley, ‘The Beginnings of the Tobacco Controversy: Puritanism, James I, and the Royal Physicians’, *Bulletin of the History of Medicine*, 67(1993), pp. 28-50, p. 28.

¹⁵¹ As argued by William Vaughan in his *Directions for Health*, p. 26, Tobacco ‘well dried, and taken in a silver pipe ... cures the migraine, the toothache, obstructions proceeding of cold, and helps the fits of the choler.’

Court conference in 1604.¹⁵² Yet, James remained a committed Calvinist and held sympathies with many Puritan views on tobacco, as well broader desires for moral reformation.¹⁵³ The King's disgust is epitomised by one passage during which attacks the moral and environmental pollution caused by indoor smoking. 'And for the vanities committed in this filthie custome, is it not both great vanitie and uncleanness, that at the table, a place of respect, of cleanlinesse, of modestie, men should not be ashamed, to sit tossing of *Tobacco pipes*, and puffing of the smoke of *Tobacco* one to another, making filthy smoke and stinke therof, to exhale arthwart the dishes, and infect the air, when very often, men that abhorre it are at their repast.' Here, environmental and moral pollution are enmeshed, reciprocal. This 'filthie custome' has not only debased the air they breathe, but the genteel atmosphere of the dinner party.

As well as infecting the air, for James smoking was simply impolite. 'Surely Smoke becomes a kitchin far better then a Dining chamber,' asks the King. Indeed, many Puritan complaints against tobacco use were often based on the unabashed 'vanity' of the enterprise. In a dietetic handbook published in 1599 by Henry Buttes,

It chaunce'd me gazing at the Theatre,
To spie a Lock-Tobacco-Chevalier,
Clowding the loathing ayr with foggie fume
Of Dock-Tabacco, friendly foe to rume.¹⁵⁴

However, while James' complaint seems to take exception to all smoking, Buttes is careful to distinguish between the 'excessive use of Tabacco' and its medicinal purpose. He reiterates

¹⁵² Kenneth Fincham and Peter Lake, 'The Ecclesiastical Policy of James I', *Journal of British Studies*, 24 (1985), pp. 169-207; Patrick Collinson, 'The Jacobean Religious Settlement: The Hampton Court Conference' in Howard Tomlinson (ed.) *Before the English Civil War: Essays on Early Stuart Politics and Government*, (Basingstoke, 1983), pp. 27-51.

¹⁵³ Harley, 'The Beginnings of the Tobacco', p. 42.

¹⁵⁴ Henry Buttes, *Dyets Dry Dinner* (London, 1599), sig. P3v-4r.

the medical faculties of the drug at the end of his pamphlet, comparing English bodies to ‘newe dampish Ovens, or olde dwelling houses that have stood long desolate’ and ‘Hence is it that we perfume and aire our bodies with *Tabacco* smoake (by drying) preserving them from putrifaction.’¹⁵⁵

The analogies between individual and public health are consistent throughout the many early critiques of smoking habits. Perhaps the inaugural critique of Jacobean tobacco consumption was published anonymously, under the title *Work for Chimny-sweepers: or, a warning for Tabbaconists* (1602). David Harley has speculated that the mystery author was one John Hammond, whose Cambridge thesis dated 14 April 1597 bears close resemblance to *Work for Chimny-sweepers*.¹⁵⁶ Frequently, our writer argues against smoking habits from an environmental platform. Tobacco smoke, he implied, is no different from the other miasmas described by Robert Burton in his ‘Digression on Bad Air’:

The darke and smoakie fume, persing the cauities and ventricles of the brain, no otherwise, then a melancholy winde or adult vapour (rising from an adult Liuer, or obstructed spleen) do breed in vs terror, and feare, discontentment of life ... For truly the inward darkness and obscuritie of the braine, doth appall and terrifie our inward senses and minde also, in no less sort then doth the externall darknesse or myst of the outward aire, terrifie & appall the same.¹⁵⁷

It is noteworthy here that our Author justifies their logic on the basis of climatology, assuming that one’s inward airs match the ‘the external darknesse or myst of the outward air.’ What is harmful to the body is harmful to the environment, and vice versa. It is useful here to reflect again Gail Kern Paster’s portrait of the humoral form, which she describes as a

¹⁵⁵ Buttes, *Dyets Dry Dinner*, sig. P3v-4r..

¹⁵⁶ Harley, ‘The Beginnings of the Tobacco Controversy’, p. 38.

¹⁵⁷ S. A. Atkins, *Work for chimney-sweepers: or A warning for tabacconists Describing the pernicious vse of tobacco, no lesse pleasant then profitable for all sorts to reade* (London, 1602), G3 (emphasis added).

‘character contingent upon a fully realized, if only partially articulated set of correspondences between inner and outer worlds, between the human body and the world in which it feels and acts in continuous, dynamic reciprocity.’¹⁵⁸ The very title of *Work for Chimney sweepers*, however satirical, suggests a unity between environmental and medical concern. The work did much to ignite debate over this nascent health concern, prompting a rebuttal from Thomas Marbecke, Provost of Oriel College, Oxford in *A Defence of Tobacco* in the same year. Marbecke, a registrar of the College of Physician, spoke from a point of authority to dismiss claims made by the pamphlet.¹⁵⁹ He also pointed to the ambiguities rife within the pamphlet: was the author consistently anti-Smoking, or merely in a public setting? On the same grounds, would he object to coal smoke? In other words, was his objection based on moral or environmental grounds? As this chapter has made clear, these concerns had been deeply interwoven since the idea of ‘pollution’ emerged in the late sixteenth and early seventeenth centuries. As such, puritans would often invoke environmental analogies to demonstrate concerns over smoking. Joseph Hall, as a young alumnus of Emmanuel College, expressed his distaste for the habit using the familiar icon of the chimney:

Look to the towred chimneis which should bee
The winde-pipes of good hospitalitie
Through which it breatheth to the open ayre,
Betokening life and liberall warfare
Lo, there th’ vnthankfull swallow takes her rest,
and fils the Tonnell with her circled nest,

¹⁵⁸ Paster, ‘The Body and Its Passions’, *Shakespeare Studies*, 29 (2001), pp. 44-56, p. 48.

¹⁵⁹ Roger Marbecke, *A defence of tobacco with a friendly answer to the late printed booke called Worke for chimney-sweepers, &c.* (London, 1602)

Nor halfe that smoke from all her chimneis goes
As one Tobacco-pipe dries through his nose.¹⁶⁰

As with James' account, two arguments are at play above. Though 'smoking like a chimney' is idiomatic to the modern reader, both tobacco smoke and the 'multitude of chimneys lately erected' described by William Harrison constituted novel additions to the domestic interior in the late sixteenth and early seventeenth century. The frequent comparison between coal and tobacco smoke is noteworthy in that it reflects overlapping concerns with moral (or cultural) and environmental pollution.

The ensuing debate over the social acceptability of smoking reflected concerns over metropolitan air quality. As early as 1599, Thomas Platter recorded that: 'I am told that the inside of one man's veins after death was found to be covered in soot just like a chimney.'¹⁶¹ Much of the King's own treatise rests upon similar climatological assumptions:

[T]hat the suffumigation thereof cannot haue a drying qualitie, it needes to further probation, then that it is a smoake, all smoake and vapour, being of it selfe humide, as drawing neere to the nature of the ayre, and easie to be resolved againe into water, whereof there needes no other prooffe but the Meteors, which being bred of nothing else but of the vapours and exhalations sucked vp by the Sunne out of the earth, the Sea, and waters, yet are the same smoakie vapours turned, and transformed into Raynes, Snowes, Deawes, hoare Frostes, and such like waterie Meteors, as by the contrarie the raynie cloudes are often transformed and euaporated in blustering winds.¹⁶²

¹⁶⁰ Joseph Hall, *Virgidermiarum: The three last Bookes. Of byting Satyres* (London, 1598), p. 65.

¹⁶¹ Thomas Platter and Clare Williams (eds.), *Thomas Platter's Travels in England, 1599* (London, 1937), p. 171.

¹⁶² James I, *A Counterblaste to Tobacco* (London, 1604), xiv.

Emulating the macrocosm, as ‘this stinking smoke being sucked up by the nose and imprisoned in the cold and moist brains is by their cold and wet faculty turned and cast forth again in watery distillations, and so are you made free *and purged of nothing, but that wherewith you willfully burdened yourselves.*’¹⁶³ Thomas Tryon continued to rail against the use of Tobacco until the end of the period, claiming the tobacco epidemic had spread to the wholesome country airs. Even those privileged by pure air ‘in the most remote parts of *England, and far from Cities and Sea-Ports*’ and are ‘most healthful and freest from Diseases’ now indulge in Tobacco use.¹⁶⁴ ‘The *Farmers Wife* will sell her *Eggs, Butter, Cheese and Wheat* to buy *Sugar, Spice and Tobacco*, which stand them in no stead, only to increase *Intemperance and Distempers.*’ What seems so very cruel to Tryon is that ‘*Plough-men and Shepherds* defile their most pleasant Air with the fulsom Fumes of *Tobacco.*’¹⁶⁵

One final concern with tobacco smoke, relating to chapter four, is its status as a foreign commodity. Medical authors had boasted the fortifying effects of tobacco on the clammy English constitution, though it remained that the crop was entirely unsuited to cultivation in England. Tobacco was hailed as an exotic commodity, though also reviled by Puritans as a signifier of racial ambiguity. Anxieties over ethnic transformation, as will be subsequently made clear, were acute in the period concerned. For those protesting the excesses of Stuart England, the intake of tobacco smoke was tantamount to treachery and exposed one to foreign vice. For James I, the product was an interloper threatening to distemper the humoral balance of the Englishman. In a brief history of its manufacture, the King described how the plant was ‘first found by some of the barbarous Indians to be a preservative, or Antidote against the Pockes, a filthy disease, whereunto these barbarous

¹⁶³ James I, *A Counterblaste to Tobacco*, xv.

¹⁶⁴ Tryon, *The Way To Health*, pp. 165-166.

¹⁶⁵ *Ibid.*, p. 166.

people are ... very much subject.’¹⁶⁶ The medicinal need for tobacco, according to James’ pamphlet, was unnecessary. By smoking the herb, Englishmen simply served to ‘imitate the barbarous and beastly manners of the wilde, godlesse, and slavish *Indians*.’¹⁶⁷ If Englishmen were so enamoured with Indian culture, he asked:

Why doe we not as well imitate them in walking naked as they doe? in preferring glasses, feathers, and such toyes, to golde and precious stones, as they do? yea why do we not denie God and adore the Deuill, as they doe?¹⁶⁸

If habit constituted a second nature, smoking tobacco exposed the Englishman to potentially violent humoral change and transformation. In a later *Proclamation concerning Tobacco* (1623), the King further admonishes the drug for ‘tending to the corruption both of the health and manners of Our people’ on the basis that ‘it is utterly unfit ... in respect of the Climate.’¹⁶⁹ Many antitobacconists whose works contributed to the tobacco controversy of the late-Tudor and Stuart period often spoke of the commodity in racialized terms. Tobacco’s quality was labelled dark and hot, in contradiction to the conditions which reared the hardy English temperament. In the aforementioned *Work for Chimny-Sweepers*, Philarates personifies the drug as a ‘swarthe Indian’, internally corrupting ‘faire Albion’ by ‘pla[ying] the painted English Curtesan.’¹⁷⁰ Describing the ‘polluting’ effects of tobacco, John Deacon declares the tobacconist a traitor:

This is a Traitour, and doth reason warke;

Braine cleare and bright, with *smokie* mists polluting:

¹⁶⁶ James I, *A Counterblaste to Tobacco* (1604), viii-ix.

¹⁶⁷ *Ibid.*, ix.

¹⁶⁸ *Ibid.*, x.

¹⁶⁹ James I, *By the King a proclamation concerning tobacco* (London, 1623), i.

¹⁷⁰ S. A. Atkins, *Work for chimney-sweepers*, A4v.

And with his colour black, obscure and darke,
Throughout the body every part imbruing.¹⁷¹

As well as constituting a figurative betrayal against one's constitution and country, Deacon's work makes a biological case against the transformative qualities of tobacco. Having apparently witnessed several anatomies of so-called 'tobacconists', he concluded that the smoke had 'corrupteth and defileth the whole body with a black, filthie, and smokie colour,' their 'entrails as blacke as a coale.'¹⁷²

Pollution comprised a threat to individual health and an exogenous risk to sociability, morals and the English constitution. This was a period in which the effects of unmitigated coal consumption were beginning to emerge in the English consciousness, albeit alongside concurrent anxieties of airborne contagion and moral decay. The early modern understanding of pollution confounds our modern expectations of technical and non-technical pollution. Unlike today, the boundaries between the figurative and literal; the metaphor and material; the 'cultural' and 'environmental' were virtually indistinct. In the previous chapter, I considered how 'climate' emerged within a qualitative template based on the concepts of early modern medicine. Similarly, 'pollution' transgressed the boundaries between physical and cultural influence. The technique and apparatus used to distinguish the physical adulteration of the air was in its infancy. Consequently, an idea of pollution existed between a moral and material definition, one that attributed air quality to human misdeeds and naturally occurring vapours. However, a dirty air was never *just* a dirty air. A dirty air signalled moral corruption, lascivious behaviour, and plague, anti-sociability and ethnic ambiguity. The chronic sensitivity toward environmental change that was detailed in the previous chapter did not only define the introverted habits of daily life, but the coordination of social spaces. The following

¹⁷¹ John Deacon, *Tobacco tortured, or, the filthy fume of tobacco refined* (London, 1616), A1r.

¹⁷² *Ibid.*

chapter will examine how early modern Englishers sought to insulate themselves from the pollution outside.

CHAPTER THREE: DOMESTICATING CLIMATE

In an age of anthropogenic climate change, where we live, how we travel, what we eat and drink, our domestic chores, lifestyles, and hobbies are suffused with the gravest environmental, ethical, and medical consequences. To varying degrees, climate change is manifest in our daily habits; whether represented by the temperature of a thermostat or the relative size of our carbon footprint. Inhabiting increasingly toxic city environs, urban-dwellers long for frequent ‘changes of air’ by retreating to higher altitudes, sultry climes abroad, or the wholesome local countryside. Orienting our homes around proximity to fresh air and sunlight, some practice *Feng Shui* and others scent living spaces with a cornucopia of natural and artificial air fresheners: candles, incense, diffusers, oils, and sprays. Potted plants and filters are sought to offset exposure to malignant airs, while anti-pollution masks provide questionable protection on street-level. The power of climate is regulated by mechanical devices and insulated by architectural design, with the majority of indoor space in the West manipulated by some kind of central air conditioning. We live in a world where climate is acutely monitored, measured and engineered to our comfort.

During the Little Ice Age, the tangible effect of global cooling and impact of environmental change can also be read in the domestic, architectural and material artefacts of early modern England. The past is often branded as inhospitable, uncomfortable and unhealthy. To a degree, there is credence in this idea. As the previous chapter demonstrated, and the beginning of this chapter will reinforce, the early modern home was the site of various environmental threats that have since diminished: malaria, rickets, and certain respiratory diseases. In subsequent chapters, the efforts of colonists and religious reformers to redefine the English relationship with their airs and weathers will be explored. For the meantime, our

discussion will consider the quotidian attempts made by ordinary and elite Englishers to change their indoor airs. In four parts, this chapter will consider routines of acclimation in the home. It will start by providing a medical geography of climate in the period, what the epidemiological historian Mary Dobson has termed ‘the contours of health and disease’.¹ It will then demonstrate four evolutions in the social and material practices designed to mitigate the presumed effects of the English weather. This will chart the legacy of Galenic medicine, medieval horticulture and the cultivation of ‘artificial air’, emergent trends in Tudor-Stuart Architecture and window making; and finally explore a hitherto forgotten early history of mechanical air conditioning.

Fashion, ritual, and design mediated the early modern experience of climate. As some historians have acknowledged, the household was on the frontline in the battle against noisome airs, pollution and extreme weather. Scholars of eighteenth-century Britain, including Vladimir Jankovic, have traced a genealogy of environmental pathologies through changes in ventilation, clothing, and travel.² Jankovic’s work traced the origins of ‘environmental consciousness’ in post-Enlightenment Britain by surveying everyday environmental and domestic behaviours that contributed to the condition of indoor air. While historians have paid attention to large scale attempts to manipulate the early modern English climate (i.e. Evelyn’s plan for London; the draining of the Fenlands), few have yet to consider how climatic variance, ‘bad’ air and pollution came to inform the private practices of early modern Englishers. As stated by Alexandra Harris, enlightenment thought on climate saw society as that ‘which asserts civilization over chaos by making contained, controlled spaces

¹ Mary Dobson, *Contours of Death and Disease in Early Modern England* (Cambridge, 2003). For a shorter account of the same topic see Dobson, ‘Contours of Death: disease, mortality and the environment in early modern England’, *Health Transition Review*, 2 (1992), pp. 77-94.

² Vladimir Jankovic, *Confronting the Climate: British Airs and the Making of Environmental Medicine* (London, 2010).

which keep the weather out.’³ This chapter will extend our historical understanding of domestic climates during a time of rapid urbanisation, carbon consumption and climatic change. As well as surveying the environmental threats that influenced architecture and domestic comfort, this will consider the quotidian and grand impacts of climate on the material culture of early modern England.

‘Beware of Whitehall’: Airs, Waters, and Places in England

Two months before her eventual death in March 1603, a sudden illness struck Elizabeth I. Amid a bitter and tempestuous winter, courtiers decided to transfer the Queen from her Palace in Whitehall eleven miles west to Richmond.⁴ ‘The Court,’ described John Chamberlain in a letter dated January 27, ‘removed hence to Richmond the 21th of this moneth in very fowle and wet weather; but the wind sodainly changing to the north-east hath made here ever since.’⁵ Throughout her reign, the Queen had made regular progresses to various palaces around London: Greenwich, Eltham, Hampton, St James’s, Somerset House and Oatlands had all at one time hosted the Queen’s court. Richmond, however, was Elizabeth’s favoured abode; her ‘warm winter-box to shelter her old age’, to quote Dr John Dee.

Elizabeth would visit Richmond around twice a year, often in late autumn and winter, when the air grew colder. During her later life, the Queen found Richmond’s atmosphere to be

³ Alexandra Harris, *Weatherland: Writers & Artists Under English Skies* (London, 2015), p. 18.

⁴ By all accounts, this was a particularly frosty winter. On 31st January the Venetian Secretary in England reported that ‘during the night came such a snow-fall and so stormy a sea that people here declared its like has not been seen for the last three years. Of the two ships which sailed that night one could not remake the harbour owing to the darkness, and was lost with every soul on board.’ Marin Cavalli, Venetian Ambassador in France, to the Doge and Senate. ‘Venice: February 1603, 1-15,’ in Horatio F Brown (ed.) *Calendar of State Papers Relating To English Affairs in the Archives of Venice, Volume 9, 1592-1603* (London, 1897), pp. 526-531. *British History Online*, accessed February 20, 2019 <<http://www.british-history.ac.uk/cal-state-papers/venice/vol9/pp526-531>>

⁵ John Chamberlain, ‘Cecil Papers: January 1603, 16-31,’ in R. A. Roberts (ed.) *Calendar of the Cecil Papers in Hatfield House: Volume 12, 1602-1603*, ed. R A Roberts (London, 1910), pp. 607-631. *British History Online*, accessed July 1, 2019. <<http://www.british-history.ac.uk/cal-cecil-papers/vol12/pp607-631>>

conducive to her health, the palace's compact royal apartments acting to insulate her body from the harmful winter air. Whitehall, by contrast, suffered from an infamously poor air. Twelve days before she was 'sickened of the cold', Dr Dee warned the Queen to 'beware of Whitehall': the Palace's sickly, ill-ventilated corridors were renowned as a bastion of pestiferous airs and ill health. Successive monarchs regarded Whitehall's rank air as a persistent threat to health. Before the Palace's incineration in 1698, the King's asthma forced William and Mary westward to Kensington in 1689. Earlier, in John Evelyn's *Fumifugium* (1661), the author prefaced his account of London's smoke with a first-hand account of a 'pernicious accident' witnessed at Whitehall. It was 'while I was Walking in your Majesties Palace, at Whitehall,' Evelyn explained, 'a presumptuous Smoake ... did so invade the Court; that all the Rooms, Galleries, and Places about it were fill'd and infested with it.'⁶

The court based their decision to remove the Queen from Whitehall on well-founded knowledge and medical advice that suggested that a change in her domestic environment would revive Elizabeth's lackluster complexion. According to John Nichols, this sudden change of environment was a remarkable success: 'when she first arrived, the change of air appeared to have had a salutary effect, for she was well-amended of the cold.'⁷ Following guidance outlined in previous chapters, a modest change of situation had resuscitated Elizabeth's declining health (at least for another couple of months). Whether we trust the integrity of Nichols' notes, the instinctive decision to move Elizabeth was made on the basis of entrenched notions of 'good' and 'bad' air. The disparity between Richmond, which lay in 'in some of the best air in the world' according to Samuel Young, and Whitehall, abhorred for its unhealthfulness, serves as an elite manifestation of the cultural codes that defined a good

⁶ John Evelyn, *Fumifugium, or, The inconveniencie of the aer and smoak of London dissipated together with some remedies humbly proposed by J.E. esq. to His Sacred Majestie, and to the Parliament now assembled* (London, 1661), i.

⁷ John Nichols op. cit. Agnes and Elisabeth Strickland (eds.), *Lives of the Queens of England* (London, 1852) vol. 2, p. 772.

indoor climate.⁸

If a recurrent theme throughout this thesis has been to question the basis of an optimum climate, the conventions inherited and developed throughout the chapter will elucidate the everyday decision making which constructed the boundaries between a healthful and unhealthful air. As expected, the early modern conventions of a(n) (un)-healthy home were based on the advice of the ancients. Above all, emphasis was on the principles enshrined in Hippocrates' *Airs, Water and, Places* thesis. In the opening chapter, the idea of 'climate' as a static geographic entity was introduced. The same is true on a provincial level. Situation was the priority: proximity to running water; distance from fens and marshes; population; quality of soil and access to natural light. 'The salubrite of habitable places is expended chiefly in three things,' Tobias Venner clarified, citing Hippocrates: 'the pureness of the ayre, quality of the soyle and situation, and the wholesomeness of the water.'⁹ Gervase Markham, like many other popular writers concerned by the intersection between health and domesticity, urged his reader to 'let not your house be too neere to great Rivers or Brookes,' for 'they may smile in Summer ... they will be angrie in Winter' and 'oft vomit forth ill ayres, and are in their owne natures Aguish and unwholesome.'¹⁰

The advice of Hippocrates and Vitruvius permeated Tudor-Stuart architecture. In Henry Wootton's 1624 discourse on *The Elements of Architecture*, he regarded 'the qualitie and temper of the Aire' surrounding property with the most 'exquisite caution'. In particular, Wootton advised that the natural situation of one's abode:

⁸ Samuel Young, *A sober reply to a serious enquiry. Or, An answer to a reformed Quaker: in vindication of himself, Mr. G. Keith and others, for their conformity to the Church of England, against what I have written on that subject.* (London, 1700).

⁹ Tobias Venner, *Via Recta ad Vitam Longam, or A plain Philosophical Demonstration of the Nature, Fasculties, and Effects of all such things as by way of nourishments make for the preservation of health* (London, 1620), p. 1.

¹⁰ Gervase Markham, *The English Husbandman The First Part: Contayning the Knowledge of the true Nature of euery Soyle within this Kingdome: how to Plow it; and the manner of the Plough, and other Instruments* (London, 1635), p. 22.

be not too grosse, nor too penetrative; Not subject to any foggy noysomnesse, from Fenns or Marshes neere adjoining; nor too Mineral exhalations, from the Soile it selfe. Not undisgested, for want of Sunne, Not unexercised, for want of Winde: which were to live (as it were) in a Lake, or standing Poole of Aire.¹¹

The same tradition insisted that a subtle change of air could alter one's health, constitution, or even character. It would therefore dictate that the 'chusing of a good aire', as William Vaughan stressed, 'must - for the preservation of health - obtain chief place.'¹² Up to the early modern period, physicians broadly assumed that an ideal climate was that 'which is a man's native and countrie aire'.¹³ They could answer the question of 'which is the best Ayre' with modest certainty: as a microcosm of His surroundings, 'every mans naturall place preserueth him, which is placed in.'¹⁴ While homespun proverbs could be of great comfort in the urbanised environments of early modern England, they were not strictly accurate. For William Bullein, 'being a natural Englishman of birth and education', the climate was mostly 'very temperate'.¹⁵ He is nevertheless perplexed by the capriciousness of the same land:

[that] ... be variable as fennes, marishes, woods, heithes, valleis, and rockie places, and neare the sea side ... marish grounds and places where hempe and flax is rotten and dead carrions be cast, or multitudes of people dwelling together, or houses environed with standing waters, whereinto iakes or sinks, have issues, or wallowing of

¹¹ Henry Wotton, *The Elements of Architecture* (London, 1624), pp. 2-3.

¹² William Vaughan, *Natural and aritificial directions for health derived from the best philosophers, as well as modern, as ancient* (3rd edn., London, 1612), p. 2.

¹³ *Ibid.*

¹⁴ *Ibid.*

¹⁵ William Bullein, *The Government of Health* (1558) op. cit. Andrew Wear, *Knowledge and Practice in English Medicine, 1550-1680* (Cambridge, 2000), p. 191.

swine, or carion unburied or foule houses or such places be dangerous, corrupteth the bloud...¹⁶

As well as producing a variety of salubrious places to inhabit, the Lord's unquestionable providence had dotted the English landscape with hazards. A multitude of epidemiological and human causes, including a concentration of poxes, plagues, and fevers, formed the 'contours of death and disease' identified in Mary Dobson's landmark monograph of the same title.¹⁷ 'Bad air' was a feature of confined, swampy, low-lying terrains, estuaries and river valleys, hampered by poor sanitation and waste disposal. 'Good' airs were found inland, amidst hilly countryside or near a sea air far from salt marshes. The consequences of inhabiting the former space, as one would imagine, were dire. If, as the physician Tobias Venner claimed, 'all such are ingenious, generous, and desirous of perfection, both in minde and body ... endeavour to live in a pure and healthy Ayre' then to dwell within a 'black spot' was to embody lassitude and disease.¹⁸ Much to the concern of Bullein, England continued to suffer the effects of inadequate sanitation and the pernicious threat of malaria.

The treacherous fens and marshes described by Bullein constituted the perfect breeding ground for the *Anopheles atropavos*, the sub-species of mosquito native to Northern Europe. Though often considered to be a tropical disease, *malaria* (sometimes referred to as 'ague') maintained a consistent, mortal presence in the British Isles before the introduction of quinine to the English diet and the draining of the Fens by the late seventeenth-century.¹⁹ Countless people were victim to England's mortality 'black-spots'; those south-eastern

¹⁶ Bullein, *The Government of Health* (1558) op. cit. Wear, *Knowledge and Practice in English Medicine*, p. 191.

¹⁷ Dobson, *Contours of Death and Disease in Early Modern England* (Cambridge, 2003).

¹⁸ Venner, *Via recta ad vitam longam* (1620), p. 1.

¹⁹ Though works including Dobson's *Contours of Death and Disease* (Cambridge, 2003) use 'ague' interchangeably with malaria, it is not always clear whether early modern ague referred to the disease. Though agues which occurred around the marshes described in this work can be confidently labelled malaria, ague was also used to describe other common fevers. To avoid confusion, this thesis concentrates on uses of 'ague' in an environmental context, i.e. around stagnant pools of water, marshes, swamps, and fens.

marshlands besieged with malaria throughout the sixteenth and seventeenth-century. Less menacing than its sub-Saharan cousin, *Anopheles gambiae*, the *atropavos* was nevertheless capable of inflicting serious harm and death. According to Thomas Dekker's *News From Graves End*, the disease originated 'from standing Pooles / From boggs; from ranck and dampish Fenns / From Moorish breaths, and nasty Denny / The sun drawes up contagious fumes.'²⁰ Flourishing near rivers, fens, and marshlands during the late-spring and early autumn, the disease abided by a distinct seasonal rhythm. Using miasmatic theory, physicians understood and treated ague as inseparable from the 'hazardous' environments it occupied.²¹ Specifically, they credited the source of *mal-aria* (literally: 'Bad Air') to the noxious vapours deriving from 'unwholesome', stagnant climates. Regional stereotypes of malarial Fenmen proliferated throughout England, with Todd A. Borlik interpreting Shakespeare's Caliban as a satire of the ostracised, malarial inhabitants of England's as yet undrained fenlands. Like Caliban, they were stigmatised as unpleasant, heathenish creatures blighted by 'all the infections that the sun sucks up/ From boggs, fens, flats' (*Tempest*, 2:2).²²

Ague was one in a series of climatic and environmental hazards that influenced domestic life in early modern England. Along with the intense periodic coldness and various forms of pollution experienced throughout the sixteenth and seventeenth centuries, available sunlight was a significant concern for city-dwellers. London at the time would have been densely occupied, narrow and enclosed by city walls. As houses grew taller natural light faced further obstruction and neighbours sought compensation and justice in court over restricted

²⁰ Thomas Dekker, *News from Graves End* (1604), sigs. C3v-C4.

²¹ Tayler Meredith, 'The Good, the Bad, and the Ague: Defining Healthful Airs in Early Modern England.' *Arcadia*, 12 (2017). Accessed online, 3 June, 2019. <<http://www.environmentandsociety.org/node/7895>> For a comprehensive epidemiological account of malaria in early modern England, see Dobson, *Contours of Death and Disease in Early Modern England* (Cambridge, 2003). Also, see Paul Reiter, 'From Shakespeare to Defoe: Malaria in England in the Little Ice Age', *Emerging Infectious Diseases*, 6 (2000), pp. 1-11.

²² Todd Borlik, 'Caliban and the Fen Demons of Lincolnshire: the Englishness of Shakespeare's *Tempest*', *Shakespeare*, 9 (2013), pp. 21-51.

access to sunlight.²³ The concentration of smog which accumulated in urban areas during colder months would have prohibited access to clean air and sunshine. Though the grievous effects of England's early coal consumption are detailed in various historical works, the indirect impact of smog on visibility and indoor living have been scarcely considered by scholars. What demographers and physicians had missed at the time, and environmental historians since, were the harmful effects of sunlight deprivation caused by urban smog. Though vitamin D deficiency in England is consistently thought of as a by-product of the Industrial Revolution, there is evidence to suggest that rickets may have been a serious problem 300 years earlier.

Daniel Whistler and Francis Glisson authored the most famous early accounts of rickets, believing that rickets was a disease new to the seventeenth century.²⁴ Both suggested that the earliest cases had appeared twenty years before them writing, in southern England (Dorset) and in the West Country (Somerset) though this is likely to be unrepresentative of the true spread of undiagnosed rickets in London. Whistler and Glisson also regard rickets as a predominately upper class disease. This is most likely based on a lack of diagnosis amongst lower orders. For example, it had been suggested that as a child Charles I had rickets from 1600 to 1612. Charles' daughter, Princess Elizabeth, actually died with rickets. Accounts of the diet prescribed in her treatment indicate that the bland diet itself may have contributed to the progress of the disease and aggravated it. Whistler had observed that 'the disease is most frequent in the ranks of the highest citizens, next amongst the dregs of the populace, least amongst those of moderate means.'²⁵ The cause of which being 'the intemperance of the

²³ Diane Shaw, 'The Construction of the Private in Medieval London', *Journal of Medieval and Early Modern Studies*, 26 (1996), pp. 447-66, esp. 455.

²⁴ Daniel Whistler, *De Morbo puerili Anglorum, quern patrio idiomate indigense vocant 'The Rickets'* (London, 1645), Francis Glisson, *Tractatus de Rachitide* (London, 1650). Jeffrey L H O'Riordan and Olav L M Bijvoet, 'Rickets before the discovery of vitamin D', *Bonekey Rep* 3 (2014), p. 478

²⁵ Daniel Whistler, *De Morbo puerili Anglorum, quern patrio idiomate indigense vocant 'The Rickets'*, p. 409.

parents and the fact that the infants are entrusted to the care of a hired wet nurse.’²⁶ Other historians have stressed the significance of the use of wet nurses, pointing to the concentration of calcium in breast milk falls as the duration of feeding is extended, and feeding cereal porridges in weaning, with high phytate content, might have added to the calcium deficiency.²⁷

While calcium deficiency may have been a contributing factor in the emergence of rickets, we may also estimate the prevalence of rickets in the city would have been higher than both Glisson and Whistler suggest. For most of those living in the cramped quarters of the city, shielded from the effects of the cold and consuming a diet not known to be Vitamin D rich, restricted sunlight would have compounded the prevalence of rickets in the early modern city. By the mid-to-late seventeenth century, the modicum of sunlight typically cast on the dour English climate became obstructed by a series of meteorological, environmental and social factors – not least by London’s emerging smog. Other historians have pointed to the onset of the ‘Maunder Minimum’ from 1645 to 1715, otherwise known as the ‘prolonged sunspot minimum’, when solar activity slumped to its lowest point in centuries. Since around 1680 contemporary European astronomers recorded not a single sunspot in the northern hemisphere of the sun. During the solar minimum, scientists have estimated that the sun was approximately 0.24% dimmer than the present day mean, with an accompanying reduction in UV irradiance of up to 7%.²⁸ Attributing changes in the terrestrial climate to this decline in solar irradiance, however significant, is a complex and fraught matter.²⁹ Despite the simultaneity between the Maunder Minimum and the Little Ice Age, solar analysts are reticent

²⁶ Whistler, *De Morbo puerili Anglorum*, p. 409.

²⁷ Mingyong Zhang, Fan Shen, Anna Petryk, Jingfeng Tang, Xingzhen Chen, and Consolato Sergi, “‘The English Disease’: Historical Notes on Rickets, the Bone–Lung Link and Child Neglect Issues’, *Nutrients*, 8 (2016), p. 722.

²⁸ J. Lean, *et al.* ‘Reconstruction of solar irradiance since 1610: Implications for climate change’, *Geophysical Research Letters*, 22 (1995), pp. 3195-3198.

²⁹ David Shindell, *et al.*, ‘Solar Forcing of Regional Climate Change During the Maunder Minimum’, *Science*, 294 (2001), pp. 2149-2152

in attributing climatic change to solar irradiance. Lacking reliable data that unequivocally links the two, solar analysts are keen to distinguish between these two historical epochs – even if historians continue to conflate them. ‘*A decline in solar activity*’, Wolfgang Behringer explains in his *Cultural History of Climate*, ‘is usually regarded as the main explanation for the [*sic*] global cooling.’³⁰ Behringer is lured by ‘one of the most elegant explanations’ for the Little Ice Age, mistakenly referring to the height of the solar minimum as ‘the cold phase between 1675 and 1715’.³¹

Though both the Maunder Minimum and LIA remain useful catchwords for historians, it is worth reiterating that just as the Little Ice Age did not indicate a homogenous deep freeze, the solar minimum hardly plunged Europe into darkness. Eddy’s original article first noted the correlation between declining sunspots and European temperatures. His work also claimed that ‘the cyclic coming and going of sunspots would have little effect on the output of solar radiation, or presumably on weather, but the long-term envelope of sunspot activity carries the indelible signature of slow changes in solar radiation which surely affect our climate.’³² More likely, environmental, architectural and social factors were responsible for sunlight deprivation. As estimated by Peter Brimblecombe, the effect of early pollution may have concealed as much as 30% of winter U.V radiation.³³ While impressionistic, Evelyn’s account of London ‘eclipsed in such a cloud of sulphur’ serves to explain the palpable gloom of early modern living.

Along with the conditions described in chapter two, pre-existing environmental threats – like malaria, plague, and poxes – had a tangible influence on the movement and domestic practices of early modern England. In the early modern city, this awareness would have been

³⁰ Wolfgang Behringer, *A Cultural History of Climate* (Cambridge, 2010), p. 86. Italics original

³¹ *Ibid.*, p. 87

³² John A. Eddy, ‘The Maunder Minimum’, *Science*, 192 (1976), p. 1202.

³³ Peter Brimblecombe, ‘London Air Pollution 1500-1900’ *Atmospheric Environment*, 11 (1977), pp. 1157-1162.

acute considering the dense concentration of houses and the lack of access to quality air and sunlight. Though understudied in an early modern context, malaria and rickets thrived in certain English environments. Without the means to travel outside the city, it was necessary to recreate a healthful air indoors. The next three sections will establish ways that early modern sought to mitigate the effects described above, through gardening, architecture and mechanical air conditioning.

'A Garden within doores': Botany, Horticulture, and 'Artificial Air'

In the battle against miasma, smoke and bad-air, the garden represented the vanguard against pestilence; an effective *cordon sanitaire* against London's pestiferous atmosphere.³⁴ Within the English garden, one not only found aesthetic and aromatic pleasures, but remedies, fruits, and reviving fragrances to counter unwanted airs. By the time of the mid-sixteenth century, a new popular format of garden design had arrived to England by Italy: a celebration of plant life for an aesthetic and sensorial benefit, later known as the pleasure garden. By the 1660s, Roy Strong notes of how the appeal of the English pleasure garden had disseminated across the middle classes.³⁵ Early modern physicians and natural philosophers recurrently cited the restorative effects of fragrant air on the senses, not only smell.³⁶ Though today gardening represents a leisurely, genteel pursuit, well-maintained green-space was imperative to maintaining sound health in early modern England. In this sense, the early modern 'pleasure

³⁴ This argument draws upon the work of Carole Rawcliffe, who has remarked that 'in an age before the development of the microscope and the advent of modern medicine, gardens constituted a frontline defence in the battle against disease.' 'Delectable Sights and Fragrant Smelles': Gardens and Health in Late Medieval and Early Modern England' *Garden History*, 36 (2008), pp. 3-21. See also Paula Henderson, *The Tudor House and Garden: Architecture and Landscape in the Sixteenth and Early Seventeenth Century* (London, 2005).

³⁵ Roy Strong, *Renaissance Garden in England*, (London, 1979), p. 165.

³⁶ Following Aristotelian theory, William Coles attributed good eyesight to the sensorial workings of the garden, specifically the effects on the fatigued vision of a painter. William Coles, *the Art of Simpling, An Introduction to the Knowledge and Gathering of Plants* (London, 1656), p. 92.

garden' is a misnomer: the notion that gardening stood as an ornamental hobby rejects a body of contemporary scholarship and knowledge which attributed sound health to the 'delectable sightes and fragrant smelles' of the garden.³⁷

Better than anyone, John Evelyn was attuned to the 'genious of gardens' to 'operate upon humane spirits towards virtue and sanctitie.'³⁸ Like his compatriot John Beale, Evelyn was an established gardener: he designed gardens throughout his life, published multiple times on the philosophy of gardening (*The French Gardener*, 1658 and later the unfinished magnum opus *Elysium Britannicum*) and possessed a formidable knowledge of tree species.³⁹ However remarkable the scale of Evelyn's vision laid out in *Fumifugium*, his tools were well-established. Evelyn's horticultural solution to an environmental problem borrowed from a significant body of classical texts, early modern botanicals and garden manuals readily available to the urban 'middling sort' by the early seventeenth century. Despite his deep connection to a tradition of popular gardening in England, scholarship has not reflected on *Fumifugium's* overt use of domestic horticultural techniques. His plan was hardly a beautifying experiment, but a genuine, theoretically grounded attempt to counter London's smoke. As noted by Mark Jenner, Evelyn's recommendations 'were perfectly logical as throughout the early modern period it was widely agreed that noxious smells and airs could produce disease.'⁴⁰ Based on the most rudimentary and pervasive medical beliefs of the early modern period, it was commonsensical to assume that the sweet scents could counteract plague and ague.

³⁷ Thomas Hill, *The Gardeners Labyrinth* (London, 1577), p. 24. Leah Knight describes in *Of Books and Botany* how 'in the sixteenth century, the relatively new but increasingly widespread recreational or pleasure garden overlapped conceptually and materially with more customary medicinal and culinary gardens.' p. 115.

³⁸ John Evelyn, quoted in Michael Charlesworth, *The English Garden: Literary Sources and Documents* (Mountfield, 1993), pp. 1269-1270.

³⁹ John Evelyn, *The French gardiner: instructing how to cultivate all sorts of fruit-trees, and herbs for the garden* (London, 1658); *Elysium Britannicum, Or the Royal Gardens* (London, 1700).

⁴⁰ Mark Jenner, 'The politics of London air: John Evelyn's "Fumifugium" and the Restoration', *The Historical Journal*, 38 (1995), pp. 535-551, pp. 545-546.

Taking source from Hippocrates, Galen, Pliny, Vitruvius and Cicero, Evelyn was also indebted to contemporaries associated with the Hartlib Circle (Samuel Hartlib, John Beale, Kenelm Digby, Robert Boyle, Robert Child, Arnold Boate, *et al.*) who had all made separate interventions on the subject of London's atmosphere (though none quite so explicitly as *Fumifugium* or *Sylva*). Around the time of the Restoration, the above group theorised the virtues of cultivating plant life to 'rectify and purify the ayre of all the neighbouring country, both for health of body and mind.'⁴¹ As born from the Baconian method, in their separate ways each had sought to renovate London's climate. Their goals, as Jenner and Cavert affirm, were deeply idealistic; based on the premise that natural philosophy, grounded in empiricism, could remake London as a new Arcadia. Though Evelyn was not alone in his reasoning, the common goal of the Hartlib Circle was to achieve the utopian vision proposed in Bacon's *Advancement of Learning* (1605). *Fumifugium*, *Sylva*, and accompanying works by Beale are suffused with idealism. Each was also rooted in practical medical and horticultural knowledge which owed much to a tradition of female labour.

In traditional environmental histories, the crucial role played by women as mediators of domestic air has been neglected in favour of top-down approaches to early modern pollution debates featuring John Evelyn and John Beale. Herbals and Gardening manuals, two allied practical genres, experienced a boom in popularity during the mid-sixteenth century; according to Allen Debus, 'herbals were among the most popular books printed in the sixteenth century.'⁴² Richard Banckes' *Herball*, the first of its genre printed in the English

⁴¹ John Beale in a letter to John Evelyn, 30 September 1659, op. cit. Graham Parry, 'John Evelyn as Hortulan saint' in Michael Leslie and Timothy Raylor (eds.), *Culture and Cultivation in Early Modern England. Writing and the Land* (Leicester, 1992), pp. 130-150, p. 140.

⁴² Alan Debus, *Man and nature in the Renaissance* (Cambridge, 1978), p. 48.

language, went through fifteen editions between 1525 and 1560.⁴³ Around the same time, Thomas Hill authored the first manuals dedicated to gardening: *A most briefe and pleasaunte treatyse* (1563), *The proffitable arte of gardening* (1568), and *The Gardener's Labyrinth* (1577, using the alias Didymus Mountain).⁴⁴ Following Hill's famous publications, an exponential increase in garden manuals appeared in print. Jennifer Munroe interprets the market for gardening manuals as an indicator of a wider set of codified practical knowledge surrounding the garden, knowledge traditionally associated with women. Early-modern gardening practice, Hill explained, was divided between 'utility and delight': 'the utility yieldeth the plenty of herbs, flowers, and fruits right delectable, but the pleasure of the same procureth a delight, and ... a jocundity of mind.'⁴⁵ These two domains were predictably divided by gender, as noted by Betty Travitsky, Anne Prescott, and Munroe. The woman's role in the garden was, traditionally speaking, conceived as aesthetic; for 'delight'. Male attention, on the other hand, was absorbed by 'utility': the marketplace and professional gardening. With the decline of the subsistence household and self-sufficient housewife, the value of women's labour decreased as greater importance was placed on gardening for profit.⁴⁶ As women became marginalised in the household their gardening practices extended 'well beyond the parameters set by male writers to a wide variety of non-decorative uses that sustained the health of their families', to quote Munroe.⁴⁷ In their capacity as purveyors of the domestic garden, Mendelsohn and Crawford describe how women brought 'female expertise in the cultivation, collection, and preparation of edible and medicinal products.'⁴⁸ The same

⁴³ Agnes Arbel, *Herbals, Their Origin and Evolution, a Chapter in the History of Botany 1470–1670*. (Cambridge, 1912), p. 41; H.S Bennett, *English Books and readers, 1475 to 1557*. (Cambridge, 1969), p. 98.

⁴⁴ For further bibliographic details, see *Ibid.*; Jennifer Munroe, 'Gender, Class, And The Art of Gardening' *Prose Studies*, 28 (2006), pp. 197-210, p. 198.

⁴⁵ Thomas Hill, *The Gardener's Labyrinth* (London, 1577), p. 25.

⁴⁶ Munroe, 'Gender, Class, And The Art of Gardening', p. 205.

⁴⁷ *Ibid.*, p. 205.

⁴⁸ Sara Mendelsohn and Patricia Crawford, *Women in early modern England 1550-1720* (Oxford, 1989), p. 225.

applied for the cultivation of ‘artificial air’: an attempt to condition the air with botanical scents. Gardening manuals not only offered advice on husbandry and taxonomies of plantlife, but also offered specific guidelines on how to manipulate the scent, taste, and shape of a plant specimen.⁴⁹

With the advent of the printing press, William Eamon contends in *Science and the Secrets of Nature* (1994) that it was but ‘a small step from purchasing a remedy from a pharmacist to buying a book of remedies to cure oneself.’⁵⁰ Despite this, suspicion surrounded women’s involvement in medicine, however quotidian their methods. Though the respected James Primrose did not doubt their sincere intentions, he said ‘women ought not so rashly and adventurously to intermeddle’ with the domain of the ‘skilful Physician’.⁵¹ Practitioners of the Galenic and Paracelsian tradition denigrated Women as ‘unlearned and unskilled competitors’; however, several dissenting voices championed the dexterity of women’s botanical and herbal knowledge.⁵² Dr. Nicholas Culpeper, the distinguished seventeenth-century herbalist, declared that ‘all the nation are already physicians ... if you ail anything, everyone you meet, whether a man or a woman, will prescribe you a medicine for it.’⁵³ Quoting the herbalist and physician Leonard Fuchs, Robert Burton also joked of how ‘many an old wife or country woman doth often more good with a few known and common garden herbs than our bombast physicians with all their prodigious, sumptuous far-fetched rare

⁴⁹ ‘For a contemporaneous discussion of experiments that attempt to alter a plant’s color or scent, see John Parkinson, *Paradisi in Sole Paradisus Terrestris: A Garden of All Sorts of Pleasant Flowers Which Our English Ayre Will Permitt* (London, 1629). See also Anonymous, *The Expert Gardener* (London, 1654), and *The Orchard and the Garden* (London, 1594).

⁵⁰ William Eamon, *Science and the Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture* (Princeton, 1994), p. 138.

⁵¹ James Primrose, *Popular Errours. Or the Errours of the People in Physick, First Written in Latine ... Translated into English by Robert Wittie Doctor in Physick* (London, 1651), p. 19.

⁵² Wear, *Knowledge and Practice*, p. 57.

⁵³ Nicholas Culpeper, *A Physical Directory, or a Translation of the London Directory* (1649), A2.

conjectural medicine.⁵⁴ In a similar tale told by Erasmus, the humanist recalled of the physician Guillelmus Copus, who during a dinner with the Parisian faculty of medicine, picked a leaf out of his salad and insisted that his colleagues identified it. None could classify what they assumed to be an exotic plant until Copus asked the kitchen maid who promptly identified the sprig of parsley.⁵⁵ As amusing as Erasmus' purported anecdote is, the above serves to elucidate the neglected areas of expertise held by women during the early modern period.

Conceived as an attempt to figuratively and literally restore London following the coronation of Charles II, Carol Rawcliffe has described how Evelyn's accentuation on the therapeutic value of gardens was an 'essentially medieval preoccupation' which had lasting ties to the English household.⁵⁶ Comparing Evelyn's famous text with the Dominican theologian Albert Magnus' rumination on the medieval garden, the author notes the uncanny similarity between both instructions. For instance, Magnus affirms that:

gardens [must] stand open to the North and East, since those winds bring health and cleanliness. To the opposite winds, namely the South and West, it should, however, be closed because of their turbulence and impurity and disease. Although the North wind delays the fruit, yet it greatly conserves the spirit and guards the health. Pleasure (*delectatio*) should be sought in the wind and not the fruit.⁵⁷

Evelyn, along with John Beale and Ralph Austen, had all championed the benefits of planting fruit trees around one's property. For the latter, 'the most pleasant and wholesome odours, are

⁵⁴ Robert Burton, *The Anatomy of Melancholy, What it is: With all the Kinds, Causes, Symptomes, Prognostickes, and Several Cures of it. In Three Maine Partitions with their severall Sections, Members, and Subsections. Philosophically, Medicinally, Historically, Opened and Cut Up* (6th edn. London, 1651), p. 563.

⁵⁵ Leah Knight, *Of Books and Botany in early modern England: Sixteenth-Century Plants and Print Culture* (Farnham, 2009), p. 16.

⁵⁶ Rawcliffe, 'Delectable Sightes and Fragrant Smelles', p. 6.

⁵⁷ Albertus Magnus, *De vegetabilibus*, ed. E. F. H. Meyer (Berlin, 1867), pp. 636-638, p. 638.

from the blossomes of all the Fruit-trees, which having in them a condenscing and cooling property are, therefore, not simply Healthfull, but are acc[o]unted Cordiall; chearing and refreshing the Heart and vitall spirits.”⁵⁸ Even Francis Bacon, the father of empiricism, attributes physiological benefits to the intake of botanical effluence. The philosopher assigns specific functions to various perfumes which, by his reckoning, ‘conveniently doe dry and strengthen the Braine’: for example, rose-water, violets, vine-leaves, and lemon pills are said to ‘moisten and refresh’ a ‘burning ague’, consumption and even chronic ‘wakefulness’, while ‘rheumes and defluxions’ are treated by ‘Rose-Mary dried, and Lignum Aloes, and Calamus, taken at the Mouth, and Nosthrils.’⁵⁹

By far and away the most significant contemporary influence on *Fumifugium* was the horticulturalist-cum-cider advocate John Beale. Beale, who had published on cider and the medicinal virtues of apple trees, considered his beloved Hertfordshire orchard to ‘not only sweeten, but also purifie the ambient aire, (which I conceive to conduce very much to the constant health and long lives, for which our County hath been alwayes famous).’⁶⁰ In his later pamphlet, *Pomona* (published alongside Evelyn’s *Sylva*), Beale proposes apples to be planted in every hedgerow in England, not only for cider but to purify the national climate.⁶¹ Four years previous to *Fumifugium*’s publication, Beale privately expressed plans for a grand horticultural experiment that would ‘rectify & purify the ayre of all the neighboring Country, both for health of body, & of minde; to prepare & dispose for Vertue, & for sanctity; & to

⁵⁸ Ralph Austen, *A treatise of Fruit Trees Shewing the Manner of Planting, Grafting, Pruning, and Ordering of Them* (London, 1665), p. 23.

⁵⁹ Francis Bacon, *Sylva Sylvarum: or, A natural history, in ten centuries. Whereunto is newly added the History natural and experimental of life and death, or of the prolongation of life* (9th edn. London, 1670), p. 132.

⁶⁰ John Beale, *Herefordshire orchards, a pattern for all England* (1665), pp. 7-8.

⁶¹ *Ibid.*

procure longevity.’⁶² In the same letter to Henry Oldenberg, Beale lists the individual properties of certain botanicals and their aptitude in counteracting the dangerous effects of sea coal. Taking inspiration from ‘ye aire in Cyprus’ which ‘by store of Cypresse trees & firres, cured ye akers of ye lungs’, Beale recommends London takes similar action: ‘Tis time for London to thinke of this, & to accepte of a sweete & easy remedy ag[ain]st ye corrosive Smoake of their Seacoale, it cuts off more than halfe their dayes.’⁶³ Throughout the 1650s, Beale continued to express similar ideas toward Samuel Hartlib in private correspondences. In a letter sent to Hartlib in March 1660, Beale embellished upon his outlines for England’s horticultural improvement, which involved planting thousands of acres of ‘odoriferous trees & shrubs, for Cypresses, pines, firres, bayes, mirtles, rosemary, roses sweet eglantine, lavender, tyme, hysope &C.’ His letter concluded with the hope ‘to entice Mr Evelyns garden to enlarge the boundaryes’, suggesting prior knowledge of his colleagues’ future goals. ‘And I should not be soory if I could turn ye wilderness & waste grounds of England into a Paradyse, that by a natural pregnancy should contend with ye fayrest of his Artificiall enforcements.’⁶⁴

Beale is referring to the tradition of creating ‘artificial air’ with herbs, plants, trees, spices and various woods. During winter, if flight from an infected air was unfeasible or too expensive, regimen authors would recommend their reader ‘correct’ their air. If an ‘aire be corrupt, and ... a man cannot remove thence very quickly’, Vaughan commanded his reader:

artificially rectifie it, by perfuming his chamber with Juniper, Rosemarie, Bay tree, or with wood of Aloes: and then by sprinkling vineger heere and there in his chamber. In briefe, a man in such cases must get him a nosegay composed of Roses, Violets,

⁶² John Beale, *The correspondence of Henry Oldenburg*, ed. and trans. A. R. Hall & M. B. Hall 13 vols. (London, 1965-1986) vol. 1, p. 315, pp. 318-19.

⁶³ *Ibid.*

⁶⁴ B.L. Add. MS 15948. fols. 89-91 op. cit. Jenner, ‘The Politics of London air’, p. 547.

Majoram, Marigold, and such lyke. And when hee goeth abroad, he must hold in his mouth eyther the pill of an Orenge, or a peece of the roote of Angelica. Lykewise, hee must haue an especiall regard, that his chamber bee at least once a day neatly swept.⁶⁵

Potpourri, pomanders, posies, all performed to offset smoke, miasma, plague and other ‘bad-airs’ which surrounded the city and invaded the home. If scent indicated health, it also prevented disease. In Alain Corbin’s landmark monograph on the history of smell, *The Foul on the Fragrant*, the author made an enduring case for the study of olfaction, specifically perfume. For Corbin, the first major scholar of the olfactory past, historians had ignored smell during the cultural turn. Western history and culture, Corbin argued, ‘is founded on a vast deodorization project.’⁶⁶ To rally support for his new, experimental history, Corbin makes a tantalising equivalence between the ‘history of the mignonette, lily, and rose’ and the history of coal.⁶⁷ Corbin proposes the former history to be ‘just as informative’ as the latter.⁶⁸ The *Annaliste*’s provocative statement demonstrates the interdependence between these two histories, particularly in the context of seventeenth-century London. To understand the history of pollution and climate, it is imperative to comprehend the history of smell and perfume.

In England, the massive increase in sea-coal consumption arguably drove the proliferation of new perfumes, potpourri, pomanders, herbals, natural scents, and other ‘artificial airs’. As London transitioned toward a new combustible age, Holly Dugan describes in her recent history of perfume how England’s smell saw ‘a profound shift in the seventeenth

⁶⁵ Vaughan, *Directions for Health*, p. 3

⁶⁶ Alain Corbin, *Historien du sensible: Entretiens avec Gilles Heur* (Paris, 2000), p. 66, op. cit. trans. Mark Jenner, ‘Follow Your Nose? Smell, Smelling, and Their Histories’, *American Historical Review*, 116 (2011), pp. 335-351, p. 338.

⁶⁷ Alain Corbin, *The Foul and the Fragrant: Odor and the French Social Imagination* trans. Aubier Montaigne (Cambridge, Mass., 1986), p. 195.

⁶⁸ *Ibid.*

century away from heavy, animal-based musk ... toward [the] fragrant, 'natural' scents.'⁶⁹ This change at once eased and agitated pre-existent anxieties around foul scents. If bad smell indicated disease and immorality, then pleasant, contrary odours would counteract the threat of miasma, ironically raising 'profound questions about other dangerously unsavoury, and unscented, contaminants that accompanied them.'⁷⁰ Though rosemary was considered an effective preventative against plague, this otherwise pleasurable aroma became a harbinger of death on the streets of London.⁷¹ In Thomas Dekker's account of the 1603 plague, he recounts the narrow paths of the City 'strewde with blasted rosemary fatall Cipresse and Rue, thickly mingled with heapes of dead men's bones.'⁷²

With increasing sophistication powerful smells were strewn and burnt to counteract miasma. Though most of Europe shared a common tradition of indoor perfuming, in the 'correction' of air Levinus Lemnius found 'no Nation more delicate, more trymmely, nor more sightly then they do in Englande'.⁷³ After his visit to England in 1560, the physician marvelled at English 'Chambers and Parlours strawed over with sweete herbs, refreshed mee, their Nosegayes finely entermingled with sundry sortes of fragraunt floures in their bed cha[m]bers and privy rooms, with comfortable smell cheered mee up and entirelye delyghted all my Senses.'⁷⁴ Lemnius' account is corroborated by Dugan who argued that continental approaches to plague prevention 'preferred to round up the ill and transport them to hospitals rather than shut them in.'⁷⁵ Elizabeth I had been the first English monarch to employ a dedicated 'herbe strewer to Her Majesty the Queen': a salaried position which required the

⁶⁹ Holly Dugan, *The Ephemeral History of Perfume: Scent and Sense in early modern England* (Baltimore, 2011), p. 19.

⁷⁰ *Ibid.*, p. 103.

⁷¹ Shakespeare's Ophelia also identifies 'Rosemary, for remembrance' during *Hamlet*, 4:5.

⁷² Thomas Dekker, *The Wonderfull Yeare* (London, 1603), sig. C3 v.

⁷³ Leah Knight, *Of Books and Botany in early modern England: Sixteenth-Century Plants and Print Culture* (Farnham, 2009), p. 116.

⁷⁴ Levinus Lemnius, *De habitu et constitutione corporis* (Antwerp, 1561) trans. Thomas Newton, *The Touchstone of Complexions* (London, 1576), p. 48.

⁷⁵ Dugan, *The Ephemeral History of Perfume*, pp. 101, pp. 110-111.

Queen's chambers to be maintained with fragrant herbs and flowers. Such was the Queen's enthusiasm for clean, fragrant air that the botanist John Parkinson remarked 'of famous memory [Elizabeth] did more desire [meadowsweet] than any other sweet herbe strew her chambers withal.'⁷⁶ Though the post was never formally abolished, the last to hold an official position was one Anne Fellowes during the reign of George IV.⁷⁷

For the middling sort, attention once again turned to health regimens, herbals and botanicals. Hugh Plat, during *Floraes Paradise* (1608), for example imagined 'a Garden within doores': 'inwardly garnished with sweet hearbs and flowers, yea & fruit if it were possible.'⁷⁸ Around the sides of the room and in the roof, 'you may hang ... small pompions or cowcumbers, pricked full of barley.'⁷⁹ Each window, preferably those 'that openeth fully from the East or West sun', should be festooned with 'square frames' filled with 'some rich earth, & plant such flowers or herbs therein.' To maintain the health of said plants, the author bizarrely recommends building a contraption 'with a pulley from your Chamber window into your Garden, or you may place thee upon shelves made without the roome, there to receive the warme sunne, or temperate raine at your pleasure, now and then when you see cause.'⁸⁰ The humble window-box here provides the means of translating the medicinal benefits of an outdoor garden into a domestic context; a technique also recommended by authors like Burton, who encouraged decorating one's windows with a variety of botanicals.

While continental physicians recommended cocooning oneself in heavy clothing, English men and women sought to create 'aromatic boundaries around themselves ... a

⁷⁶ John Parkinson, *The Theatre of Plants* (1640) op. cit. Eleanour Sinclair Rohde, *A Garden of Herbs: Being a Practical Handbook to the Making of an Old English Herb Garden* (Boston, Mass., 1921), p. 83.

⁷⁷ Rohde, *A Garden of Herbs*, p. 102.

⁷⁸ Hugh Plat, *Floraes paradise* (London, 1608), p. 31.

⁷⁹ *Ibid.*, p. 33-34.

⁸⁰ Plat, *Floraes paradise*, pp. 31-32.

distinct, environmental zone around their body.’⁸¹ As well as strewing chamber floors with herbs and flowers, Alicia Amherst describes how bed-linen, mattresses and clothing were scented with aromatic plants and herbs.⁸² In times of plague, Mouffet encourages his wealthier reader to light ‘good fires’, burning ‘Lignum Aloes, Ebony, Cinamon bark, Sassphras and Juniper’ along with ‘the piths of Oranges, Citrons, Lemons, and Myrrh and Rosen.’ The ‘poorer sort’, on the other hand, ‘may perfume their chambers with Baies, Rosemary, and Broom itself.’⁸³ The demand for strong or sweet-smelling remedies during plague epidemics, like the one which besieged the capital in 1603, led Thomas Dekker to remark of the price inflation of aromatic herbs and flowers. ‘The price of flowers, hearbes, and garlands, rose wonderfully, in so much that rosemary, which had wont to be sold for 12 pence an arnefull went now for six shillings a handful.’⁸⁴ To further complicate the association between plague and smoke, physicians believed that sea coal protected against infection.⁸⁵

As developed in previous chapters, the ambiguity of air cultivated weariness around exposure to unwanted vapours. Through the neglected horticultural expertise of women, as well as the thriving popularity of herbal and botanical literature, ‘artificial air’ provided respite from many of these miasmas. Though Evelyn and Beale tend to dominate environmental histories of early modern England, their proposals owe much to a domestic tradition dating to the late-medieval period. Perfuming air was one way in which contemporaries reacted to atmospheric variability and plague scares, though enduring resistance from the elements could only be achieved through structural and situational

⁸¹ Plat, *Floraes paradise*, pp. 110-111.

⁸² Alicia Amherst, *A History of Gardening in England* (London, 1896), p. 161

⁸³ Thomas Mouffet, *Healths Improvement: Or, Rules Comprizing and Discovering the Nature, Method, and Manner of Preparing all sorts of Food used in this Nation: Corrected and Enlarged by Christopher Bennett* (2nd edn, 1655), p. 25.

⁸⁴ Thomas Dekker, *The Plague Pamphlets of Thomas Dekker*, ed. Fred P. Wilson (Oxford, 1925), p. 35.

⁸⁵ Paul Slack, *The Impact of the Plague in Tudor and Stuart England* (London, 1985), pp. 30, 45.

adjustments to a building. ‘Natural’ air, rarefied in an age of smoke, was considered the only antidote for many ailments and the basis for enduring health. The next section will introduce a variety of architectural changes, notably glasswork and windowmaking, which corresponded to a period of nascent pollution, urbanisation and climatic change.

‘More Glass than Wall’: Architecture, Windows and ‘Selective Design’

Climate has forever played an essential role in the design and construction of buildings. As a mediator between climate and comfort, architecture is thus a unique source of environmental attitudes, preoccupations, and anxieties. That said, weather is largely absent from architectural and material histories of early modern England. A historiographical debate has long dwelled on the reality and scope of the ‘Great Rebuilding’, though the context of global cooling and early pollution is peripheral or absent in much analysis.⁸⁶ For early modern architects and physicians, the role of climate was implicit to the situation, design, and furniture of a building. Though usually applied to the analyses of modernist architecture, climate informed many architectural niches which characterised the period: glasswork, chimney technology, layout and situation.

Whereas early modern physicians promoted humoral temperance, design engineers today refer to a similar quest for ‘thermal neutrality’: a condition achieved when the human body is brought into thermal equilibrium with its surroundings. This process is subject to a multitude of variables which govern the loss and production of heat and cold: metabolic rate, clothing, ventilation, air speed, temperature, and humidity. From Robert Smythson’s opulent

⁸⁶ W. G Hoskins, ‘The Rebuilding of Rural England, 1570–1640’, *Past and Present*, 4 (1953), pp. 44-59; R. Machin, ‘The Great Rebuilding: A Reassessment Author’, *Past & Present*, 77 (1977), pp. 33-56; Matthew Johnson, ‘Rethinking the Great Rebuilding’, *Oxford Journal of Archaeology*, 12 (1993), pp. 117-125.

use of glass to the domestic adjustments used by regimen authors, architectural change was often contingent upon challenges set by England's climatic conditions, associated environmental hazards and a burgeoning reliance on sea-coal. For elites and non-elites, climate factored significantly when considering the structure, layout, and furniture of their homes. Regardless of order, it was imperative to your physical and mental health to remain as close to humoral temperance as possible. As well as the grand architectural changes that characterised Elizabethan stately homes, the culmination of medico-environmental theory is also found in the building advice of contemporary physicians and architects.

In an address to the European Conference on Architecture, the seminal modernist architect, Peter Smithson, remarked on the germinal influence of climate on vernacular English architecture. Evoking the spirit of Le Corbusier who first imagined the home as a 'machine for living in', Smithson claimed that the 'Elizabethan house plan is a remarkably climate-conscious machine: sit in the window-bays when the sun shines, retreat behind screens to fires on the spine walls deep in the interior with all one's clothes on when it is cold.'⁸⁷ Smithson was referring to the work of his namesake, Robert Smythson; the vaunted Elizabethan Architect responsible for many of the period's notable Prodigy Houses, namely Hardwick and Wollaton Halls. Behind Sir Christopher Wren, Smythson is widely regarded as the most influential architect of the Tudor-Stuart period. His oeuvre is defined by a lavish use of new materials and technologies, notably *Cristallo* glass, and an idiosyncratic take on Italian Palladianism which incorporated Gothic stylistics. With the construction of Longleat house (1568-1580) Smythson established a grandiose reputation, though it was through the design of Wollaton House that the former Mason's signature style came to fruition. From there, he

⁸⁷ Le Corbusier, *Toward an Architecture* trans. John Goodman (London, 2008), p. 151. Peter Smithson, 'Territorial imprint', W. Palz (ed.) *Proceedings of 1987 European Conference on Architecture* op. cit. Dean Hawkes, *Architecture and Climate: An Environmental History of British Architecture from 1600-2000* (Abingdon, 2012), p. 31.

designed his most influential building: Hardwick Hall. The design and execution of Hardwick, Sir Sacheverell Sitwell said, was ‘the lesson and precursor of much modern architecture.’⁸⁸ Built for Bess of Hardwick following her relocation from Chatsworth House, the house is remembered by the rhyme ‘Hardwick Hall, more glass than wall.’ Indeed, Hardwick and Wollaton showcase the early modern English obsession with the aesthetic and practical application of glazing.

Depending on certain social and regional differences, by the end of the sixteenth century even the modest habitations of some tradesmen had been installed with windows, according to Crowley.⁸⁹ Referring to the new-fangled desire for glazed windows, William Horman described their use for the unacquainted: ‘Glass windows let in the light and keep out their wind.’⁹⁰ While glazing in England constituted a luxury during the fifteenth century, Thornton noted that by 1600 ‘[a]ll houses of any pretensions had glazed windows’ with Geoffery Beard explaining that Elizabethan houses were especially renowned for their ability to ‘let in air and sunshine through great expanses of glass.’⁹¹ Crowley acknowledges how ‘glazed windows became an integral part of domestic material culture in the latter decades of the sixteenth century.’⁹² According to William Harrison, by 1577 glass had ‘come to be so plentiful and within a very little time so cheap’ that his lattices were obsolete.⁹³ Before then, the dawn of the Reformation had all but halted the manufacture of window glass; with the dissolution of the monasteries, fewer religious institutions invested in decorative stained glass. Of the remaining glass manufacturers in the country, most (if not all) produced ‘forest

⁸⁸ Sacheverell Sitwell, *British Architects and Craftsmen* (London, 1945), p. 26

⁸⁹ John E. Crowley, *The Invention of Comfort: Sensibilities and Design in Early Modern Britain and Early America* (Baltimore, 2003), pp. 65-68.

⁹⁰ William Horman, *Vulgaria* (1519; repr. Norwood, N.J., 1975), p. 242.

⁹¹ Peter Thornton, *Seventeenth-century Interior Decoration in England, France, and Holland* (London, 1979), p. 82; Geoffery Beard, *The national trust Book of the English House Interior* (London, 1990), p. 36.

⁹² John E. Crowley, *The Invention of Comfort: Sensibilities and Design in Early Modern Britain and Early America* (Baltimore, 2003), pp. 65-68.

⁹³ William Harrison, *The Description of England: The Classic Contemporary Account of Tudor Social Life*, ed. Georges Edelen (Washington, 1994), p. 197.

glass'. Unlike modern glazing, the cloudy greenish effect of 'forest glass' resulted from an impure manufacturing technique which tinted the product with Iron oxide. Coal smoke was also known to contribute to discolouration in the glass, turning a brownish black. The resulting tinge would have filtered further U.V as early moderns sought shelter from the cold.

After the arrival of Protestant refugees from Europe in the 1560s, England's dwindling glassmaking industry was revitalised. Rather than relying on imported wares, Antwerpens introduced methods of producing *cristallo* and famed glassmakers from Lorraine brought broad glass technique. Changes in furnace technology, as well as the introduction of coal as England's primary fuel, grew domestic glass production from a veritable cottage industry into a series of monopolies endorsed by the crown.⁹⁴ The fascination with glazing was particular to English architecture, with some foreigners expressing disdain for the effects of glass. Erasmus, for example, abhorred the early transition to glazed windows in sixteenth-century England. To the Bishop John Fisher, the humanist complained that 'a large part of your ill health is caused by the place where you live':

Your being near the sea and the mud which is repeatedly laid bare at low tides means an unhealthy climate, and your library has walls of glass all round, the chinks of which let through an air which is tenuous and, as the physicians call it, filtered, which is very dangerous for those who are sparely built and not robust.⁹⁵

'Personally,' admitted Erasmus, 'if I spent three hours together in such a place, I should fall sick.' Rather than encasing oneself in glass, he believed 'you would be much better suited by a room with a wooden floor and wooden panelling... some sort of miasma issues from the

⁹⁴ Eleanor S. Godfrey, *The Development of English Glassmaking 1560-1640* (London, 1975), esp. ch. 2.

⁹⁵ Erasmus to Bishop John Fisher, *Collected Works of Erasmus: The correspondence of Erasmus* ed. Richard J. Schoeck and Beatrice Corrigan (Toronto, 1992), p. 1489.

bricks and mortar.⁹⁶ Erasmus was better suited to the vernacular style of his native country.

The same enthusiasm for glass was uncommon throughout the rest of Europe.⁹⁷ Consequently, historians of material culture and architecture have often attributed the expansive glasswork of Hardwick, Wollaton, Hatfield etc. to trends in English fashion. John E. Crowley noted the importance of glazed windows as a mode of ‘self-fashioning’ and how the overuse of glass was pure ostentation, ‘to make a sheer display to viewers outside’.⁹⁸ For Crowley, ‘the lavish use of window glazing’ in aforesaid properties ‘indicated the priority of decorative fashion, as opposed to practical needs for illumination.’⁹⁹ Mark Girouard, an authority on Robert Smythson, echoes this sentiment by associating Elizabethan taste with a desire to impress: ‘they had a passion for brightness, thinking of buildings as lanterns, light within and glittering without.’¹⁰⁰ There is some basis in this theory. Though glazed windows became progressively cheaper throughout the period, the security and maintenance of glass remained costly throughout the sixteenth and seventeenth centuries. Early glazed windows were notoriously fragile and prone to breakages during heavy storms. In Norwich on July 20, 1656, when a ‘most terrible tempest of thunder and lightning, with hail stones as big as pullets eggs, which did great hurt to the corn, glass windows, &c. to the value of £3000.’ Bishop Joseph Hall was said to have contributed £20 to the fund.¹⁰¹

In a time before home insurance and fixed casements, glass windows were susceptible to theft. It was not uncommon to store or travel with glazing to deter thieves from stealing this expensive material. Considering the expense and insecurity of glazed windows, we might

⁹⁶ Erasmus to Bishop John Fisher, *Collected Works of Erasmus*, p. 1489.

⁹⁷ Mark Girouard, *Robert Smythson and the Architecture of the Elizabethan Era* (London, 1966), pp. 32-33.

⁹⁸ Crowley, *The Invention of Comfort*, p.65.

⁹⁹ *Ibid.*

¹⁰⁰ Girouard, *Robert Smythson*, pp. 32-33.

¹⁰¹ Francis Blomefield. ‘The city of Norwich, chapter 30: Of the city in the time of the Usurpation’, in *An Essay Towards A Topographical History of the County of Norfolk: Volume 3, the History of the City and County of Norwich, Part I*, (London, 1806), pp. 399-403. *British History Online*. Accessed March 6, 2019.

<<http://www.british-history.ac.uk/topographical-hist-norfolk/vol3/pp399-403>>

conclude either the use of glass was based on the self-aggrandising tendencies of late Elizabethan fashion or that their practical benefit outweighed the cumulative cost of buying, maintaining and storing glass. Certainly, there are examples of needless glasswork. Given that Hardwick is essentially a ‘house of glass’ poised on a hill amidst a northern English landscape, it is tempting to assume that design decisions were made with little consideration for practical comfort. To achieve the external symmetry of Hardwick Hall, some windows were even built between floors where they served no practical purpose. Rooms on the ground floor barely benefit from their glazing, which are made even darker by the distinctive colonnades on the north face of the building. These rooms contrasted with the enormous expanses of glass which would have flooded the south facing gallery with light. To give an idea of the amount of sunlight emitted through these windows, the National Trust have since fitted the Hall’s windows with mesh curtains to counteract damage caused to furnishings and artwork. However, the suggestion that the desire for glazed windows was purely aesthetic is to blithely disregard the two primary aims of all architecture: shelter and comfort.

Beneath the remarkable exteriors of these manor houses, famed for their striking use of glass, symmetrical design and strict geometry, Smythson disguises an elaborate internal organisation of space designed to mitigate the harshness of the local climate. Of the few researchers that have committed scholarship to understand the perceptible link between climate and Elizabethan architecture, Dean Hawkes has made efforts to dispel the notion that design decisions were made on a purely aesthetic basis. Rather than repeat centuries of praise bestowed on the stylistic extravagance of Hardwick and Wollaton, Hawkes credits Smythson with an early theory of English architecture consistent with environmental principles espoused by modernist architecture.¹⁰² In his analysis, Hawkes treats Hardwick Hall as a primary source

¹⁰² Dean Hawkes, *Architecture and Climate: An Environmental History of British Architecture c. 1600-2000* (Abingdon, 2012). See also, Hawkes, ‘The Architecture of Climate: Studies in environmental history, Smythson

in and of itself.

Though the biaxial symmetry of Hardwick suggests a corresponding interior, the layout of the hall is surprisingly complex. Unlike Italian Palladianism, where outer proportion imitated inner symmetry, Hardwick Hall, and British Palladianism generally, comprised an odd layout.¹⁰³ Most unusual are the prime public and private living spaces, which are positioned toward the south of the house. Standing at the latitude of 53 degrees and 10 minutes north and a longitude of 1 degree and 19 minutes west, this allowed the southerly quarters to directly benefit from the heat of the sun as it progresses from east to west. The High Great Chamber, to be specific, would have been flooded with natural light from noon until sunset during the height of summer.¹⁰⁴ Overhead were the Countess' own chambers: her bedroom, a bedroom for her older granddaughter and a withdrawing chamber.¹⁰⁵ Of the whole building, these rooms were the most intimate and lived-in; a 'house within a house', to quote Hawkes.¹⁰⁶

What is consistently neglected in the architectural history of both Hardwick and Wollaton is the influence of their patrons. Smythson is rightly praised as the first great English architect, though Wollaton and Hardwick's elite builders likely influenced many aesthetic and practical decisions. In the earlier address by Smithson, he attributes the 'fashion for the tall and glassy we tend to see in England' specifically to a 'celebration by architects of the "new" fuel ... coal.'¹⁰⁷ As a technological aid, coal had revolutionised the glasswork

and the Smithsons', paper presented at PLEA 2008 – 25th Conference on Passive and Low Energy Architecture, Dublin, 22nd to 24th October 2008.

¹⁰³ Dean Hawkes, 'The environment of the Elizabethan House: Hardwick Hall', p. 213. Accessed 1 June, 2019 <https://www.academia.edu/30560514/The_environment_of_the_Elizabethan_House_Hardwick_Hall>

¹⁰⁴ Dean Hawkes, 'The environment of the Elizabethan House: Hardwick Hall', p. 208.

¹⁰⁵ Peter Thornton, 'A short Commentary on the Hardwick Hall Inventory of 1601', *Furniture History*, 7(1971), pp. 14-30, Note 8, p. 15. The furnishings of these rooms included warm carpets, thick curtains and coverlets, all to supplement the warmth of the open fires.

¹⁰⁶ Dean Hawkes, 'The environment of the Elizabethan House: Hardwick Hall', p. 208.

¹⁰⁷ Peter Smithson, 'Territorial imprint', op. cit. Dean Hawkes, *Architecture and Climate*, p. 31.

industry with new furnace technology able to quickly produce expansive *cristallo* glazing. As a domestic fuel, coal warmed the complex of chambers which characterised Smythson's building layouts with fireplaces in every major room in Wollaton and Hardwick Hall. The fashion for coal had also funded both spectacles, with their owners making a significant profit from their individually owned coal pits. Both patrons were industrialists who had invested heavily in the sea-coal trade. Wollaton's proprietor, Sir. Francis Willoughby, was one of the most influential coalowners of the period and chose to situate his house nearby a local coal pit outside of Nottingham. He was even said to have paid workers with coal.¹⁰⁸ Bess of Hardwick had also owned coal mines, as well as a glassworks that provided the materials for the lavish fenestration for which her home was most famous. Both Willoughby and Bess were known as shrewd industrialists, attuned to the technological progress of the day. It would be naïve to suggest that their aesthetic and functional preferences were not taken into account in the construction of both houses.

Just as Richmond was regarded by the Queen as her 'warm winter box', the second richest woman in England most likely had expressed similar preferences. By the time that Bess would have moved into Hardwick she would have been an old woman (seventy-years-old in 1597). Peter Thornton, in his account of the Hall's 1601 inventory, describes the layers of curtains that surrounded Bess' bed, in addition to a thick duvet upon the bed and several carpets below.¹⁰⁹ This was a deliberate attempt on the part of the Countess of Shrewsbury to guard her bedroom and withdrawing room from 'the rigours of the Derbyshire climate'.¹¹⁰ Bess' penchant for glazing is suggested in a letter which predates the building of Hardwick from her then husband's son, Gilbert Talbot. Writing to his father, George Talbot, sixth Earl

¹⁰⁸ For more on Willoughby's Wollaton Hall, see Girouard, *Life in the English Country House: A Social and Architectural History* (London, 1983), p. 83.

¹⁰⁹ Peter Thornton, 'A short Commentary on the Hardwick Hall Inventory of 1601', p. 15.

¹¹⁰ Lindsey Boynton (ed.), 'The Hardwick Hall Inventories of 1601', *The Furniture History Society* (London, 1791) and David N. Durant and Philip Riden, *The Building of Hardwick Hall*, 2 vols. (Chesterfield, 1980-1984).

of Shrewsbury, and Bess, the letter draws attention to the building of Shrewsbury House which Gilbert hears will contain ‘the fayrest glasse worke that is ... anywhere in englande to be founde.’¹¹¹ There is no doubting the fashion for glasswork in Elizabethan England, though this must be countered with a consideration of the cultural context of the building process. Hawkes’ work elucidates the architectural and climatological context of Elizabethan architecture, but frequently neglects a medico-environmental pretext to these design decisions. The legal right to clean air and sunlight was contested in the early modern period, though the medical beliefs enshrined by Hippocratic medicine and disseminated in health regimens made clear the benefits of spatial and structural awareness.

One notable advocate on the necessity of windows for physical and mental health was Robert Burton, who provides forensic detail on the benefits of a well-chosen casement; ‘how we place our windows, lights and houses, how we let in or exclude this ambient air.’¹¹² Simple yet effective, such measures wrought innumerable somatic and cerebral benefits. Referring to the thermal equilibrium of Hardwick Hall, Hawkes borrows from physicist Michael Humphrey’s credos of ‘adaptive’ design to issue his own interpretation of ‘selective environments’ or ‘selective design’ in architecture: ‘*if change occurs such as to produce discomfort, people react in ways which tend to restore comfort.*’¹¹³ According to his schema, every microclimatic action has an equal and opposing reaction. The same can be applied to infrastructural adjustments in non-elite homes. As Eriksson reminds us, even modest forms of architectural reorganisation can be taken as serious examples of ‘selective design’. ‘Just by opening windows or altering the heating systems,’ Eriksson clarifies, ‘inhabitants largely

¹¹¹ Talbot Papers, Lambeth Palace Library, MS 3206, pp. 929-32.

¹¹² Burton, *The Anatomy of Melancholy*, pp. 335-336.

¹¹³ Michael Humphreys, ‘An Adaptive Approach to Thermal Comfort Criteria’ in Derek Clements-Croome (ed.), *Naturally Ventilated Buildings: Buildings for the Senses, the Economy and Society* (London, 1997), p. 46. Italics Preexisting.

affect their indoor environments and hereby the buildings' logical response to climate.'¹¹⁴

Typically, Burton's endorsements draw upon a dizzying array of historical and contemporary precedent to support his advice: 'the Egyptians, to avoid immoderate heat, make their windows on the top of the house like chimneys, with two tunnels to draw a thorough air'; and 'in Spain they commonly make great opposite windows without glass, still shutting those which are next to the sun: so likewise in Turkey and Italy (Venice excepted, which brags of her stately glazed palaces) they use paper windows to like purpose ... in the top of their flat-roofed houses, so sleeping under the canopy of heaven.'¹¹⁵ Though such measures were unsuitable for the English climate, Burton lists a number of structural precautions designed to exclude 'bad-air' and welcome wholesome, salubrious breezes. 'If the plan of the dwelling may not be altered, yet there is much in choice of such a chamber or room,' then the inhabitants should make a deliberate effort to open and close windows at opportune times in order to exclude 'foreign airs and winds.'¹¹⁶ If the air is not 'free from putrefaction, fens, bogs, and muck ... open no windows.'¹¹⁷ First among these measures was to learn to 'make choice of what wind ... they shall choose, and what avoid.' This is, needless to say, particular to one's locale; if a southerly wind invited aguish vapours into one's home, then one should position their windows contra wise. Likewise, if a northerly wind exposed one's abode to icy gales, then they should perform the utmost to shelter themselves from extreme cold. Generally, Burton recommends that 'the best site for chamber windows ... are north, east, south, and which the worst [is] west.'¹¹⁸ Alternately, Francis Bacon warns of the pernicious southern winds which make 'the breath of man is more offensive, the appetite of

¹¹⁴ Gunhild Eriksdotter, 'Did the Little Ice Age Affect Indoor Climate and Comfort?: Re-theorizing Climate History and Architecture from the Early Modern Period', *Journal for Early Modern Cultural Studies*, 13 (2013), pp. 24-42, p. 28.

¹¹⁵ Burton, *The Anatomy of Melancholy*, pp. 335-336.

¹¹⁶ Ibid.

¹¹⁷ Ibid.

¹¹⁸ Ibid.

animals is more depressed, pestilential disease are more frequent, catarrhs abound, and men are more dull and heavy.’¹¹⁹ Shakespeare also makes the association between southern wind and pestilence in *Coriolanus* (1,4):

All the contagion of the south wind light on you,
You shames of Rome! You herd of—Boils and plagues
Plaster you o’er; that you may be abhorr’d
Further than seen, and one infect another
Against the wind a mile.

Attitudes to climate manifest themselves in bricks and mortar. By examining the ‘Great Rebuilding’ through the lens of climate, the English fondness for glass work and new windowmaking technologies reveals a nascent concern for environmental design. These examples are sometimes restricted to the gentry, though the same architectural characteristics run through regimen advice from the period. ‘Selective design’ offers an alternative approach to understanding the quotidian effects of atmospheric change on domestic life, which could be as simple as opening a window or re-arranging furniture. Choosing the ‘correct’ air was integral to domestic health, though by the mid-seventeenth century the interest of natural philosophers turned to manipulating the substantive elements of climate for individual comfort. As architects began to explore new methods of window-making and glazing, members of the Royal Society were busy translating insights from pneumatic chemistry into practical machineries designed to regulate indoor temperatures and temperaments. The following will examine the simultaneous attempts made by a number of natural philosophers to introduce primitive examples of air conditioning. As with the history of early thermometry

¹¹⁹ Francis Bacon, *The natural and experimental history of winds* (4th edn. London, 1671), p. 14.

explored in chapter one, these attempts were guided by a speculative theory of climate. Given the scientific paradigm in which they worked, these imaginative attempts to regulate indoor climates were informed by a variety of philosophies: from magic and alchemy, to Boyle's famous experiments with air pressure.

'Perpetual Fire': Conditioning, Comfort, and the Royal Society

In 1664, Nathaniel Henshaw conceived of an invention which he thought could provide respite from the intemperate English climate.¹²⁰ Elaborating upon Robert Boyle's pioneering enquiries into the properties of air; Henshaw's *Aero-chalinos* ('air-chamber') represented the first documented attempt at crafting a recognisably 'modern' air-conditioning system.¹²¹ As a founding fellow of the Royal Society, the logic behind Henshaw's contraption was supported by the most cutting edge research of its day. By manually decompressing the 'heavy or ponderous' English air, native bodies would be reinvigorated: 'for who almost is there, of so happy a constitution that during health itself, and in the prime of his years, is not in some measure affected by the alteration of the weather, and by the change of the air?' To this end, Henshaw designed an 'air-chamber' to help revive the inconstant English temperament. Firstly, he stated, one must ensure that his room ('of about twelve or fourteen-foot square') be 'well ceiled' and 'well-plaister'd' so that 'no air may pass in or out.' Henshaw recommends

¹²⁰ Hugh Plat, *The Garden of Eden; or an accurate Description of all Flowers and Fruits now growing in England* (6th edn., London, 1676), p. 50

¹²¹ Nathaniel Henshaw, *Aero-chalinos, or, A register for the air for the better preservation of health and cure of diseases* (Dublin, 1664), esp. ch. 5, pp. 66-98, *passim*. To my knowledge, this represents the first majorly scholarly treatment of Henshaw's contraption which had received scant attention before now. By order of the Royal Society, the pamphlet went through a further posthumous edition in 1677, edited by his elder brother Thomas Henshaw. All references derive from Chapter V of his treatise, the formal instruction manual for the invention. Boyle himself had been inspired by Otto von Guericke's vacuum pump, invented in 1654 and described in Chapters II and III of Book III of his *Experimenta Nova*.

seeking the assistance of some ‘ingenious Masons and Joyners’ to construct a door that ‘may shut into its frame so exactly, that when it is made fast, there may not be the least passage left for the air to get in or out of the foresaid Chamber.’¹²²

Having excluded any malignant drafts from your air-chamber ‘you must farther provide yourself with a very large pair of Organ Bellows, which must be placed in some convenient part of the Room, where by the help of a Skrew, the Nose of them may be exactly joyned to a Copper Pipe, whose other end must pass through the wall of the Room.’¹²³ For best results, the opposing end of the pipe should be placed to rest in a bucket of water. Bellows fitted, the chamber was now ready for manual decompression. By forcefully pressing down onto the bellows, one may discharge the room of its stale, contaminated air. The extent of the decompression was based on the occupant’s preference; ‘you may charge, or discharge ... the Air-chamber at your pleasure, and consequently, obtain an air in it, of which rarity and density you please.’¹²⁴ If required, Henshaw suggests using ‘a large Weather glass’ to judge the density of the air. Now remedied, one could enjoy the refreshment of a pure atmosphere.¹²⁵

For most ailments, the author recommends ‘generally two, three, or more hours’ inside the chamber – ‘especially in the morning, when the use of other Remedies are found most conducive.’¹²⁶ Even in extreme cases of disease, including French Pox and Gall Stones, Henshaw affirms his confidence in his invention: ‘I should not doubt, even in these, to commend the use of this Domicil, or Air-Chamber.’¹²⁷ So allegedly versatile was Henshaw’s invention that the author prescribes its use to counteract the harmful effects of ‘any great

¹²² Henshaw, *Aero-chalinos*, p. 83.

¹²³ *Ibid.*

¹²⁴ *Ibid.*, p. 85.

¹²⁵ *Ibid.*

¹²⁶ *Ibid.*, p. 89.

¹²⁷ *Ibid.*, p. 90.

change of air, by travelling into foreign Countries.’¹²⁸ (The inventor omits how one might transport and maintain the composite elements of the ‘air-chamber’). Speculatively, Henshaw even advocates his invention’s use aboard ships to ameliorate the unpleasant nausea of sea-travel.

Henshaw’s creation never became a staple of the English domestic interior. Of the select demographic who possessed the wealth and resources to construct their own ‘air-chamber’, not to mention a spare twelve or fourteen-foot square room, even fewer possessed the time or will to sit in this chamber for two-to-three hours a day. In many ways, Henshaw’s contraption was an unmitigated failure: cumbersome, nigh-on impossible to construct and resistant to transportation. However, while the process of constructing and maintaining an ‘air-chamber’ was convoluted and evidentially laborious, the rationale behind Henshaw’s invention was indicative of attempts to mechanise air-conditioning. As early as 1608, Hugh Plat had devised his own system for maintaining a temperate greenhouse using steam. To grow roses and carnations in the winter, in *The Garden of Eden* Plat advises his reader to ‘place them in a Room ... with the steam of hot water conveyed by a pipe fastened to the cover of a pot.’¹²⁹ Following Robert Boyle’s experiments and Bacon’s idea for an air ‘chamber of health’, the author’s ‘air-chamber’ and the accompanying pamphlet is noteworthy for its attempt to channel the experimental technique for practical means.¹³⁰

Before the invention of modern air-conditioning systems, maintaining ‘thermal neutrality’ was a challenging, expensive and dangerous enterprise. From 1500-1750 around three-hundred urban conflagrations occurred in England in which ten or more houses were

¹²⁸ Henshaw, *Aero-chalinos*, pp. 91-92.

¹²⁹ Plat, *The Garden of Eden*, p. 20.

¹³⁰ Harris, *Weatherland*, p. 123.

destroyed.¹³¹ Often, this total was significantly larger. To be precise, the years 1580-1640 saw a sharp escalation in the occurrence of large-scale urban fires. After a sequence of arid summers during 1604-16 and then 1630-37, England was made particularly vulnerable to urban fire.¹³² Compounding this, the triple threat of congested urban spaces, archaic fire-safety technologies and incompetent methods of domestic fire refined the conditions for urban conflagration in England.¹³³ Once a fire had started, it was almost impossible to contain. Firefighting techniques in England had remained largely unchanged for five hundred years until the fire engine was gradually introduced during the late-seventeenth century.¹³⁴ Before then, communities relied on the use of ‘fire-hooks’ to tear off burning pieces of rubble to salvage their remaining property.

Domesticated, the hearth could perform a gamut of medical and environmental duties: its prophylactic qualities cleaned the air of infection and dampness; helped stave off miasma through scent; cooked food and provided defence against cold. The hearth was the ‘servant of the world,’ according to one pamphlet, which ‘proves obedient to all out needful uses ... without which we could not live.’¹³⁵ This idyllic vision of fire was, of course, unsustainable. To mistake the hearth as a genteel servant, was to underestimate the recalcitrance of domiciled fire. In an age of inadequate fire safety measures, the same pamphlet admits that this ‘mercilesse element’ often resisted domestication: it ‘growes rebellious, and ruins

¹³¹ Eric Jones, Stephen Porter, and Michael Turner, ‘A gazetteer of English urban fire disasters, 1500-1900’, *Historical Geography Research Series*, 8 (1984), p. 4.

¹³² John E. Morgan, ‘The Representation and Experience English urban fire disasters, c. 1580-1640’, *Historical Research*, 89 (2016), pp. 268-293, p. 268; D.J. Schove, ‘Fire and Drought, 1600-1700’, *Weather*, 21 (1966), pp. 311-314.

¹³³ Tara Hamling, ‘Seeing Salvation in the Domestic Hearth in Post-Reformation England’, in Jonathan Willis (ed.) *Sin and Salvation in Reformation England* (London, 2015), p.223-245, p. 229.

¹³⁴ G. V Blackstone provides an early history of fire-fighting in the introduction of *A History of the British Fire Service* (London, 1957).

¹³⁵ Anon., *Wofull nevves from the vvest-parts of England Being the lamentable burning of the towne of Teuerton, in Deuon-shire, vpon the fift of August last, 1612*. (London, 1612), p. 3.

where it comes'.¹³⁶

As with all developing technologies, there were obvious flaws with early attempts to introduce the chimney on a mass-scale. William Harrison's *Description of England* (1577) marveled at the 'multitude of chimneys lately erected' that had been hitherto restricted to manors and religious institutions, though to quote Tara Hamling, 'these nascent attempts to deliver available forms of domiciled fire were inundated with glaring design malfunctions.'¹³⁷ Early chimneys were inundated with design errors and impediments: from the poor ventilation of smoke to the bizarre use of wattle-and-daub as an early chimney material.¹³⁸ The negligence of townspeople grossly exacerbated these issues. In his exploration of early modern lighting, R.B Graves suggests that early modern candles were much the same as today's 'but more awkward and dangerous to keep burning for any convenient length of time.'¹³⁹ Rather than burning wax, tallow was the most common form of a domestic candle. As well as its pungent smell, tallow produced a thick smoke. Like chimneys, they were prone to accidental fires. In an account of 'the feare-full fire, that fell the town of Wooburne' in 1595, Thomas Wilcox reprimands the 'simple and sille' woman, who, changing her bedstraw, laid the old straw in the chimney when 'the cinders and sparkes that were in the same chimney, tooke hold of the that straw and inflamed and set on fire that thatched house.'¹⁴⁰

Aside from protections from the cold, the drought and extreme heat which occasionally beset this period were equally uncomfortable given the purportedly phlegmatic constitution of the English. James I himself was said to have been personally susceptible to

¹³⁶ Anon., *Wofull nevves from the vvest-parts*, p. 3

¹³⁷ William Harrison, *The Description of England: The Classic Contemporary Account of Tudor Social Life* (1587) ed. Georges Edelen (Toronto, 1994), p. 201. Hamling, 'Seeing Salvation in the Domestic Hearth', p. 229.

¹³⁸ Hamling, 'Seeing Salvation in the Domestic Hearth', p. 6.

¹³⁹ R.B. Graves, *Lighting the Shakespearean Stage, 1567 – 1642* (Carbondale, 1999), p.14.

¹⁴⁰ Thomas Wilcox, *A short narration of the feare-full fire, that fell in the towne of Wooburne, in the Countie of Bedford on Saturdaie, the 13, of September last 1595* (London, 1595), p. 14.

sharp heats, his delicate skin described as ‘soft as *taffeta sarsnet*.’¹⁴¹ He was frequently prone to outbreaks of itching, further exacerbated by the multiple layers of thick, quilted clothing he wore to resist assassination by knife attack (after several attempts on his life). His discomfort during the summer of 1620 compelled him to seek the assistance of magician, inventor, and chemist Cornelius Drebbel.¹⁴² Satiating James’s interest in the occult, Drebbel was commissioned to refrigerate the air of the largest interior space in the British Isles: Westminster Hall.¹⁴³

Even for Drebbel, an accomplished chemist and inventor, this was a sizeable task. Though he later garnered fame around European courts, especially under the patronage of the eccentric Emperor Rudolf II, he was a relative unknown in England. Drebbel would later become renowned for designing the first navigable submarine in collaboration with the English Royal Navy. For now, however, this would be his most ambitious project. The precise date of Drebbel’s demonstration is unknown, though it is estimated to have occurred sometime after the July 12 – the date on which John Williams became dean of the Abbey. Sadly, we lack any first-hand accounts of the experiment. The efficacy of the process is, however, corroborated by second-hand witnesses including Bacon who remarked of ‘the late experiment of artificial freezing’ in *De Augmentis Scientiarum* (1620) in which ‘salt is discovered to have great powers of condensing.’¹⁴⁴ In *Novum Organum*, published the same year, Bacon alludes to the process whereby Drebbel was able to perform this feat. Salt, or ‘nitre’, when ‘added to snow or ice heightens their coldness [...], salt does so by adding to the

¹⁴¹ Anthony Weldon, *The Court and Character of King James* (London, 1817), p. 55.

¹⁴² On 2nd July the Venetian Ambassador in England noted that ‘The season here is very dry and without rain, and for lack of moisture the hay is reduced to a wretched condition, while many animals are perishing in the country from hunger.’ Girolamo Lando, Venetian Ambassador in England, to the Doge and Senate. ‘Venice: July 1620, 1-9,’ in Allen B Hinds (ed.) *Calendar of State Papers Relating To English Affairs in the Archives of Venice, 1619-1621* (London, 1910) vol. 16, pp. 296-311.

¹⁴³ Tom Shachtman, *Absolute Zero and the Conquest of Cold* (London, 1999), pp. 2-5.

¹⁴⁴ Francis Bacon, *The Philosophical Works of Francis Bacon* ed. John M. Robertson (Abingdon, 2011), p. 508.

activity of the snow's cold.¹⁴⁵ Drebbel's experiments, it would seem, may have inspired Bacon's own fatal attempt at refrigeration. On a snowy coach ride near Highgate in April 1626, the physician Dr Witherborne described how:

It came into my Lord's thoughts, why flesh might not be preserved in snow, as in Salt. They were resolved they would try the Experiment presently. They alighted out of the Coach and went into a poore Woman's house at the bottom of Highgate Hill, and bought a Hen, and made the woman exenterate it, and then stuffed the body with Snow, and my Lord did help to doe it himselfe. The Snow so chilled him he immediately feel so extremely ill that he could not return to his Lodging.¹⁴⁶

Bacon was dead a week later, pneumonia the speculated cause of death. Later, Robert Boyle would write in admiration of Drebbel's experiment in *New Experiments Physico-Mechanical*.¹⁴⁷ The Dutch alchemist had arguably invented the concept of modern air-conditioning, a century before Benjamin Franklin and John Hadley's experiments in rapid air cooling.¹⁴⁸

Historians have debated Drebbel's role in inventing the thermometer, though the Dutch polymath was the first to apply the apparatus to regulate and enhance living environments.¹⁴⁹ As well as his 'perpetual motion machine' revealed in Westminster in 1607, Drebbel had obtained a patent for a number of inventions, including a self-regulating furnace. The earliest account of Drebbel's furnace is included in one such patent sold by his sons-in-law after their father's death in 1634. The document describes a furnace whose "heate may . . . be increased, moderated or abated to any proporcion or degree that shalbee held most fitt or

¹⁴⁵ Francis Bacon, *Novum Organum*, op. cit. Pierre Laszlo, *Salt: Grain of Life* (Chichester, 2001), p. 118.

¹⁴⁶ John Aubrey, 'Francis Bacon', in Oliver Lawson Dick (ed.) *Aubrey's Brief Lives*, (London, 1949), p. 124.

¹⁴⁷ Robert Boyle, *New Experiments Physico-Mechanical, Touching the Spring of the Air* (1660), p. 107.

¹⁴⁸ Benjamin Franklin, *Experiments and Observations on Electricity* (London, 1769), pp. 363–8.

¹⁴⁹ F.W. Gibbs, 'The furnaces and thermometers of cornelis drebbel', *Annals of Science*, 6 (1948), pp. 32-43, p. 34.

requisit . . .”¹⁵⁰ The invention excited new interest in the 1640s and 50s amongst the Royal Society. In the annals of the Society, Drebbel’s oven is mentioned at a meeting in October, 1662:

Sir Robert Moray offered to the consideration of the society a way to compare the effect of heat and cold in rarefaction and condensation of air, with that of force of weight. Upon which Dr. Goddard suggested Drebbel’s method of governing a furnace by a thermometer of quicksilver¹⁵¹

The oven was re-created across Europe and New England, including a replica made by Sir Christopher Wren.¹⁵² Balthasar de Monçonys recalled seeing the furnace in the London laboratory of Drebbel’s son-in-law, Dr. Johann Sibbert Kuffler, in 1663. Monçonys explained how though Kuffler ‘toiled continually at chemistry’, though he had ‘found nothing new, and the best of what he knows is what he owes to his father-in-law, as I was able to confirm.’ The Frenchman goes on to describe Drebbel’s invention in detail:

Another Philosophers furnace, which becoming hotter than the artist desires, without anyone touching it, causes a plate to lower over a register, which being thus closed, the heat diminishes until it is at the degree he desires, and if the fire were too feeble, this same plate rises and the register furnishing more air to the fire, it regains the vigor and the degree required. This instrument is on the outside at one side of the furnace, and two or three inches lower there is a glass tube joined to the wall of the furnace, inclined by some 25 degrees, of the size of the quill, at the bottom of which there is quicksilver. Above is only air, which getting too hot causes the mercury to descend,

¹⁵⁰ Hildebrand Prusen and Howard Strachy, ‘Stoves or Furnaces for Drying and Heating’ in Bennett Woodcroft (ed.), *Appendix to Reference Index of Patents of Invention* (London, 1855), p. 16.

¹⁵¹ Thomas Birch, *History of the Royal Society of London* (London, 1757), vol. 1, p. 119.

¹⁵² For Christopher Wren’s reproduction of Drebbel’s perpetual motion and his oven, see Balthasar de Monçonys, *Iovrnal des voyages de Monsievr de Monçonys*, 2 vols., (Lyons, 1666) vol.2, p. 54

and thus one sees by the marks on the tube, the quantity of the heat. And when the fire is too slow, and the air condenses, the quicksilver rises and marks by its height the degree of coolness.¹⁵³

Writing to one Mr Renes, Monconys described how Wren's own attempt resembled Drebbel's own 'machine of flux and reflux, or perpetual motion.'¹⁵⁴ Nathaniel Henshaw also remarked of Kuffler's (or Drebbel's) ovens, this time used as an incubator for chicks.¹⁵⁵ John Evelyn had also witnessed these 'iron ovens made portable ... for the Prince of Orange's army' to bake bread.¹⁵⁶ Whereas similar ovens failed to bake evenly, Drebbel's oven 'made it possible to bake the bread without burning it.'¹⁵⁷

Incubated eggs and evenly baked bread were only the beginning. Drebbel had set his sights on loftier targets befitting of a man who was purported to have simulated thunder and lightning indoors. An account of Drebbel's most intriguing invention is found in the personal manuscripts of the savant and astronomer Nicolas-Claude Fabri de Peiresc.¹⁵⁸ As a means to counteract cold and combat indoor pollution caused by wood burning and seacoal, Drebbel proposed 'an artificial sun' or 'perpetual fire which will always burn and light.' Drebbel's ingenious suggestion could also be considered as a forerunner to solar powered energy. He had told Peiresc that he was 'digging a hole in the soil with tools that gathered so many rays of the sun in this place that it would light a material, making it burn and light without being consumed.' By positioning a series of 'blazing mirrors' the sun would 'set on fire everything crossing its way half a mile, a mile around and to everything that we can cover with our

¹⁵³ Monconys, *Journal des voyages*, vol. 2, p. 54. op cit. Hebbel E. Hoff and L. A. Geddes, 'The Beginnings of Graphic Recording', *Isis*, 53 (1962), pp. 287-324

¹⁵⁴ *Ibid*, p. 54

¹⁵⁵ Birch, *History of the Royal Society of London*, vol. 3, p. 455

¹⁵⁶ John Evelyn, *Sylva, or A Discourse of Forest-Trees and the Propagation of Timber in His Majesty's Dominions* (London, 1664), p. 98.

¹⁵⁷ Gibbs, 'The furnaces and thermometers of cornelis drebbel', p. 34.

¹⁵⁸ Nicolas-Claude Fabri de Peiresc, from the *Bibliothèque de Carpentras*. MS1776, Fol. 412 v op. cit. F. M. Jaeger, *Cornelis Drebbel en zijne tijdgenooten* trans. Anon. (Groningen, 1922). *passim*.

sight.’ Dr. Kuffler told Peiresc that Drebbel had at that point conceived of a ‘perpetual fire’ which ‘burns at 200 feet around but not further.’¹⁵⁹ With investment from the State, Drebbel could ‘start a fire on a small hill near London’ which could supply all Londoners heat ‘by small pipes leading to whole houses that wished it.’¹⁶⁰ The result would offer a source of constant heat for the masses, who could ‘bring it to their houses and with it boil and roast their meat without using wood.’¹⁶¹ Like Evelyn’s failed attempts to purify London’s air, foreign policy trumped environmental concerns. Drebbel had sought the patronage of the Prince of Wales (later Charles I), but in 1623 the Prince was preoccupied with the costly pursuit of his ‘Spanish Match’ – Maria Anna of Spain – which, according to Peiresc ‘incurred a loss for the general public.’ ‘The Prince’s journey stopped him from providing what was required to realise this miracle,’ complained Peiresc, ‘he was only asking for twenty thousand pounds.’¹⁶²

Drebbel is often characterised as a ‘neglected genius’ or lost Renaissance Man, unappreciated in his time the same way that John Evelyn was. While his work experienced its own renaissance in the 1650s, Drebbel was often denigrated as esoteric and unpractical. Robert Boyle called him ‘that great, singular, learned mechanick’ and praised his ovens ‘which he could govern to any degree of heat.’¹⁶³ Simultaneously, he derides these mechanisms as impractical and more suited to ‘leisurely enquiry.’¹⁶⁴ He is now revered amongst students of thermometry as one of the founding fathers of the science of heat. Despite this, the practical utility of his works remains unappreciated. Boyle had even questioned whether his inventions had ‘died with him, or how far the meditations of others

¹⁵⁹ de Peiresc, Bibliothèque de Carpentras, MS1776, Fol. 412 v. *passim*.

¹⁶⁰ *Ibid.*

¹⁶¹ *Ibid.*

¹⁶² *Ibid.*

¹⁶³ Thomas Birch (ed.), *The works of the Honourable Robert Boyle. In six volumes* 6 vols. (London, 1744), vol. 3, p. 139, p. 174.

¹⁶⁴ *Ibid.*, vol. 5, p. 128.

have wrought upon them.’¹⁶⁵ Drebbel’s unrealised attempt at creating the first self-regulating heating system raises a broader historical discussion around the paradigmatic shift from Galenism toward mechanical philosophy.¹⁶⁶

The thermometer is an emblem of this transition, a metric instrument that necessitated empirical enquiry. The process of mechanising air was fraught with epistemological anguish. As detailed in chapter one, although the thermometer had been invented it was deeply unreliable in so much that it often measured both atmospheric pressure and heat. What today seems an obvious adjustment – joining a thermostat and oven – ‘was not the eminently practical innovation it appears to be today for a society which did not share our conception of temperature.’¹⁶⁷ One of the overbearing difficulties in early thermometry was achieving consensus as to a general scale of degrees, the same applied to indoor climate control. Drebbel’s invention differed from many similar attempts at gauging temperature, inasmuch as his design was based on the regulation rather than the diagnosis of heat.¹⁶⁸ Relative to the modern concept of thermometry and heat regulation, the early moderns were fumbling in the dark.

While their theories of temperature, pollution and meteorology lacked quantitative precision, they managed to articulate a growing need for climate control with the language of Hippocrates, Vitruvius, Galen, and emergently, Bacon and Boyle. These methods could be diffuse and overlooked, as in the case of herb strewing and gardening, and they could be manifest in the extravagant use of glass at Hardwick. Through these diverse domestic, architectural and scientific strategies, we can observe a history of environmental awareness

¹⁶⁵ Birch (ed.), *The works of the Honourable Robert Boyle*, vol. 5, p. 128.

¹⁶⁶ See Everett Mendelsohn, *Heat and Life: The Development of the Theory of Animal Heat* (Cambridge, Mass., 1964), and Hasok Chang, *Inventing Temperature: Measurement and Scientific Progress* (Oxford, 2004), esp. ch. 1.

¹⁶⁷ Robert Boyle, *The works of the Honourable Robert Boyle*, vol. 5, p. 255.

¹⁶⁸ Vera Keller, ‘Re-entangling the Thermometer: Cornelis Drebbel’s Description of his Self-regulating Oven, the Regiment of Fire, and the Early History of Temperature’, *Nuncius*, 28 (2013), pp. 243-275, p. 262.

and a level of concern for air quality that has been previously absent from early modern histories of England. This concern, as we will subsequently see, stretched to not only encompass the social and domestic sphere in England, but colonial prospects in the New World.

CHAPTER FOUR: COLONISING CLIMATE

During the initial colonisation of America, English settlers, geographers and physicians disputed the very meaning of a good and healthy climate. For a millennium, philosophers and historians had posited the existence of a temperate meridian climate around Mediterranean Europe. It was around this specific latitude, and only here, that moral virtue found a nurturing environment. To the north lay barbarians, crude and savage in disposition; to the south were the indolent and passive natives of Northern Africa. During the late-sixteenth and early seventeenth century, these ideas were fundamentally undermined by settlements in the previously ‘uninhabitable’ New World. Acclimating to colonial environments during the Little Ice Age was a question of material subsistence and cultural fortitude for the English. To adapt to climate, was to adapt the very *idea* of climate. Early modern Englishers, in light of their ‘inferior’ climate, were compelled to reappraise their northern disposition. By no means was this a simple feat. Before the English understood their climate as a civilising force, dominant physiological beliefs and classical notions of temperance undermined any claim of Anglo-Saxon supremacy.

From outright attacks on classical thinkers to the reimagining of ‘coldness’, the first half of this chapter will consider how English historians, geographers and physicians applied their interpretation of climatic influence to suit the political and colonial purposes. The ill-defined constitution of the English caused issues for medical writers and colonists alike: at once masculine and bold, based on exposure to cold, the English body was also phlegmatic and prone to inconstancy. If a cold, northern climate concurrently bred these characteristics – feebleness, femininity, and dim-wittedness, masculinity, strength and courage – how did English males reconcile the duality of their climes? Rather than signifying an empirical

measurement, 'coldness' was subject to a variety of intersecting debates over the character, complexion and culture of the English. As is the case today, climatic change during the early colonial period was a subject of intrigue, debate and denial.

As English settlers colonised North America, climatology emerged as a template for nationhood grounded in environmental rather than ethnological criteria. Before the advent of 'race' as a scientific category in the eighteenth century, early colonists perpetuated a theory of ethnic difference based on the ancient idea that climate dictated character and sensibility as well as skin pigmentation and physiognomy. As a criterion of human difference, adaptations to climate possessed far greater explanatory power than the notion of innate biological difference. For the English, a people long ridiculed for their dour national climate, their characterisation was unfavourable. Based on established climatological texts, including works by Aristotle, Ptolemy and Hippocrates, it was widely believed that they had inherited a barbaric complexion, typically associated with Scandinavian climes. As the English travailed against the unremitting conditions of the North American climate, they also battled with their representation as the climatic 'other'. To defy their ancient stereotype, geographers and colonists reconceived a hierarchy of complexion based on English superiority.

The difficulty of the North American environment brought into focus the inconsistencies of Aristotelian climatology and allied thought. Foremost, this process destabilised the notion of an unmoving temperate meridian. Throughout the early colonial process, man first self-consciously established himself as an agent of climatic change: eschewing the rigid modelling of extant climatic thought, geographers and colonists invested heavily in the idea of human adaptability, the capacity for ecological change and primitive attempts at geoengineering. This argument constitutes a significant revision of the most popular scholarly treatment of English climate history, Hubert Lamb's *Climate, history, and*

the modern world, which argued that ‘there seems to be no thought that climate, and, for that matter, the racial mixture and biological inheritance of nations, could change in the course of centuries.’¹ With the discovery of the New World, previously uninhabitable latitudes were now thought to be apt for European settlement and, crucially, transformation. By surveying the early propaganda produced during the throes of these early colonial experiments, this chapter will therefore trace the epistemological shift from a Ptolemaic world-view which posited an optimum meridian, toward a nascent Anthropocentrism: a trend which would lay the insidious foundations for further colonisation, expansion, displacement and slavery.

By ‘colonising’ climate, the following will elucidate the existing historical relationship between environment and race in the early modern world. As well as affecting ecological and early climatic change, scholars including Joyce Chaplin, Roxanne Wheeler, Mark Harrison and Gary Pukrein have elsewhere shown how early climate theory and the notion of an objective, temperate meridian provided an aetiology for modern racism.² Up until the late eighteenth century and potentially further, climate was inextricably woven into the fabric of ethnic typographies. For Roxanne Wheeler, ‘the lynchpin’ for understanding many eighteenth-century discussions of complexion and physiognomy was the same ‘climate-race-health’ nexus extant since Hippocrates. Despite this, few scholars have offered an early or precolonial perspective on the complex process whereby geographers and colonial writers

¹ Hubert Lamb, *Climate, History and the Modern World* (2nd edn., London, 1995), p. 9.

² For discussions on the influence of environmental theory in the early modern period, see Ivan Hannaford, *Race: The History of an Idea in the West* (Baltimore, 1996); Andrew Wear, ‘Making sense of Health and the Environment in Early Modern England’ in Andrew Wear (ed.) *Health and Healing in Early Modern England* (Aldershot, 1998), pp. 119-148; John Wands, ‘The Theory of Climate in the English Renaissance and *Mundus Alter et Idem*’, *Medieval and Renaissance Texts and Studies* 38 (1986), pp. 519-529; Clarence J. Glacken, *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century* (Berkeley, 1967); Margaret T. Hodgen, *Early Anthropology in the Sixteenth and Seventeenth Centuries* (Philadelphia, 1964), pp. 276-90; J. W. Johnson ‘Of Differing Ages and Climes’, *Journal of the History of Ideas*, 21 (1960), pp. 465-480; Z. S. Fink, ‘Milton and the theory of Climatic Influence’, *Modern Language Quarterly*, 2 (1941), pp. 67-80; Mary-Floyd Wilson, ‘Temperature, Temperance, and Racial Difference in Ben Jonson’s *The Masque of Blackness*’, *English Literary Renaissance*, 28 (1998), pp. 183-209; Roxanne Wheeler, *The Complexion of Race: Categories of Difference in Eighteenth-Century British Culture* (Philadelphia, 2000).

incorporated climate into a proto-racial hierarchy of skin colour.³ Up until the beginning of the seventeenth century, the assumption that black bodies were predisposed to labour in hot climates and English bodies inclined toward governance were problematised by their classical reputation specified above. Far from possessing an infallible and naturally superior temperament, English bodies – as identified in Harrison’s *Description of Britaine* – were derided as ‘blockish, uncivill, fierce and warlike.’⁴ In the context of early colonial settlement, the English came to liberate themselves from the confines of classical climatology. Emerging discourses on nature in the early seventeenth century helped the English imagine themselves as a powerful people who could triumph over climatic adversity and helped establish a new Anglocentric hierarchy of complexion.

‘Mere Dolts and Asseheads’: English Weather, Barbarism and National Character

As well as determining the rhythm of a harvest, sartorial and dietary preferences, living situations and standards, early climate theory alleged that meteorological conditions governed character on a national scale. For the English, a people long derided for their capricious and intemperate weathers, this was unfortunate. Like their barbarian ancestors, they were disposed to a weather system classically associated with savagery, ignorance, and incivility. The restatement of early climate theory in this period exacerbated national and confessional divisions, claiming that cold weather was a hallmark of barbarian civilisations, specifically the ancient nomadic Scythians. Like their Scandinavian neighbours, also ostracised from mainland Europe by climate and confession, the English were considered to be the natural

³ Gary Pukrein, ‘Climate, Health and Black Labor in the English Americas’, *Journal of American Studies*, 13 (1979), pp. 179-193, p. 180.

⁴ William Harrison, *The Description of England: The Classic Contemporary Account of Tudor Social Life*, ed. Georges Edelen (Washington, 1994), p. 446.

inheritors of this barbaric temperament.

Though physically resilient, to those versed in Greco-Roman geography it was apparent that the English suffered from a debilitating mental inferiority. Unlike their continental opponents, the French, Spanish and Italians, celebrated for their Latin complexion, the English national stereotype was that of an oafish gannet bereft of culture and class. ‘And for that we dwell northward,’ confessed William Harrison in his *Description of England*, ‘we are commonly taken by the foreign historiographers, to be men of great strength and little policy, much courage and small shift ... affirming further, that the people inhabiting the north parts are white of colour, blockish, uncivil, fierce and warlike, which qualities increase, as they come nearer the pole.’⁵ The same self-flagellation was not unusual for English geographers and historians of the mid-sixteenth century.

Far from possessing an infallible temperament, ancient philosophers and their modern copyists derided English bodies as cold and phlegmatic. Men bred ‘neere to the Pole Articke and Icie Sea’, though ‘very huge and strong bodied’ were, Levinus Lemnius confirmed, ‘for wit and learning, mere Dolts and Asseheads’.⁶ Following physiological principles demonstrated in the first chapter, classical thinkers ridiculed the English for their lack of sun. ‘By reason of their coldness & fayntnes of heate,’ Lemnius reasoned ‘[the English] be not very quick witted nor of very precise judgement, neither yet crafty and deceitful, nor such as by subtle drifts & wiliness, seek to supplant and undermine their enemy.’⁷ Harrison also attributed these qualities to ‘the weak abode of the sun with us, whereby our brains are not made hot and warmed.’⁸

The caricature of the English oaf dated to classical antiquity, based on the prevailing

⁵ William Harrison, *The Description of England*, p. 446.

⁶ Levinus Lemnius, *De habitu et constitutione corporis* (Antwerp, 1561) trans. Thomas Newton, *The Touchstone of Complexions* (London, 1576), p. 14.

⁷ *Ibid.*, p. 16.

⁸ William Harrison, *The Description of England*, p. 446.

definition of ‘climate’ and understandings of coldness. Taking its semantic root from the Greek *Klima*, ‘climate’ had originally denoted the ‘slope’, ‘declivity’, or ‘inclination’ of the sun’s relational position to the earth.⁹ Unlike definitions which emerged in the nineteenth century, the early modern understanding of climate lacked meteorological significance and reference to the weather. Instead, climate was synonymous with latitude. Typically Eratosthenes is credited with the static definition of a ‘climate’, though the term was popularised by Aristotle’s *Meteorologica*.¹⁰ According to Aristotle, the globe was divided into five ‘climes’, comprised of three uninhabitable zones: the ‘torrid’ equatorial region; two ‘frigid’ polar caps; as well as two hospitable temperate zones.¹¹

Within this model, the Northern temperate zone was divided into a further three climatic zones: the North, Middle, and South. One’s position within this tripartite of latitudes determined their humoral disposition. As opposed to the temperate middle-zone, praised as an incubator of civility, the men of the North (and therefore England) were oafish and vulgar. Lacking the moderation of the Latin temperament, the English were also opposed to the peaceable and contemplative disposition of those bred in the hot, arid climes of eastern Africa. While the humoral consistency of an individual body may fluctuate with a certain air, the physical characteristics of a ‘climate’ could not. To experience ‘climate change’, then, was to move either north or southward.

By the early sixteenth-century, however, geographical thought had undergone a significant epistemological turn. With the first European voyages to the Americas, the classical understanding of uninhabitable climatic zones was proven to be fallible and

⁹ James Rodger Fleming and Vladimir Jankovic, ‘Revisiting *Klima*’, *Osiris* 26 (2011), pp. 1-16

¹⁰ Robert Cawdrey, in his *Table Alphabeticall* (1604), assuages the term of all meteorological significance to define climate as ‘a portion of the worlde betwixt North and South.’ For an account of the semantic evolution of ‘climate’, see James Rodger Fleming and Vladimir Jankovic, ‘Revisiting *Klima*’, *Osiris*, 26 (2011), pp. 1-15

¹¹ Aristotle, *The Works of Aristotle*, trans. E.W. Webster (Oxford, 1923), vol. 3.

incomplete.¹² A once impermeable interpretation of climatic influence faced heavy scrutiny, occasionally to the point of mockery. In his famous description of the fabled ‘torrid’ zone, the Spanish missionary Josè de Acosta notes his crew having to wear *extra* layers to protect themselves from the purportedly intolerable heat of the equatorial zone:

What could I do then but laugh at Aristotle’s *Meteorology* and his philosophy? For in that place and that season, where everything, by his rules, should have scorched by the heat, I and my companions are cold.¹³

Expeditions into the ‘torrid zone’ undermined the foundations of Aristotelian geography and the zonal theory of climate. If we are to trust the account of Jean Bodin, ‘men in the sixteenth century were more impressed with the discovery that the equatorial regions were habitable than they were with the discovery of the new world.’¹⁴ Perhaps there is a degree of overstatement to Bodin’s words, though this does not negate the profound intellectual challenge represented by the now hospitable ‘torrid’ zone. By the time Bodin had published *Methodus ad facilem historiarum cognitionem* [*Method for the easy knowledge of history*] (1566), the inconsistency of Aristotelian natural philosophy was all too well-known. Robert Burton, whose work heavily borrows from Bodin’s, criticised the classical depiction of the so-called ‘torrid zone’ which, ‘by our predecessors held to be uninhabitable, but by our modern travellers found to be most temperate.’¹⁵ While the reality of these burgeoning settlements was a far cry from the northern Arcadia described by Burton (‘bedewed with frequent rains, and moistening showers, the breeze and cooling blasts in some parts’), the fact remained that

¹² Craig Martin, ‘Experience of the New World and Aristotelian revisions of the Earth’s climates during the Renaissance’ *History of Meteorology*, 3 (2006), pp. 1-16

¹³ Antony Grafton, *New Worlds, Ancient Texts: The Power of Tradition and the Shock of Discovery* (Massachusetts, 1992), p. 1.

¹⁴ Jean Bodin op. cit. Clarence Glacken, *Traces on the Rhodian Shore*, p. 437.

¹⁵ Robert Burton, *The Anatomy of Melancholy, What it is: With all the Kinds, Causes, Symptomes, Prognostickes, and Several Cures of it. In Three Maine Partitions with their several Sections, Members, and Subsections. Philosophically, Medicinally, Historically, Opened and Cut Up* (6th edn. London, 1651), p. 322-323.

climates previously judged hostile to human life were now occupied by European bodies, albeit with discomfort.¹⁶

Though geographers had become attuned to the contradictions of Aristotelian natural philosophy, ‘geographical climatology’ nevertheless remained the favoured explanation for cultural and ethnic difference throughout the early modern period. This trend can be traced to the beginning of the so-called ‘Age of Discovery’ and compounded by the emergence of Neoplatonism and the Hippocratic revival.¹⁷ For colonists specifically, classical theories of climate helped order ethnic difference on non-racial terms. Before the advent of ‘race’ as a scientific category in the eighteenth century, heat was conceived as the vital force controlling ethnic difference. Skin-colour and physiognomy were, above all, ascribed to exposure from sunlight and heat. What is particularly interesting, however, is the form that these discourses took. As Clarence Glacken reminds us, theories of national character were *not* ‘conspicuously theoretical’ in their transmission, and were ‘often described without causal explanation.’¹⁸

By the early modern period, theories of environmental influence were so deeply embedded in European consciousness and medical practice that their epistemological root was either forgotten or irrelevant. Following the generic advice of a health regimen, it was commonsensical to assume that an arid climate bred a complexion wholly different from a cold and wet one. ‘What was more logical,’ Glacken contends, ‘than to interpret the spectacle of sleepy natives in the shade of their hot warm climates as creatures held in thralldom of their climate?’¹⁹ Not only were these associations rational but pervasive in the intellectual and popular culture of early modern England. In Act 2: Scene 1 of Shakespeare’s *Tempest* (1611),

¹⁶ Burton, *The Anatomy of Melancholy*, p. 322.

¹⁷ Matthias Heymann, ‘The evolution of climate ideas and knowledge’, *WIREs Climate Change*, 1 (2010), pp. 581-597.

¹⁸ Glacken, *Traces on the Rhodian Shore*, p. 451.

¹⁹ Glacken, *Traces on the Rhodian Shore*, p. 358.

as Gonzalo and Alonso fall asleep, Sebastian remarks of the ‘strange drowsiness’ that possessed them, which Antonio attributes to ‘the quality of o’ the climate’.²⁰

For regimen writers, the interchange between culture and climate was equally axiomatic. How else could one explain the extraordinary cultural diversity of humankind? ‘Do not the *Northern cold Climates* give all the beasts of the Field hardy Constitutions and Natures, and warm Cloathing?, inquired Tryon; ‘How contrary to Reason and Nature it is for men in *cold Countries* to cloath themselves with *Silk* and *fine Calico*?’²¹ Down to the sartorial preferences of the English, who favoured cloth and furs over silks and calicoes, climate was chief among myriad factors explaining cultural and ethnic difference. Even on a provincial level, ‘who sees not a great difference between Surrey, Sussex, and Romney Marsh, the wolds in Lincolnshire and the fens?’ challenged Burton.²²

In the history of ethnic difference, the consequences of these discourses have insidious connotations. Variations in custom, the classical scholar Meric Casaubon argued, represented an unassailable indication that ‘it is not possible ... that men that live under different clymates should all live after one fashion.’²³ Just as ‘each Country has distinct *Languages*, which cannot be understood by People born in other *Climates*’, reasoned Tryon, ‘so have they likewise different Constitutions, Inclinations and Complexions, their *Herbs*, *Fruits* and *Grains* differing in their Quality and Operation.’²⁴ If a man was to travel five hundred miles in any direction, ‘he shall not be capable to understand one Word of another.’ On a regional level, for Tryon this explained local dialects and why ‘those that live in the *North*, cannot understand those of the *West*’ on account of ‘the differing Elevations of

²⁰ The association between indolence, passivity and warm climates is an enduring stereotype in colonial thought; see Syed Hussein Alatas, *The Myth of The Lazy Native: A study of the image of the Malays, Filipinos and Javanese from the 16th to the 20th century and its function in the ideology of colonial capitalism* (London, 1977)

²¹ Thomas Tryon, *A way to health, long life and happiness* (London, 1691), p. 161.

²² Burton, *The Anatomy of Melancholy*, pp. 331-332.

²³ Meric Casaubon, *A Treatise Use and Custom* (London, 1638), p. 80, p. 288.

²⁴ Tryon, *The Way To Health*, p. 161.

the *Pole* and Influences of the Sun.’²⁵

The renewal of interest in environmental influence, partly explained by new knowledge of equatorial and eastern regions, spurred an innovative generation of new geographers’ intent on revising Aristotle’s predictions. As well as the widely dispersed theories of Aristotle, Ptolemy and Hippocrates, the newer and immensely popular politico-geographical works of Bodin advocated a conspicuously patriotic (or ‘geohumoral’) interpretation of climate. The French geographer became especially renowned in England, where he ‘enjoyed a reputation for brilliance and high originality’ according to Margaret Hodgen.²⁶ Bodin’s rigid determinism, which attributed specific latitudinal regions with virtue, appealed to a country intent on asserting its corporeal primacy over the New World. Following Bodin’s influence, geography emerged as *the* dominant ‘scientific’ discipline of the sixteenth-century, and his *Six Bookes of a Commonweale* (1576; later translated from Latin in 1606) became a template for the political and colonial interpretation of climate.

Embellishing upon the theses of his predecessors, notably Aristotle, Bodin sharpened the discrepancy between Northern and Southern bodies. According to Bodin, those of the South were:

of a contrarie humour and disposition to them of the North: these are great and strong, they are little and weake; they of the north, hot and moyst, the others cold and dry; the one hath a big voice and greene eyes, the other hath a weake voyce and black eyes; the one hath a flaxen haire and a faire skin, the other hath both haire and skin black; the one feareth cold, the other heate; the one is joyfull and pleasant, the other sad; the one is fearefull and peaceable, the other hardie and mutinous; the one is sociable, the other solitaire; the one is given to drinke, the other sober; the one is rude and grosse witted,

²⁵ Tryon, *The Way To Health*, p. 161.

²⁶ Hodgen, *Early Anthropology in the Sixteenth and Seventeenth Centuries*, p. 283.

the other advised and ceremonious; the one is prodigall and greedie, the other is covetous and holds fast; the one is a souldier, the other a philosopher; the one fit for armes and labour the other for knowledge and rest.²⁷

Though foremost a political philosopher, it was upon geographers, cosmographers, and a broader consortium of learned Englishmen that Bodin's ideas exercised their greatest influence. Though his conclusions were hardly original, the Frenchman's idiosyncratic and compelling style of climatic theory – a mix of meteorology, cosmology, political theory, plus a large helping of ethnology – had, nevertheless, made a profound impact on English intellectual culture during the sixteenth and seventeenth-centuries.²⁸

As a staunchly patriotic Frenchman, Bodin's influence on English intellectual culture is surprising. He unashamedly positioned his birthplace at the centre of this model – a fairly brazen attempt to 'prove' that France, rather than Italy or Greece, was the *true* cradle of civilisation. His interpretation of Northern (including English) climates was, as a consequence, scathing. Any locale north of Calais was belittled for its lack of culture and overabundance of vulgar peoples, drawing frequent comparisons with the classical Scythians. To be English at the beginning of the sixteenth century was to be the 'other' – the 'sick man of Christendom'.²⁹ Divorced from Rome and separated by the English Channel, the British Isles would have seemed abruptly Northern by the mid-sixteenth-century.³⁰ In the reproduction of maps, displayed on walls, printed pamphlets and handkerchiefs, an image of England developed as a separate geographic entity from continental Europe and, by the end of the seventeenth century, Richard Grove describes how a 'detached and relatively objective

²⁷ Jean Bodin, *Six Bookes of the Commonweale* trans. Richard Knolles (London, 1606), p. 548.

²⁸ For Lynn Thorndike, Bodin's reading of climate represented 'little more than a borrowing from medieval astrology, whose last sighs have sometimes been mistaken for the first breath of a geographical interpretation of history.' Lynn Thorndike, 'The Survival of medieval intellectual interests into modern times', *Speculum*, 2 (1927), pp. 147-159, p. 159.

²⁹ Richard Helgerson, *Forms of Nationhood: The Elizabethan Writing of England* (Chicago, 1992), p. 25-40.

³⁰ Mary Floyd-Wilson *English Ethnicity and Race in Early Modern Drama* (Cambridge, 2003), p. 14

view of England (or Britain) had evolved'.³¹ The English state itself, Peter Stallybrass adds, consciously modelled itself on the impermeable, vestal body of Elizabeth I; 'an enclosed garden walled off from enemies.'³²

Between the years 1580 and 1625, Bodin was not only taught to English students of History and Geography but openly 'admired, quoted, and imitated'.³³ Amongst his champions were William Harrison, who quoted the philosopher in his *Description of England* (1577), as too did Edmund Spenser, Thomas Hobbes, Robert Burton, George Hakewill, John Milton, Philip Sidney and Nathaniel Carpenter.³⁴ John Milton, in particular, who had authored several political histories, bore strong influence from Bodin's *oeuvre*. In the *History of Britain*, Milton's analysis of his native brethren follows Bodin's rather Anglophobic account. It is a 'truth not often spoken', declares Milton, that although Britain 'is a Land fruitful enough of Men stout and courageous in War ...'

It is naturally not over-fertile of Men able to govern justly and prudently in Peace, trusting only in their Mother-Wit; who consider not justly, that Civility, Prudence, love of Publick good, more than of Money or vain Honour, are to this Soyl in a manner Outlandish; grow not here, but in minds well implanted with solid and elaborate Breeding, too impolitick else and rude, if not headstrong and intractable to the industry and virtue either of executing or understanding true Civil Government.³⁵

³¹ Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism* (Cambridge, 1995), p. 53; also see L. Weatherhill, *Consumer Behaviour and material culture in Britain, 1660-1760* (London, 1988).

³² Peter Stallybrass, 'Patriarchal Territories: The Body Enclosed' in *Rewriting the Renaissance: The Discourses of Sexual Difference in Early Modern Europe* (Chicago, 1986), pp. 123-142, p. 129; David J. Baker, 'My Liquid Journey': The Frontispiece to *Coryat's Crudities (1611)*', Wilson and Sullivan (eds.) *Environment and Embodiment in Early Modern England* (Basingstoke, 2007), pp. 118-136, p. 133.

³³ Hodgen, *Early Anthropology in the Sixteenth and Seventeenth Centuries*, p. 283.

³⁴ Leonard F. Dean, 'Bodin's *Methodus* in England before 1625', *Studies in Philology*, 39 (1942), pp. 160-66.

³⁵ John Milton, *The Prose Works of John Milton* ed. Rufus Griswold (Philadelphia, 1845) vol.2, p. 245.

Such was the Frenchman's influence on contemporary curricula that Gabriel Harvey once noted that 'you cannot stepp into a schollar's studye ... but shall litely find open Bodin's *de Republica*.'³⁶ However, Bodin's most prominent impact on English climatology was via Nathaniel Carpenter's *Geographie delineated forth in two bookes*, first published in 1625 with a further edition compiled a decade later.

Carpenter, sometimes held as the first 'modern' English geographer, contributed to a concept of history which derived from Baconian empiricism, stressing the supremacy of critical inquiry over tradition.³⁷ Rather than 'nature be squared to its own conceits,' he argued, the natural philosopher should 'stoop to Nature and observation.'³⁸ Considering Carpenter's vocal commitment to scientific objectivity, it is worth noting the subject matter of the final four chapters of his treatise. Moving from the physical Geography which emanates throughout the majority of *Geographie*, the latter portion of his thesis concerns the study of men – or the 'natural dispositions' they embody. For Carpenter, these matters were as intransigent as the landscapes they inhabited. 'There is nothing more subject to admiration then the diversity of the natural Dispositions in Nations,' he affirmed:

what writer ... hath not taxed pride and ambition in the Spaniard; levity, or rather (as Bodin would have it) temerity in the French; dangerous dissimulation in the Italian; Drunkenesse in the Dutch; Falshood in the Irish; and Gluttony in the English?³⁹

At once combining empirical method and popular aphorism, the contradictions of early modern geography demonstrated in Carpenter's *Geographie* reveals the epistemic conundrum of climate. If climates can be measured – then how? By the temperature of the air or the

³⁶ Gabriel Harvey, *Letter book of Gabriel Harvey, A.D. 1573-1580*, ed. E. J. L. Scott (London, 1884), p. 79.

³⁷ J. N. L. Baker, 'Nathanael Carpenter and English Geography in the Seventeenth Century', *The Geographical Journal*, 71 (1928), pp. 261-271

³⁸ Nathanael Carpenter, op. cit. Hodgen, *Early Anthropology in the Sixteenth and Seventeenth Centuries*, p. 286.

³⁹ *Ibid.*, p. 287.

temperament of its inhabitants? These conflicts inspired a fraught and intellectually subjective experience of climate and geography on a geo-political level. As European geographers became attuned to the inconsistency of Aristotelian climate projection, Bodin led a wave of emerging scholarship which questioned the situation of the hallowed ‘middle’ zone. English geographers faced a similar battle, although theirs had been undeniably more difficult.

Seeing that the most influential political geographer of the period was an intensely patriotic Frenchman, a disproportionate amount of literature revolved around an all-too-familiar Anglo-French rivalry. Certainly, there was resistance to the caricature of the degenerate Englishman. William Camden, for example, was quick to raise Julius Caesar’s claim upon his invasion of Britain that ‘the climate is more temperate than in Gaul, the colds being less severe.’⁴⁰ Overall, however, an overabundance of classical and contemporary literature supposed the opposite. As disparaging as these accounts sounded, they formed a fairly consensual idea of English ethnicity during the Elizabethan period. This is not to mistake the complexion of the English as inherently ailed, but constantly *intemperate*.⁴¹

Any claim to the temperate ‘middle-zone’ would thus require a considerable manipulation or reinterpretation of existing evidence; a challenge which English climatologists seemed to relish given their varied and imaginative attempts to reconfigure their ‘undesirable’ weather. Thomas Baines, the English physician, took the changeability of the English air to explain the volatility of English politics during the mid-seventeenth century, attributing the national taste for ‘newfangledness’ and rebellion to the ‘changeable complexion of the climate.’⁴² It was the ‘mutability of air in an island [that] contributed to

⁴⁰ Julius Caesar, *The Commentaries of Caesar*, trans. William Duncan (St. Louis, 1856), p. 140.

⁴¹ Mary Floyd-Wilson ‘English Mettle’ in Gail Kern Paster, Katherine Rowe, and Mary Floyd-Wilson (eds.) *Reading the Early Modern Passions: Essays in the Cultural History of Emotion* (Philadelphia, 2004), pp. 130-146, p. 134.

⁴² Sara Warneke, ‘A Taste for Newfangledness: The Destructive Potential of Novelty in Early Modern England’, *The Sixteenth Century Journal*, 26 (1995), pp. 881-896, esp. pp. 881-896, p. 886.

mutability of thought.’⁴³ While most interpretations of England’s climate were less literal, the collective shame of national intemperance was well-established. Notionally, this worked both to the advantage and disadvantage of the English. On the one hand, their climate was suited to barbarism, prefigured insolence and left its citizens ‘wanting in the site of beauty.’ On the other, the changeable disposition of the English body lent itself to self-improvement; a condition which would later bolster hopes of settlement in North America.

Civility could be reared in an English climate if one was cautious of the environmental perils highlighted in the Hippocratic corpus: i.e. stagnant waters, barren soils, and climatic extremes. As long as one was mindful of these constraints and dwelled within climates suited to their complexion, they would lead a healthful and happy life. For Robert Burton, author of *The Anatomy of Melancholy* (1621), there was nothing more beneficial to an ailing temperament than a sudden change of climate. Even better, a trip to one of England’s nascent colonies could redeem a lack-lustre complexion. At the same time, the issue of climatic change triggered anxieties about the susceptibility of the English to external, climatic influence. Travel abroad brought into the question whether one’s essential ‘Englishness’ be compromised or exaggerated in a changing climate. The Ancient idea of zonal climates loomed heavy over English geography and is an important cultural pretext to colonial endeavours in the New World. When colonists embarked on these voyages, they not only faced a physically hostile journey but a cultural perception of acclimation which questioned English authority, civility, and intelligence.

⁴³ Thomas Baines op. cit. Sara Warneke, *Images of the Educational Traveller in Early Modern England* (New York, 1995), p. 84.

‘Feeleth his Seed cold, be sure the man is unfruitfull’: Sex and Impotence in Cold Climates

To lack in heat represented a series of existential dilemma for English males. To be ‘cold’ became a mark of honour, and a cast of shame; it could embolden courage, yet induce impotence; it was to signal masculine prowess as well as incontinent womanhood; it became the source of English pride, connoting *mettle* and endurance while signifying the shame of incivility and barbarism. In their analyses of the English weather, contemporaries faced innumerable paradoxes which undermined a resilient national identity. Moreover, in an attempt to reconcile these contradictions, an image of masculinity emerged which revelled in the mastery of coldness. As well as explicating the ecology of patriarchy in early modern England, this section will compliment recent histories of sexual difference which have emphasised discursive analyses of biological difference.⁴⁴ If, as Judith Butler argues, ‘sexual difference . . . is never simply a function of material differences which are not in some way both marked and formed by discursive practices’, then the inherent ambiguity of humoral pathology allows for a critical analysis of early modern masculinity.⁴⁵ The ensuing debate between English physicians and geographers, their ancient counterparts and modern successors discloses a compelling juncture between geo-politics, gender and climatic discourse.

For early moderns, heat was the defining attribute of sexual difference.⁴⁶ According to the humoral economy of sex, most agreed that women were naturally cold and men were likewise hot. Unlike the relatively modern preoccupation with genitalia, fluctuations in heat

⁴⁴ Mark Breitenberg, *Anxious Masculinity in early modern England* (Cambridge, 1996); Alexandra Shephard, *Meanings of Manhood in early modern England* (Oxford, 2003).

⁴⁵ Judith Butler, *Bodies That Matter: On the Discursive Limits of Sex* (New York, 1993), p. 2; also see Judith Butler, esp. *Gender Trouble: Feminism and the Subversion of Identity* (London, 1990).

⁴⁶ Owsei Temkin suggests that the first thermometer was designed, in part, to differentiate between the sexes. *Rise and Decline of a Medical Philosophy* (Ithaca; New York, 1973), pp. 160-161.

were the primary explanation for male virility and fertility. The shock of climatic volatility, including native exposure to extreme cold, embodied many exogenous threats to the English male body. While many historians of climate are quick to reference Kupperman's claim that a 'move into an area of tropical heat and humidity' would risk the disintegration of the English character, her thesis neglects that many anxieties regarding climatic change were also extant in English domestic life.⁴⁷ Along with being cast as Europe's brutish and mentally deficient sibling, English males (particularly the literate elite) were troubled by the gendered connotations of endemic cold. The demographic specificity of the regimen's proposed readership, namely the dilettante male, is suggestive of wider anxieties regarding the physical and mental susceptibility of the masculine body to his environment. Because of their gluttony and lassitude, the body of the city-dweller was susceptible to discord in their local 'air' and the gendered implications of cold air.

In the history of early modern sexual difference, historians have preoccupied themselves with the implications of excessive natural heat amongst men and women. Thomas Lacquer's deeply influential *Making Sex: Body and Gender from the Greeks to Freud* (1994), is best known for coining the 'one-sex' understanding of homogenous sexual difference which defined Galenic physiology.⁴⁸ According to this theory, women were considered imperfect men and the boundaries between sexes were interchangeable. Lacking essential sexual difference, Lacquer cites Galen who ruminated on the changeability of the male form.

think first, please, of man's [external genitalia] turned in and extending inward between the rectum and the bladder. If this should happen, the scrotum would

⁴⁷ Karen Kupperman, 'The Puzzle of the American Climate in the Early Colonial Period', *The American Historical Review*, 87(1982), pp. 1262-1289, p. 1266; 'Fear of Hot Climates in the Anglo-American Colonial Experience', *William and Mary Quarterly* 41, 2 (1984), p. 213.

⁴⁸ Thomas Laqueur, *Making Sex: Body and Gender from the Greeks to Freud* (8th edn., Cambridge; Mass., 1999), p. 28.

necessarily take the place of the uterus, with the testes lying outside, next to it on either side.⁴⁹

For Lacquer, male and female categories do not comprise a binary but a broader continuum of anatomical and behavioural qualities. Gender extremes, according to this module, are defined by an excess of heat. Other historians have taken exception with Lacquer's teleology, stressing the significance of the 'unbearable coldness of female being' which English males so feared.⁵⁰ The fear of cold, specifically a fear of genital retraction, amongst English males has been acknowledged by Gail Kern Paster who notes 'tales of sixteenth-century penises ... turning cold and soft, of collapsing into impotence' which proliferated in medical advice books.⁵¹

While gendered aspects of the humoral economy are well-founded, environmental historians have ignored or overlooked their equivalences with early climatic theory. According to prevailing medical belief, vital heat (*calidum innatum*) was biologically determined and the maintenance of this heat depended on one's *pneuma* (usually interpreted as 'breath' or 'air'), travelling through the blood and around the body. Galen described the heart as 'the hearthstone and source of the innate heat by which the animal is governed', warning that if this fire were to decline so too would the functions of one's internal organs.⁵² For Aristotle, 'vital heat' was foremost associated with successful reproduction. Depending on how much heat the male body retained in the heart and blood, they would remain fertile. Aristotle hypothesised that semen was a converted form of blood. By lacking the vital heat required to convert blood into semen, Women were thus unable to produce semen due to their

⁴⁹Galen, *On the Usefulness of the Parts of the Body*, trans. Margaret Tallmadge May, 2 vols. (Ithaca; New York, 1968) vol. 2, p. 62.

⁵⁰ Paster, 'The Unbearable Coldness of Female Being: Women's Imperfection and the Humoral Economy' *English Literary Renaissance*, 28 (1998), pp.416-440

⁵¹ *Ibid.*, p. 417.

⁵² Galen, *On the Usefulness of the Parts of the Body*, p. 170.

aforementioned frigidity.⁵³ As Ian MacClean reminds us, in early modern England even ‘the hottest female is colder than the coldest male.’⁵⁴ Concurrently, if a woman were to experience or exhibit substantial inward heat, they would be reprimanded as monstrous.⁵⁵ Menstruation was said to occur when the heat of the male’s ejaculate was not sustained and ultimately rejected by the female body. Similarly, the body of the preadolescent male – subject to radical changes in temperature – was unfit to produce semen. Crudely put, ‘a man’s virility ... was dictated by the temperature of his testicles.’⁵⁶ To maintain the ‘vital heat’ necessary for successful reproduction, as Plato described a system whereby excessive heat is cooled by outside air and is powered by the process of digestion.⁵⁷ Consequently, anxious English writers and geographers impulsively asserted that it was because of their coldness that Englishmen eat and drink more than their continental neighbours.

Unable to maintain humoral consistency, specifically a hot and dry complexion, the male libido would wane and his body develop feminine characteristics. Persistent fears of male impotency and ‘coldness’ characterised discussions of sexual health throughout the seventeenth century. Writing on the subject, the surgeon John Tanner in *The Hidden Treasures of the Art of Physick* (1659) blames the ‘cold seed’ of man on infertility. ‘Before you try these uncertain conclusions upon the Woman,’ he argued, ‘examine the man, and see if the fault be not in him ... if the man be of an effeminate Spirit, if he hath no Beard, if he be long casting forth his Seed, and taketh little delight in the act, and the Woman in the act

⁵³ Paul Studtmann, ‘Living Capacities and Vital Heat in Aristotle’, *Ancient Philosophy*, 24 (2004), pp. 365–379.

⁵⁴ Ian MacClean, *The Renaissance Notion of Woman* (Cambridge, 1983), p. 34. Concurrently, if a female was to experience or exhibit any sign of substantial inward heat, they would be castigated as monstrous.

⁵⁵ Paster, ‘The Unbearable Coldness of Female Being’, pp. 416-440, *passim*. Paster elsewhere draws upon the work of Michel Foucault, tracing a longer genealogy of what he called ‘the hysterization of women’s bodies.’ Humoral theory, she argues, was ‘instrumental in the production and maintenance of gender and class difference.’ Without the humoral discipline afforded to the male, the female body was thus overburdened by ‘humoral forms of embarrassment’, i.e. menstruation and incontinence. Gail Kern Paster, *The Body Embarrassed: Drama and the Disciplines of Shame in Early Modern England* (New York, 1993), p. 7.

⁵⁶ Shephard, *Meanings of Manhood in early modern England*, p. 59.

⁵⁷ Friedrich Solsmen, ‘The Vital Heat, The Inborn *Pneuma*, and the *Aether*’, *The Journal of Hellenic Studies*, 77 (1957), pp.119-123.

feelesh his Seed cold, be sure the man is unfruitfull.’⁵⁸ In *A Golden Practice of Physick*, Thomas Platter confirmed that when the male ‘Seed be not concocted, but crude thin and waterish, or too cold, and with[out] spirits, or the like, which takes away the vertue, it cannot beget Children.’⁵⁹

Regimen authors offered their own dietary solutions to impotence within males. William Vaughan, for example, suggests a diet of ‘young duckes stifled with borage smoke, & being eaten in cold weather’ so to ‘strengthen the voyce, and increase naturall seede.’⁶⁰ As described in Chapter one, humoral balance altered according to the life-cycle: a child’s body is marked by a sanguine, hot complexion which matures into adolescence and is then overtaken by age, growing colder and drier. Henry Cuffe, the politician and author, described the process whereby ‘heat without any the least intermission or pause, worketh upon our moisture, and by little and little consumeth it, it selfe also in time decaying’ and eventually ‘declineth our body unto colde and drinesse, till at length death ceaseth upon our bodies.’⁶¹ As one’s lifeblood burnt out in old age, the male body settles into impotency. Yet this process could be expedited by an extreme climate.

If English masculinity was ‘inherently anxious’, to quote Mark Breitenberg, it was also fundamentally unstable and fragile in the face of a changing climate. The unease described by Breitenberg reflects the humoral instability associated with masculinity: a gender based on a complex network of humoral contingencies, not least weather. Climate entered popular discourse by way of vernacular medical literature and this conversation was immediately imbued with ethnic and gendered characteristics. England’s climate, derided as constantly inconstant, did much to exacerbate concerns over sexual difference. As Gail Kern

⁵⁸ John Tanner, *The Hidden Treasures of the Art of Physick* (London, 1659), p. 346.

⁵⁹ Felix Platter, *A Golden Practice of Physick* (London, 1662), p. 173.

⁶⁰ William Vaughan, *Natural and artificial directions for health derived from the best philosophers, as well as modern, as ancient* (3rd edn., London, 1612), p. 19.

⁶¹ Henry Cuffe, *The Differences of the Ages of Mans Life* (London, 1607), pp. 117, 114.

Paster has elsewhere shown, the female humoral form – lacking the supposed autonomy of its male equivalent – was imagined as a ‘leaky vessel’: ‘in the theory of temperaments,’ she explains, ‘the body of woman absorbs gender like a sponge, is saturated by it as a cold, clammy fluid of difference.’⁶² Woman was therefore requiring of ‘patriarchal discipline’, according to Paster. Simultaneously, Breitenberg regards the male body as ‘by definition perilously close to becoming "feminine," ... anxiously attentive to the balance of its own troublesome fluidity.’⁶³

This attentiveness was expressed in all manner of ways, from discursive treatments of coldness to practical adjustments to one’s diet or lifestyle. Ultimately, this was to ameliorate the more worrying implications of a cold climate. Well into the eighteenth-century, medical tropes proliferated which framed the female body as subject to an ‘unbearable coldness’. William Congreve, in an ‘Essay Concerning Comedy’ went as far to speculate that it was ‘by reason of their Natural Coldness’ that ‘humour cannot exert itself to that extravagant degree, which it often does in the Male Sex.’ Congreve confesses that he has ‘never made any Observation of what I Apprehend to be the true Humour in Women.’⁶⁴ Lacking the ‘vital heat’ that sustains masculine virility, the Englishman’s genitalia could turn cold, soft, and hairless, eventually unable to male offspring (if conception was at all possible).⁶⁵ According to Lemnius, cold men:

have faltering tongues, and nothing ready in utterance, a nice, soft, and womanish voyce, weake and feeble faculties of nature, ill memory, blockish wit, doltish minde,

⁶² Paster, ‘The Unbearable Coldness of Female Being’, p. 417.

⁶³ Breitenberg, *Anxious Masculinity in Early Modern England*, esp. ch.1, p. 67.

⁶⁴ William Congreve, ‘An Essay Concerning Comedy’ in *Letters and Documents*, ed. John C. Hodges (New York, 1964), p. 183.

⁶⁵ Paster, ‘The Unbearable Coldness of Female Being’, p. 417; Shephard, *Meanings of Manhood in Early Modern England*, p. 59.

courage (for lacke of heat and slendernesse of vitall spirit) fearfull and timorous, and at the wagging of every straw afraid⁶⁶

Masculinity, on the other hand, was sustained by ‘natural’ or ‘vital’ heat. Omitting the physiological traits of masculinity, the maintenance of a hot complexion was the defining biological characteristic of masculinity in early modern Europe. A hot and dry temperament was, Lemnius states: ‘first in order ... for the conservation of health’ and ‘whosoever is of that Complexion and constitution, is of stature comely, and of shape and beauty agreeable and consonant to manly dignity.’⁶⁷ A frigid complexion, by contrast, was ‘the worst of all others, and furthest from that state which is perfectest and best.’⁶⁸

‘Lest we derogate anything from the praise of this our happy Island’: Coldness and English Nordicity

Coldness, with its implicit associations with incivility and effeminacy, provoked a litany of concern from English scholars who chose to either denounce their northern lineage or slander southern climes. It was neither the desire of the English to hold false pretences to a Mediterranean climate – from which it was so obviously separate – nor submit entirely to their barbarian heritage, but to reconfigure the orthodox concept of temperance. English temperance, as we will see, was, therefore, to be assertively masculine, bold, war-like and courageous, while also enveloping the civil virtues of classical civilisations. ‘The wits our climate sends forth,’ declared one anonymous English writer, ‘were ever equall, and rather

⁶⁶ Lemnius, *Touchstone of Complexions*, pp. 63-65.

⁶⁷ *Ibid.*, p. 18.

⁶⁸ *Ibid.*, p. 16.

deeper Schollars than either the Italians or the Spaniards.’⁶⁹ Remarking of England’s climatic equilibrium, Michael Drayton’s preface to *Poly-Olbion* (1612), describes his native Albion as a place:

Where heat kills not the cold, nor cold expels the heat,
The calms too mildly small, nor winds too roughly great,
Nor night doth hinder day, nor day the night doth wrong,
The Summer not too short, the Winter not too long.⁷⁰

Others smeared the humoral partition of Europe made by classical scholars. In his *Popular Errours or the Errours of the people in matter of Physick* (1651), James Primrose contended with the ancient assumption that northern climates nurtured phlegmatic complexions. ‘Whatsoever the Climate and Country be, even in the most Northern Climates,’ Primrose observed, ‘there are men of every temper, hot, cold, cholerick, flegmatick, sanguine, melancholick.’⁷¹

Some writers even challenged the latitudinal situation of Britain which, rather than lying in the intemperate North, was argued to possess many of the same qualities of an Iberian climate. While Thomas Coghan conceded that ‘the ayre of Brittain is foule with often stormes and clouds,’ it was also ‘without extremitie of cold.’⁷² Attempting ‘to reconcile these sayings of ancient authors,’ Coghan claimed that ‘*England* may bee called temperate in heate in respect of Spaine, and temperate in cold in respect of *Norway*, yet to be reckoned cold notwithstanding & moist, because it declineth from the mids of the temperate Zone

⁶⁹ Z. S. Fink, ‘Milton and the theory of Climatic Influence’, pp. 70-71, p. 290.

⁷⁰ Michael Drayton, *Poly-Olbion* (London, 1612), p. 1

⁷¹ James Primrose, *Popular Errours or the Errours of the people in matter of Physick* (London, 1651), p. 127

⁷² Thomas Coghan, *The haven of health: chiefly gathered for the comfort of students, and consequently for all those that have a care of their health* (4th edn, London, 1636), xv.

Northward.⁷³ Here, the author not only places Britain (or, at least, Southern England) in the framework of a ‘temperate’ climate but importantly *defers* the unwanted effects of ‘Northerness’ to neighboring localities. ‘We must note here,’ defended Thomas Walkington,

that this [barbarism] is spoke of the remoter parts neare vnto the pole, lest we derogate anything from the praise of this our happy Island (another blisfull Eden for pleasure) ... wherein there are and ever have been as pregnant wits, as surpassing politicians, as judicious understandings, as any clime euer yet afforded under the cope of heauen.⁷⁴

This is a recurring trend within early English climatology, whereby writers sought to contrast, or ‘other’, the *far* North as the proper enclave of incivility as opposed to the temperate *near* North.

The same insistence on dividing Northern latitudes is reminiscent of Louis-Edmond Hamelin’s definition of ‘Nordicity’: a term to describe varying degrees of ‘Northerness’ as distinguishable by a series of human and geographical factors. In the same way that Bodin divides the Northern Hemisphere into three regions of thirty-degrees each, and again into subdivisions of fifteen degrees, Hamelin advocates the division of the Canadian North into four latitudinal classifications: the *Near North*, the *Middle North*, the *High North*, and the *Far North*. While this study lacks the quantitative means to recreate said categories, the concept of a northern gradient appeals to the analysis of England’s climate.⁷⁵ Rather than denoting one homogeneous zone, English writers were quick ‘to mark the English temperament as more barbaric than the French, yet more civilised than the Irish, the Scots, and the Welsh; as more

⁷³ Coghan, *The haven of health*, xv.

⁷⁴ Thomas Walkington, *The Optick Glasse of Humors. Or the Touchstone of a Golden Temperature* (London, 1621), p. 16.

⁷⁵ In Hamelin’s study, ‘Nordicity’ is categorised according to ten criteria: ‘1. Latitude; 2. Perma-frost; 3. Number of Days above 42 Fahrenheit; 4. Negative thermal index from 65 Fahrenheit; 5. Length of freeze up; 6. Vegetation; 7. Communication; 8. Population (native and white); 9. Exploitation of resources; 10. Cost of goods. Louis-Edmond Hamelin. *Canadian Nordicity: It’s Your North, Too* (Montreal, 1979)

refined than the commoner, yet more robust than the decadent noble.⁷⁶

England *was* northern inasmuch as it embodied the more desirable qualities of Northerness: virility, strength and courage. Many authors, medical and geographic, would differentiate between the temperance afforded to inhabitants in the south of England, in opposition to cities ‘situated clean contrary, towards the North-west, North, and North-East,’ which while ‘commonly strong and dry ... are subject through suppression of excrements, unto headaches, sharp pluries, coughs, exullceration of the lungs.’⁷⁷ In the context of England’s brutal colonisation of Ireland, climatic discourse became a conduit to reinforce to the notion of the Irish as a heathenish ‘other’. While Ireland shared many climatic similarities with England, Daniel Baldwin – in his pamphlet *Ireland Cur’d of all Distempers* – finds the air to be ‘of great prejudice to those bodys that have no natural sympathy with the climate.’⁷⁸ As a means to separate the ‘barbarous’ climate of Ireland with the invented civility reared in Southern England, a sharp distinction was drawn between the two qualitatively comparable environments. Supposing the existence of an optimum English temperament, the colonisation of Ireland, as well as the New World, could thus be defended as an act of moderating the excesses of a certain clime.⁷⁹

With the distinction drawn between the Far and Mid-North, English writers disavowed the most disconcerting characteristics associated with an intemperate, cold climate. Foremost, this involved tackling the troublesome association between coldness and masculinity. Rather than deny the endemic coldness experienced in England, writers twisted the gendered

⁷⁶ Floyd Wilson, ‘English Mettle’, p. 136

⁷⁷ Thomas Mouffet’s *Healths Improvement: Or, Rules Comprizing and Discovering the Nature, Method, and Manner of Preparing all sorts of Food used in this Nation: Corrected and Enlarged by Christopher Bennett* (2nd edn, 1655), p. 16

⁷⁸ D. Baldwin, *Ireland cur’d of all Distempers* (2nd edns., 1690)

⁷⁹ See Karen Kupperman, ‘Climate and Mastery of the Wilderness in Seventeenth-Century New England’, in David Hall and David Allen (eds.), *Seventeenth-Century New England: A Conference* (Boston, 1984), pp. 1-37; Kupperman, *The Jamestown Project* (Cambridge, Mass., 2007); Ethan H. Shagan, *The Rule of Moderation: Violence, Religion and the Politics of Restraint in Early Modern England* (Cambridge, 2011), p. 196.

implications of ‘coldness’ to bolster a concept of venturous, resilient masculinity. Borrowing from a theory of temperaments expressed by Vitruvius, Pliny, and Aristotle, writers above would assert that it was because of – rather than in spite of – coldness that English bodies were sealed and heated.⁸⁰ By the seventeenth century, John Locke had begun to promote the use of the ‘cold regimen’ in favour of a hot one.⁸¹ By this, he argued that children should not be swaddled in clothing; they should play in open air and be washed in cold water. Otherwise, he argued, the child’s health and constitution would quickly deteriorate. Preempting the later eighteenth century vogue for cold bathing and the ‘cold regimen’, Locke identified the warm regimen as making the body too lax and unmanly.

The shock of cold could harden, without fear of genital retraction and impotence. ‘There is nothing that does more help Concoction than the cool refreshing Influences of the Air; for it strengthens the natural Heat,’ argued Thomas Tryon. ‘People in cold Weather have greater and stronger Appetites, and more Spirits than in hot; and therefore are able to endure more Action; so likewise such as are bred in cold Countries, are harder, stronger, and for the most part longer liv’d than those that inhabit in over-hot Regions.’⁸² In Tryon’s work of 1691, the author effectively paraphrases ideas expressed a century earlier by Lemnius’s *Touchstone of Complexion*; an indication of the consistency of ‘geo-humoral’ thought in early modern England. Lemnius’s work, translated into English by Thomas Newton in 1576, is responsible for many of the colourful and varied illustrations of the English/ Northern temperament which were to follow. Lemnius, himself a Dutchman, hailing from the border between the temperate and frigid North seems to cast a comparably sympathetic take on the Far North. ‘So, they that dwell Northward and in cold regions,’ they are, ‘by reason of grosse bloud and thicke

⁸⁰ Floyd-Wilson, ‘English Mettle’, p. 136

⁸¹ Hisao Ishizuka, *Fiber, Medicine, and Culture in the British Enlightenment* (Basingstoke, 2016), p. 43

⁸² Tryon, *The Way to Health*, pp. 235-236

Spyrites, are seene to be bolde and full of venturous courage.’⁸³ He went on to quote the poetry of Lucane, who juxtaposed Northern and Southern (often also encompassing the East) qualities:

Such as in th'East and scorching Climes
are bredde: by course of kind,
And Countries influence, meycockes soft
By daily prooffe we finde.
The North, that colde and frostie it,
Such weaklings none both breede:
The folkes there borne novvarres can daunt:
of death they haue no dread.
In this their errour happie they,
whom greatest feare of all,
(Of death I meane) cannot affray,
nor courage once appall.
They recke not they, what brunts they beare,
they feare not enmyes blade,
These laddes dare venture life and lymme,
in manly Martiall trade.⁸⁴

Inverting classical associations between coldness and impotence, Lucane finds the ‘scorching Climes’ of the East make men’s ‘meycockes soft.’ An excess of heat was as dangerous as excessive cold – yet Lucane’s account tends to focus on the virtues of the cold which ‘such

⁸³ Lemnius, *The Touchstone of Complexions*, pp. 13-15.

⁸⁴ *Ibid.*, p. 15.

weaklings none both breede ... of death they have no dread.' Finally, the poet insists that 'these laddes' bred in such climes, rather than succumb to the adversity of their weathers, 'dare venture life ... in manly Martiall trade.'⁸⁵

As Daryl Parker has elsewhere shown, this interpretation of 'Martiall trade' is a significant way in which coldness was reimagined.⁸⁶ In his analysis of Hamlet's Northern ethnicity, he suggests that the emergence of this new stereotype; an ethnic persona 'remarkable for its masculine boldness' and closely related to the newly defined 'mechanician'.⁸⁷ Carpenter discloses in his *Geography* that, in their lack of brainpower and ability to govern effectively and amiably, the English gained a reputation for 'Mechanicall works and martial endeavors; the extreame towards the Equator to the work of Religion and Contemplation: The Middle to lawes and civility.'⁸⁸ While sharing many continuities with the doltish caricature of Northerness, this was a calculated revision of the brawny but witless Briton. The newly defined 'mechanician' barely refuted the more disparaging qualities of Northerness, but altogether redefined them as diligent and productive. Floyd-Wilson has elsewhere commented on the materiality of this characteristic; a hardy, industrious quality defined as 'mettle'. In a subversion of England's classical complexion, Floyd-Wilson comments on the use of the term in Act 3, Scene 5 of Shakespeare's *Henry V*, when French infantry are stunned by the bravery, or 'mettle', of their English opponents:

Constable: *Dieu de batailles*, where have they this mettle?
 Is not their climate foggy, raw, and dull,
 On whom, as in despite, the sun looks pale,

⁸⁵ Lemnius, *The Touchstone of Complexions*, pp. 13-15.

⁸⁶ Daryl Palmer, 'Hamlet's Northern Lineage: Masculinity, Climate, and the Mechanician in Early Modern Britain', *Renaissance Drama* 35 (2006), pp. 3-25, *passim*.

⁸⁷ Dr John Dee first invented the term, which was defined in the Oxford English Dictionary as 'A Mechanicien, or a Mechanicall workman is he, whose skill is, without knowledge of Mathematicall demonstration, perfectly to worke and finishe any sensible worke...' *Oxford English Dictionary*, s.v. 'mechanician', n.1

⁸⁸ Nathanael Carpenter, op. cit. Hodgen, *Early Anthropology in the Sixteenth and Seventeenth Centuries*, p. 286.

Killing their fruit with frowns? Can sodden water,
A drench for sur-reined jades, their barley broth,
Decoct their cold blood to such valiant heat?

According to this original depiction of masculinity, the English were such stuff as armaments were made of. ‘Mettle’, Floyd-Wilson explains, literally derived from ‘Metal’ and not only connoted fortitude of spirit, but real, physical humoral substance.⁸⁹

Conventionally speaking, mettle was rarely the possession of the elite or refined. Such transmutations of coldness also coincide with a revival in Viking studies and a reappraisal of England’s barbarian past. Most notably, Olaus Magnus’ *Historia de Gentibus Septentrionalibus* (1555; translated into English as *A Description of Northern Peoples* in 1658), considered Britain to be firmly set within ‘Europa Frigida’. In Scandinavia, Britain found a common identity: in their ‘their violent struggles in war, their buildings, their social intercourse, and also the cheerful processions that entertain this race, who live under the influence of the harsher planets’.⁹⁰

Rather than denoting an empirical measurement, ‘coldness’ was instantly subject to a series of intersecting debates over the character, complexion and culture of the English. As a category of analysis, climate can therefore help elucidate several diffuse historical questions around the intersection between gender and ethnicity in the early colonial period. To be ‘cold’ became the source of English pride, connoting *mettle* and endurance, while signifying the shame of incivility and barbarism. Then, as today, climate became the subject of vehement denial. The epistemic conundrum represented by classical climate theory forced a reconsideration of England’s relationship with its aerial environment on a corporeal and

⁸⁹ Floyd-Wilson, ‘English Mettle’, p. 136

⁹⁰ Olaus Magnus, *Historia de Gentibus Septentrionalibus*, trans. Peter Fisher and Humphrey Higgens, ed. Peter Foote (London, 1998) vol. 3, p.771.

global level. In their analyses of the English climate, contemporaries were faced with innumerable paradoxes which threatened a concept of national identity based on unfettered chauvinism and inherent superiority complex. In an attempt to resolve these inherent contradictions, an image of masculinity emerged which revelled in the mastery of coldness.

'A Golden Mean betwixt Two Extremes': Mapping the Early American climate

Like the wavering climes of the North Atlantic Archipelago, the English temperament was considered to be unruly, capricious and potentially volatile. Given the endemic mildness experienced in their native isles, it was held that the English might only prosper in moderate situations: not too hot or cold, wet or dry. Though their main continental adversaries, the French and Spanish, were naturally imbued with a constitution which flourished in heat, the English endangered themselves in tropical warmth. For many colonists, the enduring commitment to classical climatology throughout the sixteenth century buttressed their unease with cross-Atlantic travel. The Hippocratic revival, the enduring influence of Galen and humoralism, as well as the popular works of Jean Bodin (and his English admirers), had established a medico-geographical paradigm hostile to intercontinental travel. 'All the inhabitauntes of the worlde', stated Richard Eden, were encoded with their own specific constitution 'and strength of body that euery of them are proportionate to the Climate assigned vnto them, be it hotte or colde.'⁹¹

By breaching their natural order, colonists risked their health and even endangered their lives. It was generally believed that a marginal shift southward, by about 10° latitude,

⁹¹ Richard Eden op. cit. Edward Arber (ed.), *The First Three English Books on America* (Birmingham, 1885), xlii.

could manifest itself in a kind of transmogrification.⁹² In theory, a move toward an area of torrid heat or humidity would risk the dissolution of their hardy, English character. As Karen Kupperman warns, ‘at the worst, English people might die, even at 40 degrees of latitude. At the least, they could become like the despised Spaniard.’⁹³ As burgeoning settlements were established in New England, English colonists travailed against an interpretation of climate which cast their new latitude as uninhabitable, insalubrious and potentially dangerous. For investors, the American climate posed a series of practical concerns for early colonial experiments: how would the sensitive English constitution react to an alien climate? How might they mentally and physically adapt to these surroundings over time? And, perhaps most importantly, how would colonists reconcile the capricious American climate with their promise of a new Arcadia? The answer to the above lay in their search for the ‘golden mean’: the temperate meridian latitude that not only sustained but nourished English life.

Reporting to his native England in 1635 upon his return from Quincy, Massachusetts, the colonist Thomas Morton claimed to have discovered just that: a new earthly paradise or ‘Second Canaan’. Under its sacred latitude, which Morton believed to share a meridian with Israel, New England was said to occupy ‘*a golden mean betwixt two extremes: I mean the temperate Zones, betwixt the hot and cold.*’⁹⁴ Per Aristotle’s theory of climate, based on the division between ‘torrid’, ‘frigid’ and ‘temperate’ latitudes, Morton found New England to inhabit the fabled middle. Massachusetts’s climate and topography was, in his words, ‘made most apt and fit for man to use’; specifically, a land designed for the English constitution.⁹⁵ Using a template adapted for over a millennium, Morton had justified early settlements by appealing to an arbitrary, optimum latitude. ‘For that country that doth begin her boundes at

⁹² Kupperman, ‘Fear of Hot Climates in the Anglo-American Colonial Experience’, p. 216.

⁹³ Kupperman, ‘The Puzzle of the American Climate in the Early Colonial Period’, p. 1266.

⁹⁴ Thomas Morton, *New English Canaan, or New Canaan containing an abstract of New England* (London, 1632), p.11.

⁹⁵ *Ibid.*

40 Degrees ... and ends at 45 Degrees at the famous Golden latitude’, explained the writer, ‘and doth participate in heate and cold indifferently, but is oppressed with neither.’⁹⁶

Morton’s account straddled two ostensibly discordant climatic theories: one derived from Christian eschatology, and the second based on the contemporary techniques of portolan navigation using precise latitudinal coordinates. The Lord himself, described Morton, indicates heaven’s blessing using His own ‘compasse of that Golden meane.’⁹⁷ For Morton, as with countless early colonial investors and writers, paradise had now – at least in theory - become a navigable, geographical reality. Fundamental to the understanding of climate in the Age of Discovery was the same enduring tension between a vision of the New World as an Edenic paradise, Canaan or Arcadia, and an empirically complex portrait of a capricious, unknown and often challenging environment. In their joint quest for the fabled ‘golden mean’ evoked by Morton, colonists were forced to not only question the unremitting and turbulent conditions of their adopted environment but a providential world-view that assumed the existence of a temperate haven for English bodies.

For early colonial writers, the location of an objective ‘golden mean’ became imperative to sustaining hopes of a successful colonial project. Rather than blindly follow the antiquated projections of Aristotle’s *Meteorology*, the ensuing ‘Age of Discovery’ brought about a new epoch in climatic thought. Though Aristotle’s theory of climate endured in a broader sense, the assumption of a temperate ‘middle’ had now shifted – but where? Who was to say that Italy had an automatic claim to temperance, rather than Scandinavia, Britain or North America? As will be shown, the quest for this hypothetical meridian was by no means as straightforward as polemicists like Morton would have it. The theory of a ‘golden mean’ was, of course, no more than a narrative prop employed to recycle a theory of climate which

⁹⁶ Morton, *New English Canaan*, p.12.

⁹⁷ *Ibid.*, p.15.

complimented the unstable English temperament; a device used to manipulate the torrid conditions into a framework of healthfulness and prove that the New England climate was ripe for colonisation.

The essential dilemma posed by foreign airs was based on the ill-defined constitution of the English. Such beliefs proved remarkably durable in spite of the growing success of English colonial settlements in the Caribbean throughout the seventeenth century. In William Vaughan's *Directions for Health*, the physician-cum-colonist speculates that an Englishman could not survive more than five years near the equator; however, by the sixth edition published in 1626, Vaughan had revised his estimate to fifteen years.⁹⁸ As well as stipulating the basis for physical health, the mental health of an individual was contingent upon one's humoral balance. An immediate change of situation could reconstitute the humoral body, but also impact on the mind. Even though a traveller may resist the physical consequence of climatic change via rigorous 'seasoning' (described below), Eden suggests that while they 'may dwell and abide there, as in their natural place and temperament ... so greates a love resteth them to their native situation.'⁹⁹

Homesickness, in other words, was also a considerable factor in the decision to venture abroad. As Rebecca Earle's revealing work on travel, climate and colonialism has lately shown, a consistent feature of Europe's colonisation of the Americas during the fifteenth and sixteenth centuries was countered by a yearning for natal soil. It is notable, Earle argues, that Europe's colonisation of the Americas in the fifteenth and sixteenth centuries happened as many Renaissance writers hailed the attachment individuals innately felt toward their home countries.¹⁰⁰ So profound was this attachment between people and place that Earle

⁹⁸ Vaughan, *Directions for Health*, (4th ed., London, 1617), pp. 2, 8.

⁹⁹ Edward Arber, ed., *The First Three English Books on America* (Birmingham, 1885), xlii.

¹⁰⁰ Rebecca Earle, 'Climate, travel and colonialism in the early modern world' in Sara Migletti and John Morgan (ed.) *Governing the Environment in the Early Modern World* (London, 2017), pp. 22-38, pp. 22-23.

notes how travel was ‘likely to induce almost unbearable homesickness.’¹⁰¹ Contrary to the portrait of the early modern Conquistador as ‘clad in invincible armour of impenetrable self-confidence’, Earle argues that the process of early colonisation was an anxious pursuit, ‘not least because the health and stability of the European body was always in doubt.’¹⁰² This was particularly true of the English body; a physique untested even in Mediterranean conditions. As unpalatable as the thought may be, our historical actors were not simply genocidal villains, but fragile, unstable bodies reluctant to depart from the comfort of their native air. Consequentially, this mentality bred an entrenched fear of travel to foreign climates; a fear that Kupperman, amongst others, has described in detail.¹⁰³

Given the considerable risk to one’s health brought on by travel, early seventeenth century propaganda rested on one of two climatic arguments: first, that the physical stress caused by intense heat was compensated by the divinely ordained bounty of their new environs, or, secondly, that the weathers of New England were harmonious with the English constitution.¹⁰⁴ Naturally, many propagandists rejected the notion that the English body was naturally incompatible with their new climate, choosing to laud the medicinal effects of American air. Francis Higginson, the first minister of Salem, Massachusetts, was a notable defender of this belief, contending that in New England ‘there is hardly a more healthfull place to be found in the World that agreeth better with our English Bodies.’¹⁰⁵ He testifies that ‘many that haue beene weake and sickly in old *England*, by comming hither have beene

¹⁰¹ Earle, ‘Climate, travel and colonialism in the early modern world’, p. 23

¹⁰² *Ibid.*, pp. 23, 32.

¹⁰³ Karen Kupperman, ‘Fear of Hot Climates in the Anglo-American Colonial Experience’, p. 213. See also, Sam White, ‘Unpuzzling American Climate: New World Experience and the Foundations of a New Science’, *Isis*, 106(2015), pp. 544-566; and Sam White, *A Cold Welcome: The Little Ice Age and Europe’s Encounter with North America* (London, 2017), esp. ch.1.

¹⁰⁴ Joyce Chaplin, *Subject Matter: Technology, the Body, and Science on the Anglo-American Frontier, 1500 – 1676* (London, 2001), p. 152.

¹⁰⁵ Francis Higginson, *New-Englands plantation, with the sea journal and other writings* (London, 1629), Cr-Cv.

thoroughly healed and growne healthfull and strong.’¹⁰⁶ Case in point was Higginson himself, who swears to have been resuscitated by the New England air. ‘None can more truly speake hereof by their owne experience then my selfe’, Higginson proclaimed, with friends noting ‘how verie sickly I haue been’ before his weak stomach was invigorated by ‘an extraordinarie cleere and dry Aire that is of a most healing nature to all such as are of a Cold, Melancholy, Flegmatick, Reumaticke temper of body.’¹⁰⁷ ‘No Countrey yeelds a more propitious ayre for our tempor, then *New-England*,’ proclaimed John White, and that ‘manie of our people that have found themselves alway weake and sickly at home, have become strong, and healthy there.’¹⁰⁸ More often, the miraculous effects of the New English climate were attributed to ‘the drynesse of the ayre and constant temper of it’, which naturally benefited the cold, phlegmatic temperament of the English.

Like many of his fellow countrymen, Higginson endured a similar complexion: a phlegmatic and cold disposition reared by a damp and frigid English climate. William Wood echoes these benefits, confirming how the many ‘that have come infirme out of *England* ... have beene restored by that medicineable Climate to their former strength and health.’¹⁰⁹ Though the medical benefits of Atlantic travel were contentious, Higginson encourages ‘all cold complections to come to take Physicke in *New-England*: for a sup of *New-Englands* Aire is better then a whole draught of old *Englands* Ale.’¹¹⁰ However conceited, Wood, White and Higginson’s separate advertisements for New England follow a remarkably similar rationale for colonialism.

The original purposes of their separate texts were brazenly propagandistic: a

¹⁰⁶ Higginson, *New-Englands plantation*., C-C1.

¹⁰⁷ Ibid.

¹⁰⁸ John White, *The planters plea, Or The grounds of plantations examined, and usuall objections answered Together with a manifestation of the causes mooving such as have lately undertaken a plantation in New-England* (London, 1630), pp. 24-25.

¹⁰⁹ William Wood, *New England’s Prospect* (London, 1634), p. 9.

¹¹⁰ Higginson, *New-England’s plantation*, C-C1.

concerted attempt to encourage Englanders to set sail on a treacherous mission toward a turbulent and challenging environment. Consequently, given the varied and politically motivated interpretations of weather, these pamphlets offer very little from a climate modelling perspective. They do, however, provide a compelling insight into how new climates came to disrupt and/or affirm colonial narratives by openly discussing the fallibility of the English body against the native constitution. From a methodological standpoint, these documents serve to clarify the extent to which early climatic theory was manipulated to serve political and even colonial means. However manipulative or inaccurate, they assuaged many culturally entrenched climatic anxieties. The supposed benefits of the American air not only illuminate a climatic argument for the colonial process but the palpable fear that the English climate had a degenerative effect on the body.

While many pamphlets lay on radically different interpretations of the American climate, each shared a common belief that English settlement was destined by God. Only the promise of a Second Canaan, Arcadia, or New Eden would suffice to attract pilgrims to risk life and limb to travel across the turbulent Atlantic Ocean. There is even evidence to suggest that Columbus' fateful voyage was also based on the stubborn conviction that a New Indian Eden lay westwards, in spite of the understandable apprehensions of his peers.¹¹¹ While this risk was undoubted, prevailing religious belief drew the New World as possessing a revivifying climate which beckoned the settlement of a New English nation. On the basis of New England's 'temperate' climate, which apparently suited itself to English bodies, expansion could be justified as providential gift. Such was Edward Winslow's interpretation of the New England climate::

¹¹¹ Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (Oxford, 1964), esp. ch. 1.

I cannot but thinke that God hath a purpose to give that Land as an inheritance to our Nation, and great pittie it were that it should long lie in so desolate a state, considering it agreeth so well with the constitution of our bodies, being both fertile, and so temperate for heate and cold, as in that respect one can scarce distinguish *New-England* from *Old*.¹¹²

Beyond medical theory, which maintained that bodies born into a certain climate were automatically suited to said air, Englishmen felt a spiritual commitment to their native landscape, a covenant which was expedited by the Reformation. As Alexandra Walsham's survey of the English landscape clarifies, post-Reformation Englishmen and women retained a lasting and spiritually gratifying relationship with their environs in spite of the supposed 'disenchantment of the world'.¹¹³ For the inhabitants of early modern English communities, the natural world was a powerful demonstration of God's omnipotence. Nature was God's 'textbook' for humanity; 'a laboratory in which He taught, demonstrated, and tested His providence.'¹¹⁴ In his commentary on Genesis, first published in English in 1578, John Calvin clarifies the providential role played by weather: 'The intemperature of the aire, yce, thunder, unseasonable raines, drouthe, hailes, and whatsoever is extraordinarie in the world, are the fruites of sinne.'¹¹⁵ From the perspective of many early colonists, any signal of foul or inclement weather was likewise interpreted through an unambiguously providential lens.

Since Plato's *Atlantis*, the notion of an overseas island utopia occupied a fertile position in European literary consciousness. Throughout the Renaissance, the idyll of The Island was seen as classically desirable and naturally appealed to English thinkers, themselves

¹¹² Edward Winslow, *Good Newes from New England* (London, 1624), p. 52.

¹¹³ Alexandra Walsham, *The Reformation of the Landscape: Religion, Identity and Memory in Early Modern England* (Oxford, 2012).

¹¹⁴ Walsham, *Providence in Early Modern England* (Oxford, 1999), p. 2.

¹¹⁵ John Calvin, *A Commentarie of John Calvine, upon the first booke of Moses called Genesis*, trans. Thomas Tymme (London, 1578), p. 114. Calvin emphasises in the marginalia that 'Wether untemperate and such like are the fruites of sin'.

islanders. Whether this awareness extended beyond the upper echelons of English society in the early stages of colonialism remains a separate, contentious issue. Nonetheless, the New World – envisaged as an island in popular literary accounts – constituted a vital discursive arena in which the effects of climatic change and variance were addressed. As recognised by Richard Grove, some of the most insightful contemporary responses to these questions are found in the work of Shakespeare, notably *The Tempest* (1610-11). Unlike its antecedents, including Thomas More’s *Utopia* (1516), Shakespeare imagines a colonial environment beset by contradiction: at once paradisiacal and surreal; treacherous and refreshing. Rather than altogether admonish the utopian ideal, Shakespeare uses his alien landscape to explore contemporary anxieties around embodiment, ‘seasoning’ and exposure to heat. When Trinculo considers the threat of a distant storm, he fears a lack of shelter and provision:

Here's neither bush nor shrub to bear of any weather at all, and another storm brewing;
I hear it sing i' the wind: yond same black cloud, yond huge one, looks like a foul
bombard that would shed his liquor. If it should thunder as it did before, I know not
where to hide my head: yond same cloud cannot choose but fall by paitfuls.¹¹⁶

Unlike the recurrent mythmaking of some early travel accounts, Shakespeare reflects on the subjectivities that characterised early colonial pursuits. Earlier, Gonzalo finds the island contains ‘everything advantageous to life’, Antonio and Gonzalo criticise their new habitation as barren, while Adrian strikes a more conciliatory tone. Satirising the expectations and realities of colonial living, the four disagree on the conditions of the climate.

Adrian: The air breathes upon us here most sweetly.
Sebastian: As if it had lungs and rotten ones.
Antonio: Or as 'twere perfumed by a fen.

¹¹⁶ William Shakespeare, *Tempest* (2, 2).

Gonzalo: Here is everything advantageous to life.

Antonio: True; save means to live.

Their exchange indicates the difficulty experienced by colonists to simply define the boundaries of a salubrious climate. Without the rigour of later measurement, early consensus was difficult to achieve. Shakespeare appears to grapple with the epistemological challenge of the foreign airs via Prospero: a character who over the course of the play complicates the boundaries between magician and natural philosopher.¹¹⁷ For Grove, Prospero's role expressed the significance of 'rigorous empiricism' when faced by a natural environment so unfamiliar that any cultural precedent is made redundant.¹¹⁸ Travel writers did not abandon all Utopian thought when the challenges of adverse weather were made clear, but as Grove describes, the type of environmental paradises developed by writers became 'of a very practical kind, reflecting the favourable perceptions of many tropical islands as sites of nurturing relief from arduous and disease-ridden sea journeys.'¹¹⁹ In their search for the golden mean, it was necessary to adjust expectations. In reality, the American climate represented a profound physical, mental, and intellectual challenge for early colonial exploits.

'As temperate and as fruitfull as any other paralell in the world': Propaganda, Prospects and Labour in Early America

The vocabulary applied to distinguish these imagined Arcadias was derived from the modern art of navigation and geography. The world as envisaged by early colonial prospectors was one composed of intersecting coordinates; 'a sphere caught in a network of latitudes and

¹¹⁷ Barbara Mowat, 'Prospero and the renaissance scientist', *New Directions for Teaching and Learning* (1981), pp. 77 – 84.

¹¹⁸ Grove, *Green Imperialism*, p. 34.

¹¹⁹ *Ibid.*, p. 39.

longitudes, its theoretical surface as uniform as that of a billiard ball’, to quote Alfred Crosby.¹²⁰ Whenever the situation of America is mentioned by early colonial promoters, including those by John Smith, John White, William Wood, and Edward Winslow, climate is exclusively regarded in latitudinal terms. Lacking universal measurements to communicate the sensation of the American climate, writers were forced to rely on an outdated interpretation of zonal theory to attempt to describe the (un)healthfulness of American air.

Richard Eburne, in *A plaine pathway to plantations* (1624), described the Newfoundland climate ‘very agreeable to the Constitution of our *English bodies*’ on the basis that it ‘lieth aboute foure degrees neerer the South then *England*.’¹²¹ In spite of his generous praise of this notoriously frigid climate, Eburne had never visited Newfoundland. In his *Advertisements for the unexperienced planters of New-England* (1614), John Smith boasted that ‘this Country wee now speake of, lyeth betwixt 41. and 44½ the very meane for heat and cold betwixt the Equinoctiall and North Pole.’¹²² Two years later, Smith claimed this meridian ‘as temperate and as fruitfull as any other paralell in the world’, comparable to ‘the most temperate part of *Portugale*, the ancient kingdomes of *Galazia*, *Biskey*, *Nauarre*, *Arragon*, *Catalonia*, *Castilia* the olde, and the most moderatest of *Castilia* the new, and *Valentia*, which is the greatest part of *Spain*.’¹²³ Further to the east, Smith likened the New England climate to that of ‘the temperatest parts of *Natolia*, *Armenia*, *Persia*, and *China*, besides diuers other large Countries and Kingdomes in these most milde and temperate Regions of *Asia*.’¹²⁴

Early colonial investors and travellers had good reason to be optimistic. Based on

¹²⁰ Alfred W. Crosby, *The Measure of Reality: Quantification and Western Society, 1250-1600* (Cambridge, 1997), p. 98.

¹²¹ Richard Eburne, *A plaine pathway to plantations that is, a discourse in generall, concerning the plantation of our English people in other countries* (London, 1624), p. 105

¹²² John Smith, *Advertisements for the Unexperienced Planters of New England, Or Anywhere: Or, The Pathway to Erect a Plantation* (London, 1614), p. 13.

¹²³ John Smith, *A description of New England, or, Observations and discoveries in the north of America in the year of Our Lord 1614* (London, 1616), pp. 14-15.

¹²⁴ *Ibid.*

Aristotelian projections, the New England climate – lying approximately five degrees south of London – should have fallen within the temperate zone. However, when settlers were confronted with evidence to the contrary, that New England was measurably colder in winter than Old and hotter in the summer, settlers were made to face the chance that this new western Arcadia was irreparably tarnished.¹²⁵ Unsurprisingly, the application of this defunct Aristotelian template materialised in confusion for many writers. In *Good Newes from New England*, Winslow repeats that though he cannot ‘distinguish *New-England* from *Old England*, in respect of heate, and cold, frost, snow, raine, winds’ he admits that given his plantation’s latitude of 42° ‘it must needs be much hotter.’¹²⁶ Winslow struggled to account for this presumed miscalculation: ‘I confesse, I cannot giue the reason of the contrary; onely experience teacheth us, that if it [heat] doe exceed *England*, it is so as must require better judgements to discern it.’¹²⁷ Where the old philosophy of Plato and Aristotle had failed, the ‘better judgements’ of Baconian method invited further exploration and the examination of new climates, particularly southward. But even as far south as Guiana, colonists were baffled by the inconsistency of climate theory. Sitting on the brow of the equator, Guiana – ‘in respect of the nearness of the Sunne, which causeth excessive drowth and heate’ – should have occupied ‘the uninhabitable and burning Zone’ according to the teachings of ancient philosophers.¹²⁸ However, the daily experience of J. Day and his crew ‘doth assure us of their certaine mistaking in that point.’¹²⁹ ‘For though the situation be in part under the equinoctial,’ confirmed Robert Harcourt, ‘it is habitable.’¹³⁰

During the early stages of the colonial process, knowledge of the American

¹²⁵ Kupperman, ‘Climate and the Mastery of Wilderness in Seventeenth Century’, p. 9.

¹²⁶ Winslow, *Good Newes from New England*, p. 62.

¹²⁷ *Ibid.*, p. 62.

¹²⁸ Robert Harcourt, *A relation of a voyage to Guiana Describing the climat, scituation, fertilitie, prouisions and commodities of that country, containing seuen prouinces, and other signiories within that territory* (2nd edns., 1631), p. 24.

¹²⁹ *Ibid.*

¹³⁰ *Ibid.*

environment could be described as fragmentary at best.¹³¹ Throughout the sixteenth century, maps depicting New England solely comprised a coastal line that distinguished sea from land punctuated by a series of place-names. It was only by the time that some of the first seminal travel pamphlets were published – notably John Smith’s *Advertisements for the unexperienced planters of New-England* (1614) and *Description of New England* (1616) – that an image of New England emerged which included inland westward of the coast.¹³² However, even as a complete image of the New English topography developed, accounts failed to account for the marked seasonality which characterised their newly adopted climate. Given that many early descriptions of the American climate were by spring and summer visitors, it is unsurprising that their accounts picture New England within perpetual springtime. Consequently, early colonial perceptions of foreign airs were shrouded by a persistent confirmation bias which, as Cronon states, failed to recognise that ‘even when what they wrote was literally true, they often failed to note that it wasn’t *always* true.’¹³³

The failure of colonists to account for the periodicity of the American climate meant a winter shortfall consistently beset early communities, from Plymouth, Massachusetts Bay or Sagadahoc. The latter’s failure in 1609 did much to disparage impressions of northern New England.¹³⁴ After the Popham colony failed, writers including John Smith came to describe territories north of the Penobscot River as ‘a Countrey rather affright than delight one, and how to describe a more plaine spectacle of desolation, or more barren, I known not.’¹³⁵ Other early accounts were naturally more sceptical toward the presupposed bounty of American settlements, ‘If any man shall accuse these reports of partial falsehood, supposing them to be

¹³¹ William Cronon, *Changes in the Land: Indians, Colonists, and the Ecology of New England* (New York, 1983), p. 19.

¹³² *Ibid.*

¹³³ *Ibid.*, p. 35.

¹³⁴ Cronon, *Changes in the Land*, p. 26.

¹³⁵ Smith, *A description of New England*, p. 36.

but Utopian, and legendary fables, because he cannot conceive that plentie and famine, a temperate climate and distempered bodies, felicities and miseries, can be reconciled together, let him now reade with judgment but let him not judge before he hath read.’¹³⁶

Winslow and Harcourt et al. were neither the first nor last to express misgivings regarding early climate theory, with Thomas Tryon vociferously censuring ‘the Error of the Antients when they divided the Earthly Globe into five *Zones*.’¹³⁷ ‘Experience has confuted their guessing Philosophy’, Tryon sniped in his *Friendly Advice to the Gentleman Planters* (1684), explaining how the ‘Frigid’ and ‘Torrid’ zones were both ‘commodious enough to dwell in, if Discretion and Sobriety be used.’¹³⁸ By ‘discretion and sobriety’ Tryon alluded to the widely practiced techniques of ‘seasoning’: a term used from the 1550s onward to evoke the process of becoming physically acclimated to a foreign air.¹³⁹ Taking its etymology from dendrology, ‘seasoning’ originally denoted the process of drying and fortifying wood shipped overseas. Like felled lumber, English bodies abroad were subject to treatment processes described in an eight-point plan by Tryon. In his advice, Tryon warned against eating meat; ‘full and liberal eating’; ‘great drinking’; encouraged resting from ‘from *Eleaven* a Clock till *Two* in the Afternoon’ and cautioned ‘to avoid the frequent eating and drinking of all Foods or Liquors in which the *Sweet* Quality is too highly predominant.’¹⁴⁰ Tryon advice is specific to the ‘gentlemen-planters of the East and West Indies’, though much of his advice resonated with the experience of New England colonists made to adapt to significantly colder temperatures and turbulent seasonality.

If, on the other hand, a local climate was considered naturally harmful to English

¹³⁶ Anon., *A True Declaration of the estate of the Colonie in Virginia, With a confutation of such scandalous reports as have tended to the disgrace of so worthy an enterprise* (London, 1610), p. 34.

¹³⁷ Thomas Tryon, *Friendly advice to the gentlemen-planters of the East and West Indies In three parts* (London, 1684), pp. 48-49.

¹³⁸ Tryon, *Friendly advice to the gentlemen-planters of the East and West Indies In three parts*, pp. 48-49.

¹³⁹ Kupperman, ‘The Puzzle of the American Climate in the Early Colonial Period’, pp. 1262-1289.

¹⁴⁰ Tryon, *Friendly advice to the gentlemen-planters of the East and West Indies In three parts*, pp. 54-66.

bodies, colonial writers assured that these effects would dissipate with time. As more English settled, the land would change to suit their foreign complexion; for Richard Eburne, ‘it be the people that makes the land English, not the land the people.’¹⁴¹ Thomas Browne expresses the same sentiment in his bestselling *Religio Medici* (1643), during which the physician declared:

I was borne in the eighth Climate, but seeme for to bee framed, and constellated unto all; I am no plant that will not prosper out of a Garden. All places, all ayres make unto mee one Country; I am in England, everywhere, and under any meridian.¹⁴²

Many colonists objected to the claim that the English body was incompatible with the American climate by citing the abundance of fuel surrounding new settlements. Though it ‘may be objected that it [New England] is too cold a Countrey for our *English* men,’ William Wood, the author of *New England’s Prospect* (1634), reasoned that where ‘there is Wood good store, and better cheape to build warme houses, and make good fires’, the Winter is made ‘lesse tedious’.¹⁴³ ‘*Igne levatur hyems*’, or ‘Winter relieved by fire’ argued the colonist.¹⁴⁴ John White, in the *Planters Plea* (1630), offered a similar answer. Despite admitting that during winter ‘the Snow lyes indeed about a foot thicke for ten weekes or there about’, ‘the cold of Winter is tolerable ... and is remedied by the abundance of fuell.’¹⁴⁵

Exploiting the colonies’ natural resources, the English had engineered a suitable climate. Though the unprecedented rate of timber consumption in England had led to significant deforestation and a turn to coal by the early to the mid-seventeenth century, in New England Higginson boasted ‘here we have plenty of fire to warme us’.¹⁴⁶ Whereas John Smith reports of how the Dutch have little or no wood ‘none to build ships, houses’, instead

¹⁴¹ Eburne, *A Plain Pathway to Plantations*, xiv-xv.

¹⁴² Thomas Browne, *Religio Medici* (London, 1643), pp. 126-127.

¹⁴³ Wood, *New England’s Prospect*, p. 4.

¹⁴⁴ *Ibid.*

¹⁴⁵ White, *The Planters Plea*, pp. 28-29.

¹⁴⁶ Higginson, *New –Englands Plantation*, Cr-Cv.

relying on anything ‘they fetch from forren Countries’, the inhabitants of New England are blessed with enough wood ‘at their doores to make fires, and traine oyle with the splinters of the roots of firre trees for candles.’¹⁴⁷ The only reason that New England was comparatively colder was, as John Mason claimed, because it was more ‘slenderly peopled, voide of Townes and Cities, whereof Europe is full; the smoake whereof and heats of fires much qualifieth coldnesse of the Aire.’¹⁴⁸ Colonisation not only suited the English but the natives, at least according to an account given by Wood, who claimed that:

‘They [the Indians] say he is a good God that sends them so many good things, so much good corn, so many cattle, temperate rains, fair seasons, which they likewise are better for since the arrival of the English; the times and seasons being much altered in seven or eight years, freer from lightning and thunder, long droughts, sudden and tempestuous dashes of rain, and lamentable cold winters.’¹⁴⁹

As long as colonists and propagandists convinced themselves that their presence was ‘improving’ the climate, then conquest could be defended as moderation. Their presence on the continent had, Edward Johnson claimed, served as ‘moderating the winter’s cold of late very much, which some impure to the cutting down the woods and breaking up the land; but Christ have the praise of all his glorious acts.’¹⁵⁰

While there was the widespread belief that the English body could survive – even prosper – in warm conditions, no one proposed or expected that white colonists could ever acclimate to southern temperatures like African slaves.¹⁵¹ Initial colonial exploits were

¹⁴⁷ Smith, *Advertisements for the unexperienced planters of New-England*, p. 28.

¹⁴⁸ John Mason, *A briefe discourse of the Nevv-found-land with the situation, temperate, and commodities thereof, inciting our nation to goe forward in that hopefull plantation begunne.* (Edinburgh, 1620), p. 8.

¹⁴⁹ Wood, *New Englands Prospect*, p. 84.

¹⁵⁰ Edward Johnson, *Wonder-Working Providence of Sion’s Saviour* (1654), ed. William Frederick Poole (Andover, Mass., 1867), p. 55

¹⁵¹ Pukrein, ‘Climate, Health and Black Labor in the English Americas’, p. 181.

predicated on the assumption that natives of hotter climates ‘were physiologically more suited to work and live in heat than migrants from colder regions; conversely, people born in cold areas were biologically better fitted to inhabit cooler climates than travelers from warmer sections of the earth.’¹⁵² In an Indian context, Mark Harrison has described how climate ‘became a potent metaphor for the differences between ruler and ruled.’¹⁵³ Having cast themselves as hardy, industrious, and courageous Northern men capable of withstanding the turbulent Scandinavian climate, it was necessary for colonial rule to denigrate the inherited complexion of the Indian population as effeminate, supine and indolent. Prolonged exposure to heat, rather than some innate biological quality, explained the assumed lassitude of the Indians. The same was true for African slaves.

As described by Mart Stewart, the climatic rationale for slavery ‘became a key part of the defence of that peculiar institution and a fundamental of Southern nationalism.’¹⁵⁴ Not to stigmatize Southern states, it should be repeated that such principles were endemic to the so-called English Americas, the only difference being that northern colonies feared that their climate was incompatible with black labour. Seasoning worked both ways: just as the English feared humoral change in heat, African labourers were untested in cold climates and hence thought unsuited northern latitudes. To quote Edward D’ Oyley during his brief tenure as governor of Jamaica in 1662, blacks should endure ‘seasoning in the winter as the English in summer.’¹⁵⁵ Colonists in the north assumed that black health would naturally worsen under exposure to the cold, becoming potentially unprofitable in the winter seasons.¹⁵⁶

¹⁵² Pukrein, ‘Climate, Health and Black Labor in the English Americas’, p. 187.

¹⁵³ Mark Harrison, *Climates and Constitutions: Health, Race, Environment and British Imperialism 1600-1850* (Oxford, 1999), p. 1.

¹⁵⁴ Mart A. Stewart, ‘Let us begin with the weather?’: climate, race, and cultural distinctiveness in the American South’, Teich, Porter and Gustafsson (eds.) *Nature and Society in Historical Context* (Cambridge, 1997), pp. 240-257.

¹⁵⁵ Additional MSS. British Museum, 11,410, ff. 10-12. op. cit. Pukrein, ‘Climate, Health and Black Labor in the English Americas’, p. 188.

¹⁵⁶ Pukrein, ‘Climate, Health and Black Labor in the English Americas’, p. 190.

The idea of climate adaptation was fashioned to justify and bolster a theory of racial hierarchy and servitude which would later evolve into contemporary racism. A theory of climate that was once hostile to northern bodies was subverted to suit the colonial aims of the English in the New World. The medico-environmental basis of climate theory described in chapter one was weaponised to boast of a superior English constitution, co-opting and manipulating the work of Hippocrates, Galen and Aristotle. Through their discursive manipulation of classical climate theory, English geographers and physicians contributed to an idea of average weather revolved around the temperate, oceanic airs of the North Atlantic Archipelago. As England emerged as a colonial power, the zonal climate theory which informed initial journeys across the ocean was replaced by an anglocentric theory of climate. The speculative ideas of Aristotle made way for an ‘empirical’ theory of climate. This empiricism, associated with geographers like Carpenter and colonists like Smith, was nevertheless fraught with bias. To reiterate points made in early chapters, their idea of climate was defined by a subjective template of measurement. That is to say a ‘good’ foreign climate was that sustained English life. This reductive and anthropocentric idea of climate began a model of climatology which gave license to colonists, who sought to justify imperial domination on the basis of their conceited and contradictory idea of ‘nature’.

What inspired their pursuit for land was, of course, fiscal. The desire for wealth gave native Englanders the impetus to join voyages across the Atlantic. Yet one final element of this story is missing from the above: religious belief. It is all too simple to say that attitudes around climate were forged around self-aggrandisement and wealth. Religion and the doctrine of divine providence have been alluded to throughout this thesis and runs through each of the themes analysed. The final chapter will be dedicated to understanding the relationship between natural, human and divine agency in the context of the Reformation. While drawing

on classic treatments of divine providence in England, the chapter will offer a new understanding of how the idea of climate shaped and was shaped by the prevailing confessional tumult that characterised the late sixteenth and seventeenth centuries.

CHAPTER FIVE: WORSHIPPING CLIMATE

In the early modern period, the Church of England changed the climate. Whether a wind was ‘Protestant’ or ‘Popish’, rainfall was a blessing or curse, a heatwave was beneficent or oppressive depended entirely on the dominant reading of climate proposed by ecclesiastical authorities. During the various reformations that defined early modern Europe, ecclesiastical responses to climatic variability sought to galvanise religious and political consensus in a time of bitter sectarian conflict. Though divided by faith, the popular understanding of climatic changes and extremes were invariably providential. Whether a Dutch Calvinist, Spanish Catholic, French Huguenot or Anglican, the Hand of God was thought to guide all creation.

From the beneficence of a timely and temperate summer to the tempestuous storms and endless winters that characterised the LIA, His hand guided all creation. In this sense, climatic variability acted as a spiritual barometer for western Christendom, fluctuating between salvation and damnation. Sometimes these changes were fortuitous, guiding the sails of a naval victory, other times, disastrous. What differed between denominations was the moral interpretation of these capricious changes in weather. For every celebration of deliverance, confessional opponents would decry damnation. In the hands of English ecclesiastical and secular authorities, providence was forged into a weapon against confessional opponents and enemies of the new faith. It was a period in which climate therefore became newsworthy in a popular sense. Disseminated in Church ordinances for special worship and prayer, every major climatic episode formed a further prop in England’s path toward salvation. Responses to climatic fluctuations were therefore not only religious but political: suffused with a confessional bias toward the recently established Church of England and against the Catholic enemy.

Throughout this chapter, I will argue that the response of ecclesiastical and secular authorities to climatic adversity not only offered validation for various hardships during the period but bolstered the distinctive confessional identity of the English in the century following the Elizabethan Religious Settlement in 1559. Charting the many days of prayer, worship, atonement, and humiliation issued in the wake of climatic tumult, the chapter will analyse the development of confessional responses to national climatic events from the Henrician Reformation until the Glorious Revolution in 1688. Specific case studies include the 1580 Dover Strait Earthquake, the Defeat of the Spanish Armada in 1588, and the famous frost fairs of the mid-seventeenth century. By the 1580s climate emerged as an inspiration for Anglican propaganda, culminating in a series of Elizabethan weather prayers and memorabilia commemorating the defeat of the Spanish armada in 1588. The chapter will analyse the local reaction to specific ordinances and state prayers issued during times of inclemency as well as unofficial processions and fasts held on a local level. Though scholars have regarded the importance of fast days, days of atonement and national prayers as cultivating a cohesive political and confessional culture, few have considered the commemoration of bad weather and climatic change as a genre in and of itself. By examining weather prayers within the contemporary political culture of early modern England, we can see a political culture attune to changes in climate. If Nature was read as a textbook for humanity, climate constituted a palimpsest upon which successive Monarchs and clergymen revised, edited and erased certain confessional narratives. In the countless days of special worship, atonement and prayer, weather and climate were woven into the confessional fabric of early modern England as Protestants searched for vindication of their nation's divergent confessional path.

‘Whatever is disorderly in the world, are the fruits of sin’: Climate and Confession in Early Modern Europe

Following the Reformation, a wave of theology that underlined man’s liability for earth’s deterioration compounded the ecology of sin and salvation. As principle custodian of His design, Man was obliged to up-hold and respect the dominion he had over the natural environment. This covenant, broken during the Fall, gave way to ecological tumult and deterioration. ‘Cursed is the ground for thy sake’, God told Adam, ‘thorns and thistles shall grow for you’ (Genesis 3:17, 18). Rebelling against God, Man had irrevocably corrupted Nature. Just as Adam had triggered irreversible damage to the Garden, sixteenth-century reformers argued that humanity’s delinquency had led to an ongoing state of natural degeneration.

Many English reformers drew on Luther and Calvin, who were generally consistent in their understanding of *natura corrupta*. Writing on Genesis, Calvin maintained that ‘the inclemency of the air, frost, thunders, unseasonable rains, drought, hail, and whatever is disorderly in the world, are the fruits of sin. Nor is there any other primary cause of diseases.’¹ In his own commentary on Genesis, Luther strikes a similar tone: ‘And what of thorns, thistles, water, fire, caterpillar, flies, fleas, and bedbugs? Collectively and individually, are not all of them messengers who preach to us concerning sin and God’s wrath?’² Each bout of thunder, rainstorm, drought or deep freeze presented an unmissable occasion to sound the

¹ ‘The earth was cursed on account of Adam (Gen 3:18) ... the whole order of nature was subverted by the sin of man ... Moses does not enumerate all the disadvantages in which man, by sin, has involved himself; for it appears that all the evils of the present life, which experience proves to be innumerable, have proceeded from the same fountain. The inclemency of the air, frost, thunders, unseasonable rains, drought, hail, and whatever is disorderly in the world, are the fruits of sin. Nor is there any other primary cause of diseases ... For if the stain of sin had not polluted the world, no animal would have been addicted to prey on blood, but the fruits of the earth would have sufficed for all, according to the method which God had appointed (Gen 1:30).’ John Calvin, *Commentary on Genesis* trans. John King, 2 vols. (1554; Baker, 1996), vol. 1, pp. 62-63, 117.

² Jaroslav Pelikan (ed.), *Luther’s Works: Lectures on Genesis* (St Louis, 1958) vol. 1, p. 208.

proverbial alarm. Preaching to his parishioners in Sussex, in 1598 Huw Roberts remarked how: ‘everie calamitie ... everie flood of waters, ruin of buildings, unseasonable weather ... everie one of these and of the like adversities, as oft as they happen in the world, are sermons of repentance to all that see them, or hear thereof.’³

For English preachers and pamphleteers active in the mid to late sixteenth century, there was no shortage of ‘visible sermons’ to exploit.⁴ During the century between the Elizabethan settlement and the execution of Charles I, an unprecedented increase in natural disasters and climatic anomalies beset the British Isles. As well as the obvious implications of such climatic change for the bounty of the harvest, the height of the LIA also heralded a rise in certain types of natural disaster, such as a measurable increase in the number of storms and instances of flooding.⁵ England experienced its only ever ‘tsunami’ in 1607, killing approximately 2,000 people around the Bristol Channel Estuary.⁶ The Dover Straits earthquake in 1580 is today estimated as one of the most powerful earthquakes to hit England, measuring an approximate 5.7 on the Richter magnitude scale. Throughout the sixteenth- and seventeenth centuries, the Thames froze countless times and all the while England was subject to many urban conflagrations, thunderstorms, and droughts.⁷ If ‘the “early” sixteenth century was everywhere favored by the climate;’ wrote Fernand Braudel, then ‘the latter part everywhere suffered atmospheric disturbance.’⁸ These changes directly resulted from the

³ Huw Roberts, *The day of hearing: or, six lectyres vpon the latter part of the thirde chapter of the Epistle to the Hebrewes* . . . (Oxford, 1600), op. cit. Alexandra Walsham, *Providence in Early Modern England* (Oxford, 1999), p. 105.

⁴ Walsham, *Providence*, ch. 3.

⁵ Raingard Eber calculated a 400% increase in severe storms on the Flemish coast in the latter half of the sixteenth-century. ‘Fear of Water and Floods in the Low Countries’, in William Naphy and Penny Roberts (eds.) *Fear in Early Modern Society* (Manchester, 1997), pp. 64-77, p. 64. John Emrys Morgan, *Flooding in early modern England: cultures of coping in Gloucestershire and Lincolnshire* (2015) PhD thesis, University of Warwick.

⁶ Simon Haslett and Edward Bryant, ‘Was the AD 1607 Coastal Flooding Event in the Severn Estuary and Bristol Channel (UK) Due to a Tsunami?’, *Archaeology in the Severn Estuary* 13 (2002), pp. 163–167.

⁷ Hubert Lamb, *Climate, history and the modern world* (2nd edn., London, 1995), p. 221.

⁸ Fernand Braudel, *The Mediterranean and the Mediterranean World in the Age of Philipp II*, trans. Sian Reynolds, 2 vols. (London, 1972) vol. I, p. 275.

Grindewald Fluctuation: a major oscillation in the Northern European climate at the beginning of the LIA which coincided with the early Reformation. As substantiated by many historical climatologists, Western Europe had suffered a significant climatic downturn after the end of the Medieval Warm Period (MWP). After 1565, Christian Pfister describes a series of ‘cumulative cold sequences’ for the periods 1565-74, 1583-89 and 1623-28 and ‘years without summer’ in 1587 and 1628.⁹

For the inhabitants of English parishes, these events were of divine origin. Whatever natural mechanisms contributed to inclement weather, storms, floods, hurricanes, and earthquakes counted as auxiliaries (*causa remota*) of God’s original machinations. It was only after the Scientific Revolution that robust challenges to Aristotelianism challenged the Lord’s role as *causa prima*. Before then, natural philosophers personified God as ‘a busy controller and unpredictable meddler in human affairs.’¹⁰ Not that preachers understood these interventions as needless or cruel. Each action corresponded to the cumulative sins of a population. In his controversial 2013 tome *Global Crisis: War, Climate Change, and Catastrophe in the Seventeenth Century*, Geoffrey Parker designates this mentality as the ‘peccatogenic outlook’.

From the Latin *peccatum*, or ‘sin’, the peccatogenic outlook denotes a worldview that attributes natural disorder to human misconduct.¹¹ According to this outlook, afflicted communities interpreted extreme weather events as a signal of divine wrath and prompted a

⁹ Christian Pfister, ‘Climatic Extremes, Recurrent Crises and Witch Hunts: Strategies in Coping with Exogenous Shocks in Late Sixteenth Century and Early Seventeenth Centuries’, *The Medieval History Journal* 10 (2007), pp. 33-73; ‘Variations in the Spring-Summer Climate of Central Europe from the High Middle Ages to 1850’, *Earth Sciences* 16 (1988), pp. 57-82.

¹⁰ Walsham, ‘Deciphering Divine Wrath and Displaying Godly Sorrow: Providentialism and Emotion in Early Modern England’, Jennifer Spinks and Charles Zika (eds.) *Disaster, Death and the Emotions in the Shadow of the Apocalypse, 1400-1700* (London, 2016), pp. 21-43, p. 34.

¹¹ Geoffrey Parker, *Global Crisis: War, Climate Change and Catastrophe in the Seventeenth Century* (London, 2013), pp. 8-9.

‘search for scapegoats’.¹² Memorably, Wolfgang Behringer examined how alleged witches faced increased persecution with worsening weather.¹³ Behringer cites a direct correlation between the peaks of the witch craze in Germany and the concurrent Grindewald fluctuation. During the oscillation, ‘weather magic’ (*Wetermacherei*) accusations and subsequent witch trials rose exponentially. Most victims were women based in marginal areas of crop cultivation where rural communities would have felt the acute burden of a bad harvest. After a series of failing harvests and arctic temperatures in southern Germany during May 1626, Behringer explains how some 900 men and women accused of manipulating weather were arrested, tortured and killed.¹⁴ Despite being a primarily German phenomenon, accusations of weather magic emerged throughout Europe. Of the few examples in England, there is the tale of an old woman aboard a ship bound for Maryland who was accused and ultimately executed for bewitching their ship with stormy weather.¹⁵

In an English context, while the accusation of weather magic was less prevalent, the same scapegoating reoccurred in times of climatic hardship. On a local level, the principle blame for inclement weather was at the expense of specific sinners: Sabbath breakers, blasphemers, drunkards, and adulterers. Sometimes, these grievances were economic. The ‘thunder, haile and lightning from heaven’, which destroyed the corn-yields of Humberstone, Lincolnshire in 1616, were ‘thought to be a punishment from God, on the behalf of the poore.’¹⁶ National events, like the Bristol Channel Floods and the Dover Straits Earthquake, were particularly subject to blustering rebuke by zealous preachers. Calamity signalled that the precarious covenant between God and Man had been further breached and they took it as

¹² Parker, *Global Crisis*, pp. 8-9.

¹³ Wolfgang Behringer, ‘Weather, Hunger and Fear: Origins of European Witch-Hunts in Climate, Society and Mentality’ *German History* 13 (1995), pp. 1-27.

¹⁴ Parker, *Global Crisis*, p.9.

¹⁵ Clayton Colman Hall (ed.), *Narratives of Early Maryland, 1633–1684* (New York, 1946), p. 141.

¹⁶ Anon. *Thunder haile & lightning from heaven. Sent against certain covetous persons, inhabitants of Humerstone, Lincolnshire, 5. mikles from Grimsby...* (London, 1616), i.

their God-given mission to restore the *Corpus Christianum*. The Flood, Revelations, and the destruction of Sodom and Gommorah were especially popular comparisons used to stir millenarian anxieties. For example, during the Bristol Channel ‘tsunami’ of 1607, when a ‘wonderful overflowing of waters’ destroyed thirty towns and killed 2,000 in the West Country, one pamphleteer speculated the Lord had attempted to ‘drown all mankind as he did at first.’¹⁷ Following the 1580 earthquake, Arthur Golding also refers to the Old Testament for inspiration. ‘Before the destruction of Jerusalem’ he warns, ‘there went innumerable signs, tokens and wonders’; thus, just as He had ‘chastised the Children of Israel’ for their ‘dyeer wais’, the earthquake which shook south-east England was a harbinger of further destruction.¹⁸

Behringer and Parker both consider moments of persecution and fear mongering as reactionary impulses based on material deprivation and economic collapse. According to Parker, the effect of climate instability on civilisation is plain: extreme fluctuations in climate result in lessened or ruined harvests, lessened harvests lead to inflated grain prices, inflated grain prices materialise in hunger, rioting, and general unrest. This ‘fatal synergy’ between human and natural factors, Parker concludes, culminated in the several revolutions, rebellions, and wars which characterised the so-called ‘General Crisis’ of the seventeenth century. On this basis, many historians have since criticised Parker’s thesis both for reducing economic performance to ‘a mere epiphenomenon of weather’ and for perpetuating ‘old fashioned Malthusianism.’¹⁹ Parker’s treatment of the ‘peccatogenic outlook’ also fails to acknowledge

¹⁷ Anon., *1607. A true report of certaine wonderfull ouerflowings of waters, now lately in Summerset-shire, Norfolke, and other places of England destroying many thousands of men, women, and children, ouerthrowing and bearing downe whole townes and villages, and drowning infinite numbers of sheepe and other cattle* (London, 1607), vi.

¹⁸ Arthur Golding, *A discourse vpon the earthquake that hapned throughe this realme of Englande, and other places of Christendom, the first of Aprill. 1580. betwene the houres of fiue and six in the euening.* (London, 1580), v.

¹⁹ Jan de Vries, ‘The Crisis of the Seventeenth Century: The Little Ice Age and the Mystery of the “Great Divergence”’, *Journal of Interdisciplinary History* 44 (2014), pp. 369-377, as discussed by William Cavert,

that extreme climatic conditions were not simply taken as signs of divine displeasure. Contrary to Parker's argument, climatic change, and related natural disasters, were subject to a matrix of emotional responses, not only fear and hunger.²⁰ As contended by E.P Thompson, the food riot is as much an expression of injustice and a protest against bad governance as it was appetite.²¹ The rioters described by Parker were active in their attempts to reset political and economic forces, not mindless victims of their 'catastrophic' environs. Early modern riots were, to quote Keith Wrightson, 'not the desperate and bloody furies ... of a demoralised mob.' 'Whatever their menacing postures, rioters were concerned with the rectification of specific grievances, and infused with a sense of justice.'²² Parker cites Francis Bacon's quip that 'rebellions of the belly are the worst', though this is more likely an elite projection of peasant behaviour. A broad set of emotional responses to climate that derived from medical thought and reformed Christian belief drove English reaction. Beyond fear, climatic change could incense humility, reflection, and charity.

Extreme weather events were subject to a diverse emotional vocabulary often excluded from environmental historiography. Though often violent and spectacular, few climatic events of the period claimed many lives. The Bristol Channel Flood of 1607 being a notable exception, most documented climatic extremes and related disasters resulted in few fatalities. In such cases, preachers taught these violent episodes in nature to be the 'gentle corrections and paternal chastisements' on behalf of a loving and beneficent God.²³ Most

'Winter and Discontent in England' in John Morgan and Sara Miglietti (ed.), *Governing the Environment in the Early Modern World: Theory and Practice* (London, 2017), pp. 114-134, p. 116. Paul Warde, 'Global Crisis or Global Coincidence?', *Past and Present*, 228 (2015), pp. 287-301, p. 291.

²⁰ Spinks and Zika, 'Introduction: Rethinking Disaster and Emotions, 1400-1700' in Spinks and Zika (ed.) *Disaster, Death and the Emotions in the Shadow of the Apocalypse*, pp. 1-19, *passim*.

²¹ E.P. Thompson, 'The Moral Economy of the English Crowd in the Eighteenth Century', *Past and Present* 50 (1971), pp. 76-136.

²² Keith Wrightson, *English Society 1580-1680* (London, 1982), p. 175, 178.

²³ Walsham, 'The Happiness of Suffering: Adversity, Providence, and Agency in Early Modern England' in Michael J. Braddick and Joanna Innes (ed.) *Suffering and Happiness in England 1550-1850: Narratives and Representations* (Oxford, 2017), pp. 45-65, p. 52.

times, they reprimanded their parishioners in cases of bad weather, though equally these were opportunities to incense devotion, encourage charity and bolster confessional identity. In the context of East Anglian storm surges Dolly McKinnon has described how the emotional response to climatic adversity followed a distinct taxonomy.²⁴ If dyke building represented the manipulation of God's creation, a break in the dyke caused by a surge was a sure sign of God's Promethean vengeance. Alternately, if a storm had left a community intact from the worst effects of a surge, the community expressed gratitude toward their merciful creator.²⁵ The same applied to the multiple warring factions of Western Christendom in the early modern period. When the Dutch praised God for sparing the Low Countries from devastation, their Catholic counterparts knew that their Lord had punished a heretical, iconoclastic and ungodly people.²⁶ As noted by Grégory Quenet in his survey of seventeenth century seismology, c.1600-1680 only a quarter of cases were earthquakes 'presented explicitly as signs of divine wrath.'²⁷ Other times, earthquakes – or analogous events – were interpreted as opportunities for spiritual renewal and collective gratitude.

Throughout the violent confessional disputes that defined sixteenth-and seventeenth century Europe, Church authorities designed responses to climatic change and specific weather events to bolster confessional identity and provide a network of meaning that explained the circumstances of the LIA. With reference to Heinz Schilling and Wolfgang Reinhard's confessionalization thesis, Elaine Fulton has described how the reception of

²⁴ Dolly McKinnon, "'Jangled the Belles, and with Fearefull Outcry, Raysed the Secure Inhabitants": Emotion, Memory and Storm Surges in the Early Modern East Anglian Landscape' in Jennifer Spinks and Charles Zika (ed.) *Disaster, Death and the Emotions in the Shadow of the Apocalypse* (London, 2016), pp. 155-175.

²⁵ Marie Luisa Allemeyer, 'The Struggle Against the Sea: An Early Modern Coastal Society Between Metaphysical and Physical Attempts to Control Nature', Andrea Janku, Gerrit J. Schenk, and Franz Mauelshagen (eds.) *Historical Disasters in Context: Science, Religion, and Politics* (London, 2012), pp. 75-93, p. 76.

²⁶ Raingard Eber, 'Fear of Water and Floods in the Low Countries', Penny Roberts and William G. Naphy (eds.), *Fear in Early Modern Society* (Manchester, 1997), pp. 62-77, pp. 66-70.

²⁷ Gregory Quenet, 'Earthquakes in early modern France: From the Old Regime to the Birth of a New Risk' in Andrea Janku, Gerrit J. Schenk and Franz Mauelshagen (ed.) *Historical Disasters in Context: Science, Religion, and Politics* (London, 2012), pp. 94-114, p. 101.

natural disaster in the early modern period can be understood as a mechanism of confessional power.²⁸ In the event of a natural disaster, local secular and ecclesiastical authorities took the chance to ‘proclaim the rectitude of their path to salvation, to reinforce the cohesion of their community of belief, and to enhance the authority of their local state in whatever form that power existed.’²⁹ Though the confessionalization thesis has met robust historiographical scrutiny since its inception, Fulton contends that the framework introduced by Schilling and Reinhard in the 1980s offers a compelling perspective on the intersection between early modern politics, religion, and environment.³⁰ To summarise, the thesis describes four ‘confession building’ steps consistent across much of Western Europe. First, the Church issues a confession of faith (i.e. the Thirty-Nine Articles). Second, this confession is enforced using extensive methods of re-education, propaganda, indoctrination, censorship, and visitations. Third, confessional homogeneity is enforced by way of persecution of religious minorities: mixed marriages are banned and, in some cases, minorities are exiled. Finally, confessionalization involves the general extension of bureaucratic strategies and the expansion of the state into daily life. Through the cooperation of secular and ecclesiastical authorities, confession building blurred the distinction between Church and State to the point that politics became religion and vice versa.

In the event of extreme weather and associated local disruption, authorities therefore seized their moment to provide a confessional explanation: to celebrate deliverance or castigate social pariahs. In many cases, it was ‘the former response which prevailed in times of national crises. As the following will detail, many national moments of climatic adversity

²⁸ Elaine Fulton, ‘Acts of God: The Confessionalization of Disaster in Reformation Europe’ in Andrea Janku, Gerrit J. Schenk and Franz Mauelshagen (ed.) *Historical Disasters in Context: Science, Religion, and Politics* (London, 2012), pp. 54-75.

²⁹ Fulton, ‘Acts of God’, p. 54.

³⁰ Marc Forster, ‘With and Without Confessionalization: Varieties of Early Modern German Catholicism’, *Early Modern History* 1(1997), pp. 315-343, pp. 315-316; Harm Kluetling ‘Problems of the Term and Concept “Second Reformation”: Memories of a 1980s Debate’ in John M. Headley, Hans J. Hillerbrand and Anthony J. Papalas (eds.) *Confessionalization in Europe, 1555-1700* (Aldershot, 2004), pp. 37-50, p. 47.

were met with confessional tub-thumping. First, however, it was necessary for Church authorities to extinguish the Popish association between traditional processions associated with climatic wellbeing and replace them with a reformed, Protestant version of medieval ceremonies. These days of thanksgiving, atonement and fast were deliberately designed after a Calvinist model and retained the hallmarks of reformed theology. The concept of a Day of Atonement was lifted directly from Calvin's Geneva (as inspired by the Old Testament), involving almsgiving, psalm-singing, prayer and sermon attendance. Emergently, ecclesiastical authorities imbued worship with a specific confessional narrative. By the mid-seventeenth century, these days of special worship reached the apex of their utility and were frequently applied during times of bad weather. The interim, however, was also marred by suspicions around clandestine Popery and weather magic.

'By the virtue and operation of God's words ... the wicked spirits kept in the air may be laid down': Ritual and the Early English Reformation

From the sixteenth century onward, the Church of England regularly promoted days of fast, thanksgiving and prayer were in response to major climatic events. Whether hailing a generous harvest during seasonable weather or atoning for intemperate conditions, moments of climatic significance led ecclesiastical and civil authorities to order dedicated days of worship during which subjects were required to abandon work and reflect on the providential circumstances of their weathers. Though the tradition of special worship days traces to the medieval period, with the Henrician Reformation the practice became established as a reoccurring feature of the liturgical calendar. More importantly, days of worship were progressively shorn of their Popish connotations and imbued with an explicit bias toward the

newly established Church of England.

With Henry's split with Rome, many devotional practices outside the Church space were derided as superstitious and eventually abandoned. However, one procession endured: the annual Rogation week. Of the many medieval ceremonies culled during the foundation of the English Church, the practice of public Rogationtide was considered to help influence good weather and fertility. Trees were blessed on the Twelfth day after Christmas, the gospel was read at certain springs to make water purer and corn was blessed by young men and maids after receiving the Eucharist on Palm Sunday.³¹ Through the medieval period, Rogation ceremonies had largely fulfilled a collective desire for self-rebuke during times of drought, inclemency or disaster. They were also social occasions which, to the consternation of reformed clergy, often involved bacchanalian merrymaking. For these reasons, the procession endured in an altered state. One of the first official days of worship designated by the Church of England was a rogation procession in response to wet weather and threats to the harvest. Henry VIII had instructed Archbishop Cramner to organise private and public prayers in the parish of Canterbury on 23 August 1543.³² The mandate was a rather utilitarian document, in contrast to the zealous sectarian prayers produced later by Bishop John Aylmer. In order to 'beseche him to send unto us seasonable and temperate wedar,' the ordinance calls upon the Archbishop to order local clergymen to 'cause such general Rogacions and processions to be made.'³³ Already in the early years of the English Church, clergy became weary of the popish implications of rogation and carousing on 'gang-days'. A year before the procession called by Henry, in a 'Sermon on the Cross Days or Rogation Days' Richard Taverner bemoaned a lack

³¹ Keith Thomas, *Religion and the Decline of Magic: Studies in Popular Beliefs in Sixteenth- and Seventeenth Century England* (Aylsbury, 1978), p. 71.

³² Royal mandate to Cramner, 23 Aug. 1543, LPL Cranmer Register, I, fol. 22., op. cit. Natalie Mears, Alasdair Raffae, Stephen Taylor and Phillip Williamson (with Lucy Bates) (eds.) *National Prayers: Special Worship since the Reformation. Volume 1: Special Prayers, Fasts and Thanksgivings in the British Isles, 1533-1688* 2 vols. (Woodbridge, 2013) vol. 1, p. 11.

³³ op. cit. Mears, et al. (eds.) *National Prayers*, vol. 1, p. 11.

of piety associated with annual Rogation. At the same time, Taverner acknowledges the utility of Rogation. By reading the gospel ‘in the wide field amongst the corn and grass’, he described how ‘the power of wicked spirits which keep in the air may be laid down, and the air made pure and clean, to the intent the corn may remain unharmed and not infected of the said hurtful spirits, but serve us for our use and bodily sustenance.’³⁴

For many ‘hotter’ sort of Protestant, the pagan connotations of the practice were plain to see. Under the Kingship of Edward, in 1548 a series of Royal Injunctions thereby prohibited religious processions often held during periods of national adversity. What followed was a substantial rebranding of Rogation. The ceremony was exempted from the royal injunctions of 1559 though ‘processions’ were forbidden.³⁵ Banners, crosses, and bells were banned from processions around parish perimeters in a bid to expunge the occasion of remaining pagan signifiers. The ceremony, stressed the Bishop Edmund Grindel, was ‘not a procession but a perambulation.’³⁶ Semantics aside, the ‘perambulation’ was intended to make sure parish boundaries had not been encroached upon over the year, as well as to offer prayers for good harvest and beneficent weather. Bishops were subject to questioning by authorities over the character of their perambulations though Rogation continued fairly unchanged. Concurrently, the Church increasingly depended on days of special worship to supplement concerns over bad weather.

Collective prayer, it was issued, represented an effective and less ostentatious alternative to these so-called superstitions. A host of biblical precedents supported the introduction of weather prayers, specifically Helias’s prayer for rain after several years of

³⁴ Richard Taverner, *Postils on the Epistles and Gospels*, ed. E. Cardwell (Oxford, 1841), p. 280.

³⁵ Walsham, *The Reformation of the Landscape: Religion, Identity and Memory in Early Modern England* (Oxford, 2012), p. 257.

³⁶ Edmund Grindel, *The Remains of Edmund Grindal* ed. W. Nicholson (Cambridge, 1843), pp. 240-241.

drought.³⁷ These days were to be administered by the Church of England, with unauthorised days of atonement, prayer and fasting raising suspicions of clandestine popery and political subversion. Between 1535 and 1643, ninety-four days of prayer, fast, and thanksgiving were ordered in England and Wales. Special worship saw a particular upsurge during the reign of Elizabeth I, when thirty-two days of worship were administered.³⁸ Although the Elizabethan Church issued many state approved days of humiliation and public thanksgiving, the practice owed much to the radical, or puritan, extension of the Church.³⁹ Days of nationwide worship continued throughout the late-sixteenth and seventeenth centuries in spite of the fact that the second and third Books of Common Prayer (1552, 1559) had integrated occasional prayers during times of war, pestilence and bad weather.⁴⁰

'Powre out thyne indignatioun upon the heathen': Weather Prayers in Elizabethan England

Though Rogation and other early rituals had fallen out of favour with Puritan elites and reformed clergy by the end of the century, concern over 'bad weather' and environmental change continued to permeate special worship between 1540 and 1686. During the 1580s, the subject of bad weather, dearth and related climatic phenomena established itself as a separate genre of state prayer under the tenure of Bishop of London, John Aylmer. Under Aylmer's tutelage, the Church of England issued a series of services, prayers and thanksgiving that harnessed a powerful confessional vocabulary. Whether referencing a multitude of aborted Catholic plots to assassinate the Queen, the several planned Armadas during the end of the

³⁷ See Thomas Beacon, *A new pathway vnto praiierful of much godly frute and christen knowledge, lately made by Theodore Basille* (London, 1542).

³⁸ Natalie Mears, 'Public Worship and Political Participation in Elizabethan England' *Journal of British Studies*, 51 (2012), pp. 4–25, p. 7.

³⁹ Christopher Durston, "'For the Better Humiliation of the People": Public Days of Fasting and Thanksgiving during the English Revolution', *The Seventeenth Century*, 7(1992), pp.129-149.

⁴⁰ Mears, 'Public Worship and Political Participation', p.7

century, or the support of French Huguenots during the Wars of Religion, each prayer clearly buttressed confessional divides. The same applied to treatments of climatic events: heavy rain, drought and dearth, the ‘Protestant Wind’ which defeated Phillip’s Armada as well as the 1580 Dover Straits Earthquake.

For the purpose of this chapter, the 1580 Earthquake will be referenced as an example of a climatological phenomenon. The reason for this is threefold: firstly, based on contemporary knowledge of seismology which speculated that earthquakes were the product of subterranean winds. To quote the official state ordinance released in the aftermath of the 1580 Earthquake:

naturally Earthquakes are sayde to be engendered by winde gotten into the bowels of the earth, or by vapors bred and closed within the hollowe caves of the earth, where by their striving and struggling of themselves to get oute, or being haled outward by the heate and operation of the Sun, they shake the earthe for want of sufficient vent to issue out at.⁴¹

Secondly, evidence suggests that the Little Ice Age and the effects of global cooling brought about a measurable increase in earthquakes in Europe and Asia.⁴² Finally, considering the relatively low scale of loss associated with the 1580 Dover Straights Earthquake, the event can be barely constituted as a ‘natural disaster’. Rather, the event was more consistent with heavy thunderstorms, hurricanes and floods which were interpreted as portents of destruction but not necessarily destructive themselves.

The 1580 Earthquake, known at the time as the ‘London Earthquake’, remains the

⁴¹ Anon., *The order of prayer upon Wednesdayes and Fridayes, to avert and turne Gods wrath from us, threatned by the late terrible earthquake to be used in al parish Churches and households throughout ye realm, by order given from the greenes majestie most honourable privy council* (London, 1580) op. cit. Mears, et al. (eds.) *National Prayers*, vol. 1, pp. 140-151, p. 148.

⁴² Sung-Ho Na, Tae-Woong Chung, Dork Sahagian, ‘Did the Little Ice Age release earthquakes’, *Science Discovery*, 2 (2014), pp. 47-50

second strongest in English history after the Dogger Bank earthquake of 1931. Though lasting little over a minute, the legacy of the earthquake continued well into the seventeenth century in multiple sermons and lectures on providence. According to Lily B. Campbell, ‘no event of its time appears to have called forth more prompt pamphleteering, and Englishmen who had experienced it seem never to have forgotten it.’⁴³ Most famously, Shakespeare alludes to the event as a marker of time in *Romeo and Juliet* (Act 1, Scene 3). As the Nurse reminisces over the Juliet’s infancy, she remembers how ‘Tis since the earthquake now eleven years, And she was weaned—I never shall forget it.’ The sheer rate of the journalistic response to the event was, Campbell believes, ‘astonishing.’⁴⁴ Abraham Fleming’s pamphlet, published on June 27, 1580, comprised a compendium of the writers who depicted the aftermath of the earthquake.⁴⁵ Nine separate accounts of the event were published within a week, an attempt to meet hysterical demand for news throughout the nation. In the rapid reproduction and dissemination of pamphlets, climatic events acquired a medium which reflected their newsworthiness promoted by the established Church.

Though the damage and loss of life caused by the event was minimal, the city was overcome with palpable alarm and nervous excitement. Naturally, days of special worship and prayer were announced in the immediate aftermath with the then bishop of London John Alymer preparing a form of prayer for the whole realm. After the earthquake, specially commissioned liturgies were included as appendices in the Book of Common Prayer.⁴⁶ In the prayer, as well as a wealth of pamphlets produced in the wake of the event, the earthquake was quickly understood as a divine foretoken of greater destruction. Fears were exacerbated

⁴³ Lily B. Campbell, ‘Richard Tarlton and the Earthquake of 1580’, *Huntington Library Quarterly*, 4 (1941), pp. 293-301, p. 293.

⁴⁴ Lily B. Campbell, ‘Richard Tarlton and the Earthquake of 1580’, p. 293.

⁴⁵ Abraham Fleming, *A bright burning beacon forewarning all wise virgins to trim their lampes against the comming of the Bridegroom* (London, 1580). The pamphlet included reports by Francis Shackleton, Arthur Golding, Thomas Twine, Thomas Churchyard, Richard Tartelton, John Philippes, Robert Gittins, John Grafton, and of course, Abraham Fleming.

⁴⁶ Mears, et al. (eds.) *National Prayers*, p. 140.

by the news that Lawrence Chaderton had made a prophetic choice of sermon the day before the earthquake. Preaching from Joel 3:16, Chaderton had warned his flock that: ‘The heaven and earth will shake, but the Lord will be the hope of his people’.⁴⁷ This was also compounded by the rumour that the inhabitants of Ashford and Great Chart in Kent had refused to observe the national fast and were struck by seismic aftershock.⁴⁸

According to contemporary accounts, the earthquake had caused great commotion and desire for news in the capital. In a correspondence with Edmund Spencer published anonymously after the earthquake, Gabriel Harvey describes the aftermath of the earthquake. While playing cards with two women and two men, Harvey recounts the ‘very instant that the earth under us quaked and the house shaken above, besides the moving and rattling of the table and forms where we sat.’⁴⁹ Immediately, the women rushed to judgement and prayer:

The gentlewomen’s hearts, nothing acquainted with any such accidents, were marvelously daunted, and they, that immediately before were so eagerly and greedily preying on us, began now forsooth very demurely and devoutly to pray unto God.⁵⁰

Fleming accounts the same desire for atonement. The capital, he witnessed, chattered ceaselessly ‘of Gods judgements, the fearing of His vengeance, the suspecting of great daunger; the prophesieng of Doomes day, the confessing of sin, the blaming of all estates, the complaining against pride, the exclaiming against envie, the crieng out against the abuse of the Sabbath day, the finding fault with a thousand enormities.’⁵¹ Though victims’ complaints were ‘against diverse disorders’, Fleming nonetheless admits ‘the peoples mouth were full of

⁴⁷ Francis Dillingham, *Laurence Chaderton, D.D. (First Master of Emmanuel)*, ed. E.S. Shuckburgh (Cambridge, 1884), p. 14.

⁴⁸ Walsham, *Providence*, p. 134.

⁴⁹ Anon., *Three proper and witty letters lately passed between two university men touching the earthquake in April last and our English reformed versifying* (1580), p. 7.

⁵⁰ *Ibid.*

⁵¹ Fleming, *A Bright Burning Beacon*, D1.

common places in that instant.’ The earthquake had ignited a ‘sudden zeal’ amongst townspeople, who were eager for vindication. Thomas Churchyard offers a similar perspective in an accompanying doggerel:

‘Let London weep, whose wals of late did shake with trembling feare, Put sackcloth on, and waile your sins, with many abytter teare: For in your pompe, and chiefest pryde, when Plagues began to seace, And peoples hardned stubborne heartes, forgot the God of peace ... The streets did shake, the Churches reeled, the ground it quivered sore, Men stoode amazed, and women shreekt, the babes did crie and rore.’⁵²

Beneath the flagrant sensationalism of many cheaply produced providential pamphlets, these narratives worked to bolster confessional identity and propagate anti-Catholic sentiment. Fleming draws a direct lineage between ‘wonderfull accidentes, and principally of Earthquaks ... which haue happened in the realms of England, Ireland, & Scotland, from the time of K. William the Conquerour, to the reigne of our souereigne Lady and gracious Queene Elizabeth.’⁵³ In the ongoing providential tale of England’s salvation and their covenant with God, this was a further moment of ‘fortunate advancement of our most gracious souereigne Ladie *ELIZABETH*, by the grace and providence of almightie God.’⁵⁴ Paraphrasing official state prayers at the time, Arthur Golding regards the earthquake as a further deliverance in the reign of Elizabeth, with English rescued ‘again from the bondage of the Romishe Antichryst, intop the libertie of the Gospell of his sonne Jesus Christ.’⁵⁵ Golding also admonishes his reader for the ‘great numbers both olde and yong’ who have lapsed

⁵² Thomas Churchyard, *A Warning for the wise, a feare to the fond, a bridle to the lewde, and a glasse to the good* Written of the late earthquake chanced in London and other places, the. 6. Of April 1580. (London, 1580), Bivv.

⁵³ Fleming, *A Bright Burning Beacon*, ch. 12.

⁵⁴ Ibid. For further on covenant theology in early modern England, c.f. Theodore Dwight Bozeman, ‘Federal Theology and the “National Covenant”: An Elizabethan Presbyterian Case Study’, *Church History*, 61 (1992), pp. 394-407.

⁵⁵ Arthur Golding, *A discourse upon the earthquake that hapned through this realme of Englande, and other places of Christendom, the first of Aprill. 1580* (London, 1580), Bivr,

against ‘into papistrie, or let them runne loose into godlesse atheism.’⁵⁶ The judgement was therefore considered as much a deliverance for those pious adherents of the new faith as much as it was a violent rebuke of relapsed Catholics.⁵⁷ These responses were by no means restricted to the printed page. As far away as Coventry, Walsham notes the impact of the earthquake on confessional practice. Corpus Christi Day had outlasted the Reformation here until the year of the earthquake, when the practice was banned altogether.⁵⁸ Of course, the most widely held response to the events of April 6 was produced by the English Church in the form of a national Day of Atonement. This offered two benefits: the honest appeal for divine favour and a unifying expression of English Protestantism.

In the Church of England’s official report of the earthquake, issued alongside a form of prayer, it is soon made clear that this incident constituted a warning, not a judgment.⁵⁹ ‘For although it shook all houses castles, Churches, and building, everywhere it went, and put them in danger of utter ruine ... it overthrew few.’ This was, the report reads ‘rather a shaking of Gods rod at us, than smiting us according to our desserts’: ‘Turne this Earthquake, oh Lorde, to be benefite of thine elect, as thou didst when thou shookest the prison, loosedst the locks, fetter and chains of thy serventes, Paul and Silas.’ After referencing familiar biblical precedence, i.e. when ‘He chastised the Children of *Israel* diverse ways’ before ‘he destroyed them in the wilderness, the report assures that these were simply ‘friendly and fatherly admonitions.’ That is not to say that these signs should not, however, be taken seriously. The averted disaster was a time for ‘pondering the manner of this Earthquake thoroughly’, to ‘let us enter ourselves, examine our times past’ and ‘the late restitution of the Gospell.’ ‘Since the reign of Mary (‘at whiche time we vowed all obedience to God, if he would vouchsafe to

⁵⁶ Golding, *A discourse upon the earthquake* (1580), Ciiv.

⁵⁷ Fulton, ‘Acts of God’, p. 62.

⁵⁸ Walsham, *Providence*, p.135.

⁵⁹ Anon., *The order of prayer upon Wednesdayes and Fridayes, to avert and turne Gods wrath from us*, op. cit. Mears, et al. (eds.) *National Prayers*, vol. 1, pp. 140-151.

deliver us againe from the bondage of the Romishe Antichrist') England had experienced a general détente, in the eyes of Aylmer: 'a long resting and refreshing time, blessed with innumerable benefites both of body and soule' and, in the meantime, built 'a golden world above all the residue of our neighbours bordering rounde about us.' For Aylmer, the aftermath of the earthquake was opportunity to remark of the fortitude of the Church of England and remind Englishmen and women of their exceptional status as keepers of the true faith. In contrast to the disastrous earthquakes 'in the Realme of *Naples* in the yeare 1566' and when '*Ferrara* in *Italy* was destroyed in the yeare 1570', 'wee have builded our houses wiselye upon the rocke, which neither wind, water, nor Earthquake, no nor Sathan himselfe wyth all his Feends can shake downe or empayre.' Consequently, the accompanying form of prayer is littered with anti-Papal sentiment.

O Lord, sanctifie their blood, that it may water thy Church, & bring a mightie increase and gaine to thy self, and a decrease and losse to the kingdome of Antichrist, and to the Princes of the earth, who are become his slaves and butchers ... wee pray unto thee for this Church of England, that thou wilt continue thy gracious favour towards it, to maintaine thy Gospell still amongst us, and to give it a free passage.⁶⁰

The end of the prayer makes several appeals for the Lord to aid Elizabeth I against 'all the traitorous practises of her enemies devised against her, & thy trueth.' He includes a particularly colourful attack on the Pontifex, with reference to the Whore of Babylon:

Strengthen her hande, to strike the stroke of the ruine of all their superstition, to doubt into the bosome of that rose coloured whore, that which shee hath powred out against thy Saintes, that shee may give that deadly wound not to one head, but to all the

⁶⁰ Anon., *The order of prayer upon Wednesdayes and Fridayes, to avert and turne Gods wrath from us*, op. cit. Mears, et al. (eds.) *National Prayers*, vol. 1, pp. 140-151.

heads of that cruell beast: that the life that quivereth in his dismembered members ter amongst us may utterly decay

After a bout of stormy and wet weather in 1585, Bishop Aylmer issued a further prayer in same vein. Prayers were issued which not only emphasised human sinfulness but the recent history of the Church of England. Parishioners were encouraged ‘with grieffe and unfeigned sorrow [to] confesse thaet wee have sundrie ways abused thy Fatherly goodnesse, in multiplying our offences and ... defiling this good Land with all abhominations. All have sinned from the least to the highest, there is no parte whole or free from greuous enormities.’⁶¹ At the same time, memories of the Marian persecution are elicited, as well as Elizabeth’s ascension to the throne and the restoration of the true faith. The prayer has been specifically noted for its ‘shrill, intemperate tone’ which ‘reflected growing clerical concern about godliness and sin, as well as anxiety about the possibility of an ideological war with Spain.’⁶² Though ostensibly a prayer about weather, the work begins by reminding laymen and women of their ‘miserable captivitie of bothe body & soul under Antechrist’ and the ‘calamitie in the late dayes of persecution, when the bodies of the Sainctes were burned in our sreates.’⁶³ The prayer continues: ‘Thou didest exalte thy Servant Elizabeth, and deliveredst her from the mouth of the Lyon.’ Finally, there is a plea that God ‘turne away this plague of rain and all other plagues from us, and let us not be confounded in the sight of our & thine enemies ... Powre out thyne indignatioun upon the heathen which knowe thee not, and upon that cursed sea and generation of the Antichrist.’ After more bad weather in 1586, further services were called during a time of dearth. The poor harvests of 1586 brought scarcity,

⁶¹ Anon., *A necessarie and godly prayer appointed by the right reverend father in God John bishop of London to be used throughout all his dioces upon Sondayes and Frydays, for the turning away of Gods wrath* reprinted in *Two forms of prayer of the time of Queen Elizabeth now first reprinted*, ed. Ayrton Chaplin (Cambridge, 1876), pp. 9-16.

⁶² *Ibid.*, p. 9.

⁶³ Anon., *A necessarie and godly prayer*, p. 12.

inflation and social distress in the context of heightened fear over impending war.⁶⁴ Again, the spectre of Rome and the popish Antichrist loom over the context of climatic hardship. England's deliverance from 'the thraldom of captivitie under the tyrannie of Rome' begins the prayer, which continues by rejoicing in the recent blessings 'he hath shed down from heaven.'⁶⁵

'He blew with His winds, and they were scattered': Remembering the 'Protestant Wind'

The memory of collective hardship in times of climatic change constituted a temporal marker in the history of the Church of England. Explicitly or not, these memories were defined by their proximity to moments of political (mis)fortune. It is telling that during the tumult of the late sixteenth century and the Anglo-Spanish war special days of worship relating to climate increased, while the relative détente of James I's reign brought fewer occasions for weather prayers. Again, with the beginning of the Civil War, pleas for atonement increased.

The memory of certain weather events were refined by ecclesiastical authorities to endure for decades or even centuries. This is none more evident than in the case of the so-called 'Protestant Wind' which supposedly defeated the 'invincible' Spanish Armada in 1588 and returned during the Glorious Revolution of 1688.⁶⁶ This moment represents the most enduring example of how confession and climate became entwined during the late sixteenth century. In the immediate aftermath of the defeat of the first armada, the Church of England

⁶⁴ Mears, et al. (eds.), *National Prayers*, p. 162.

⁶⁵ *An order for publicke prayers to be used on Wednesdayes and Frydayes in every parish Church within the province of Canterburie, convenient for this present time set forth by authoritie* (1586) op. cit. Mears, et al. (eds.), *National Prayers*, pp. 164-165.

⁶⁶ Geoffrey Parker and Jonathan I. Israel, 'Of Providence and Protestant Winds: the Spanish Armada of 1588 and the Dutch Armada of 1688', Jonathan I. Israel (eds.) *The Anglo-Dutch Moment: Essays on the Glorious Revolution and Its World Impact* (Cambridge, 1991), pp. 335-365.

announced a series of thanksgiving days for the failure of the Spanish armada along with a prayer hailing the Protestant wind. ‘The Lord arose, and tooke the cause ... into his own hands, and fought against them, that fought against us. The Lord scattered them with his windes, he confounded and disappointed their devises and purposes for joyning their powers together against us.’⁶⁷ Whether decided by the workings of providence or a prevailing easterly, the defeat of the Spanish Armada remains an archetypal example of the impact of climate as an agent of historical change. For King James, then only King of Scotland, he took the victory as a chance to exhibit his poetic prowess and memorialise the conditions of the Catholic defeat:

The nations banded ‘gainst the Lord of Might
Prepared a fore, and set them to the way;
Mars dressed himself in such an awful plight,
The like whereof was never seene, they say;
They forward came in monstrous aray,
Both sea and land beset us everywhere;
Brugges threatened us a ruinous decay,
What came of that, the issue did declare.
The windes began to tosse them here and there,
The seas began in foaming waves to swell;
The number that escaped, it fell them faire;
The rest were swallowed up in gulfes of Hell;

⁶⁷ Anon., *A psalme and collect of thanksgiving, not unmet for this present time: to be said or sun in churches* (1588) op. cit. Mears, et al. (eds.), *National Prayers*, p. 186.

But how were all these things miraculously done?

God laught at them out of his heavenly throne.⁶⁸

Even Phillip II himself, as legend would have it, was convinced of his own divine misfortune.

‘The will of God be done,’ remarked the King upon hearing news of the destruction, ‘I sent my ships to fight with the English, not with the Elements.’⁶⁹

The wind was said to have returned one hundred years after the defeat of Philip’s Armada, this time to aid the sails of William of Orange during the Glorious Revolution.⁷⁰ While historians have previously attributed the coinage of the term ‘Protestant wind’ to c. 1688, evidence suggests it was in widespread use during the seventeenth century. In a letter to his step-father, Sir Dudley Carleton II wrote: ‘some say the fleet for Spain is driven back by the contrary westerly wind, which the Puritans call a Protestant wind, because it will suffer nobody to sail to Spain.’⁷¹ The phrase was widely popularised in an adaptation to the doggerel ballad ‘Lilliburlero’ published a year before the ‘revolution’ in 1688. The ballad was written by Thomas Wharton, to the tune of a lively march composed by Henry Purcell. However, the song only achieved success in October 1688 when Irish troops responded heartily in reference to the 1588 wind. According to Burnet, the ballad ‘made an impression on the army [of James] that cannot be imagined by those who saw it not. The whole army and at last the

⁶⁸ Op. cit. Thomas Lathbury, *The Spanish Armada, A. D. 1588: Or The Attempt of Philip II and Pope Sixtus to re-establish Popery in England* (London, 1840), p. 125.

⁶⁹ George Ripley (ed.), *The New American Cyclopaedia: A popular Dictionary of general Knowledge* (New York, 1863) vol. 13, p. 242.

⁷⁰ Parker and Israel, ‘Of Providence and Protestant Winds: the Spanish Armada of 1588 and the Dutch Armada of 1688’, pp. 335-365, *passim*.

⁷¹ D. Carleton to Sir Dud. Carleton, September 6, 1623, Mary Anne Everett Green (ed.) *Calendar of State Papers, Domestic Series, of the reign of James I, 1623-1625, preserved in the State Paper Department of her Majesty's Public Record Office* (London, 1857) Vol. 4, p. 74. This finding contradicts the claim made by S. Lindgrén and J. Neumann that ‘the term seems to have fallen into disuse until 1687’. ‘Great Historical Events That Were Significantly Affected by the Weather: 7, “Protestant Wind”—“Popish Wind”: The Revolution of 1688 in England’, *Bulletin of the American Meteorological Society*, 66 (1985), pp. 634-644, p. 683.

people, both in the city and country were singing it perpetually.⁷² The specific lines referencing the wind sung:

O' but why does he stay behind,
Lilli Burlero Bullen a-la,
Ho by my Shoul 'tis a Protestant Wind,
Lilli Burlero Bullen a-la'

A further half century later, the myth of the Protestant Wind was inculcated into the minds of children. In a nursery rhyme first published in 1756, scholars have suggested that a variation of the ballad was used as the basis of 'Rock-a-Bye-Baby'. Katherine Thomas interprets the rhyme as an allusion to the wind that caused James II, his family and any potential heirs to fall down 'cradle and all'.⁷³ Though this provenance is speculative, in 1688 contemporaries were all-too-aware of these parallels between the events of 1588 and 1688. 'The Dutch,' wrote one account, 'are convinced that they will be as fortunate in their plan to attack England as Philip II was unfortunate.'⁷⁴ Denis de Sainte-Marthe, during a correspondence with a Catholic friend at the time of the second armada, teased his compatriot: 'do you remember that powerful Naval Army that Philip II Roy of Spain, who was one hundred years ago to invade England, and to restore Papism?'⁷⁵ Among the hordes of Dutch soldiers, there were 'few among them who are unaware of the period of history and do not know by heart the

⁷² Bishop Burnet, *History of his own time: from the restoration of King Charles II, to the conclusion of the Treaty of Peace at Utrecht, in the reign of Queen Anne* ed. William Smith, vols. 2 (London, 1840), vol. 2, p. 502.

⁷³ Katherine E. Thomas, *The Real Personages of Mother Goose* (New York, 1930), pp. 288-90.

⁷⁴ BL MS Add. 38495, fo. 28v, Moreau, Polish resident in the United Provinces, to the king of Poland, The Hague, 12 Oct. 1688.

⁷⁵ Denis de Sainte-Marthe, *Entretiens touchant l'entreprise du prince d'Orange sur l'Angleterre* (Paris, 1689), pp. 89-91. 'There were a hundred and thirty great warships, among them sixty-five galleons, each of which was about the height of a castle. What did this great armament produce for the Spaniards? The English fought them with so many fugitives that they sank eleven of their largest ships; the storm dissipated most of the others, which were going to fail on the coasts of France, England, Scotland, and Ireland.' Original translation.

inscriptions on the medals which were struck at the time.’⁷⁶

Medals produced in the immediate wake of the Spanish defeat consistently attribute victory over Catholic forces to divine fortune, specifically weather. A variety of these medals are now held at the Royal Maritime Museum in Greenwich (fig.1, 2). ‘*Flavit Jehovah et Dissipati Sunt*’, read the most famous of these commemorative medallions struck following the defeat of the ‘invincible’ Spanish Armada in 1588: ‘Jehovah blew with His winds, and they were scattered.’ Crowned with a Tetragrammaton, the obverse face of the medallion depicts the victorious English fleet. Curiously, no historians have sought to comment on the reverse of the medal, which is framed by the Latin ‘*Allidor non Leador*’ or ‘I am assailed not injured.’ The accompanying image shows a Church stranded on a remote island, surrounded by tempestuous storms. The image features as a climatic allegory for the exceptional status of the Church of England as an outpost of true faith amidst a sea of turbulence and dissent. These medallions were not, however, the product of English craft, but a gift from Maurice of Orange. Clearly, their confessional allies in the United Provinces had also cause to celebrate, as did all of Protestant Europe.



Figure 1: Obverse, left. Reverse, Right. Gerard van Bylaer, Medal commemorating the defeat of the Spanish Armada, 1588 (MEC0012). Produced in the Netherlands. Silver. 51mm. Held at the National Maritime Museum, Greenwich, London.

Two further though lesser known counters, also produced in the Netherlands, expand on the themes depicted above.⁷⁷ The first shows a naval formation sailing as the sun disperses the clouds, with an inscription reading 'POST NVBILA PHOEBVS Ao 1588' ('after the clouds, sunshine in the year 1588'). The other side of the counter displays the Arms of Zeeland enclosed by the arms of its main towns. The second shows a family praying to storm clouds, with the inscription 'HOMO PROPONIT, DEUS DISPONIT' ('Man proposes, God disposes'). The text is coupled with an image of a shattered Spanish Galleon, with the legend reading: 'HISPANI FUGIVNT ET PEREVNT NEMENIE SEQVENTE' ('The Spanish flee and perish, no one pursuing.') Though the connotation of this imagery need not be explained further, it is worth deliberating on the function of these pieces. Like state prayers and days of special worship, medals and counters formed a confessional narrative of climate. If we are to trust the account of Dutch soldiers who could recount the images and inscriptions which adorned these medals, it is safe to assume their propaganda was ubiquitous and effective.

When the Protestant wind returned in 1688, the memory of earlier deliverances spurred piety and also great anxiety amongst English Protestants. Never in English history, before or since, had the direction of the wind been the subject of such popular scrutiny. In the weeks leading to the eventual invasion of the Dutch fleet, residents of Cheapside reportedly crowded the weathercock at Bow Church praying daily for a strong easterly to help dethrone

⁷⁷ Counter commemorating the defeat of the Spanish Armada, 1588 (MEC0048). Produced in Middleberg, the Netherlands. Silver. 33mm; Counter commemorating the defeat of the Spanish Armada, 1588 (MEC0049). Produced in the Netherlands. Silver. 30mm. Both held at the National Maritime Museum in Greenwich, London.

the supposed Catholic sympathiser James II.⁷⁸ In spite of a common aversion to weather from the east, John Evelyn recorded Englishmen and women ‘praying incessantly for an Easterly Wind.’⁷⁹ In the Netherlands, the chaplain John Whittle asked daily ‘how the wind sate’:

the very first Question by all was, *Sir, I Pray how is the Wind today? Are we likely to get an Easterly Wind ere long? Pray God send it,* and such like. The Ministers themselves pray’d, That God would be pleas’d for to grant an East wind. Others a favourable Wind that might bring his Illustrious Highness the Prince of *Orange*, with this whole Fleet (which now attended him) unto the desired Haven: for nothing could possibly be more desired than a fair Wind for the [Prince’s] Navy, by all sorts and conditions of men (except Papists). There was a Report here, that the Jesuits had promised the late K. James, that the Westerly Wind should continue until *Christmas*; but that was false, every man knows.⁸⁰

In The Hague, a Polish resident reported that to claim that ‘the wind is Popish’ became a crime subject to a heavy fine, which was duly administered to guilty parties.⁸¹ Such was James II’s own anxiety on the state of the wind that the King erected a weathercock ‘of no ordinary dimensions’ on the roof of Whitehall’s banqueting hall.⁸² The same story is corroborated by Maximilien Misson, who described how the King – ‘being very restless and uneasy’ – ordered a weathercock to be placed in view of his own apartments on the 2nd of October (1688) so ‘that he may ascertain with his own eyes whether the wind is Protestant or

⁷⁸ Thomas Babington Macaulay, *The History of England from the Accession of James II* (London, 1929) vol. 2, p. 65. Macaulay described how gales ‘blew obstinately from the west, and which at once prevented the Prince’s armament from sailing and brought fresh Irish regiments from Dublin to Chester, were bitterly cursed and reviled by the common people. The weather, it was said, is Popish.’

⁷⁹ E. S. De Beer, (ed.) *The Diary of John Evelyn*, 6 vols. (Oxford, 1955) vol. 4, pp. 599-600.

⁸⁰ John Whittle, *An Exact Diary of the Late Expedition of his Illustrious Highness the Prince of Orange etc.* (London, 1689), pp. 14-15.

⁸¹ BL MS Add. 38495, fo. 28v.

⁸² John Heneage Jesse, *Memoirs of the court of England during the reign of the Stuarts, including the protectorate* (London, 1840) Vol. 4, p. 408.

Popish.’ After receiving a letter from Newport on October 30th informing him (mistakenly) of the dispersion of the Prince’s fleet, the King was alleged to have joked ‘at last, then, the wind has declared itself a Papist.’⁸³

Both within the popular mythology of the Protestant Wind and contemporary historiography, a crudely deterministic portrait of climate are evident.⁸⁴ Rather than explore the complex ideological relationship between nationhood, climate and religion that emerged in the heat of the Reformation, historians have invariably relied on a staid narrative of events perpetuating the alleged bias of the weather. As well as attributing overwhelming explanatory power to climate, this method overlooks the fascinating interplay between weather and confessional politics in the period concerned. In England, both Armadas represented something far greater than mere coincidence, but divine approval of their Island’s divergent confessional path. Bookended by two dramatic Protestant victories, the period in question formed a specific historical moment when climate was interpreted according to the dominant religio-political settlement. In 1588 and 1688, respective armadas were bound by a common goal: to upend the confessional bias of the English monarchy (Protestant in 1588, purportedly Catholic in 1688). On both occasions, the Protestant Wind scored an undisputed victory. In the historical memory of early modern England, both were commemorated as a vindication of England’s covenant with God and celebrated as a signal of their collective salvation.

⁸³ Maximillan Misson, *Protestant exiles from France in the reign of Louis XIV : or, The Huguenot refugees and their descendants in Great Britain and Ireland* ed. David Carnegie Agnew (Edinburgh, 1871-1874) vol. 2, p. 12.

⁸⁴ Hubert Lamb, ‘The Weather of 1588 and the Spanish Armada’, *Weather*, 43 (1988), pp. 386-395. Lamb refers to the destruction of the Spanish Armada in 1588 as ‘the most widely known example of a turning point in history in which weather has played some part.’ p. 386.

‘For the Better Humiliation of the People’: Days of Thanksgiving, Fast and Atonement in Stuart England

During the comparatively peaceful reign of James I, fewer days of special worship were ordered in response to national crises and bad weather.⁸⁵ While deliverances from the papal scourge were commemorated in prayer and sermons throughout the realm until the rise of William Laud weather prayers lacked the harder confessional edge they had earlier represented. In spite of this, a distinct confessional vocabulary emerges in discussions of climate throughout the seventeenth century. In 1611, following an arid couple of years, prayers for rain were ordered to appease their angry God: ‘thou art justly angrie with vs, and now doest manifest this thy displeasure, in shutting up the windowes of Heaven, and in hardening them as iron, or brasse, in scattering the Cloudes, and commanding them that they drop not upon the drie and thirstie earth, even parched with the heate of thine indignation.’ The prayer pleads the Lord to ‘not onely sprinckle our consciences with the dew of thy grace, but also outwardly powre downe thy fruit-bringing Showres.’⁸⁶ Several weather prayers are based on established certain metaphors which attributed moral and spiritual virtues to atmospheric conditions. In the context of the exhaustive heat of the early 1610s, or 1660s, precipitation is cast as a spiritually nourishing intervention. Conversely, during the epic flooding of 1613, an excess of water is regarded as a mission ‘to wash away the vncleane pollutions of our sinnes ... and to cast them into the bottome of the sea.’⁸⁷

With the rise of Laud, fast days overtook prayer as the primary response to national

⁸⁵ Durston, “‘For the Better Humiliation of the People’”, p.130.

⁸⁶ Anon., *A forme of praier to be used in London, and elsewhere in this time of drought. Set forth by authoritie* op. cit. Mears, et al. (eds.), *National Prayers*, pp. 266-267.

⁸⁷ Anon., *A forme of prayer to be publickely used in churches, during this unseasonable weather, and abundance of raine. Set forth by authoritie. Hosea 5.15. In their affliction they will seeke me early.* (1613) op. cit. Mears, et al. (eds.), *National Prayers*, pp. 268-271.

crises, including extreme weather. That said, utmost suspicion was cast over those choosing to observe *unofficial* fast days and prayer in bad weather. Clandestine efforts to mobilise were usually met with considerable alarm from the established Church, especially in periods of national crisis such as the 1640s.⁸⁸ In 1603, Archbishop Richard Bancroft first curtailed these unofficial fasts in a statement banning unsanctioned fasts.⁸⁹ As per Laud's influence, a systematic campaign was launched against the perceivably subversive practice of unofficial fasting. By the mid-1630s, the hagiographer Samuel Clarke describes unauthorised fasts as 'a dangerous exercise', which risked serious punishment.⁹⁰ Yet, these practices endured. After the town's devastation by fire on August 6 1613, the minister John White continued to hold a weekly fast throughout the 1620s.⁹¹ Nor were these clandestine occasions restricted by geography. In Perth, 'a fearful inundation of waters was never seen in living man's remembrance' beset the town on October 22, 1620. As recorded in the local magistrates, the local minister Mr John Malcolm, 'powerfully endued with God's spirit' ordered a week of fasting, preaching and prayer. After the devastation of the flood, Malcolm

caused ring the preaching bell and the hail inhabitants came to the kirk and there he exhorted them to repent of their sins whil had procured the said judgement of God to come upon the city. Fasting preaching and prayer continued all that week, our pastor continuing to exhort them to true repentance and amendment of life.⁹²

Such was the fear of the local community, that Malcolm's 'powerful exhortations moved the people to cry to God with tears, clamours and cries, and to hold up their hands to God to

⁸⁸ Durston, "For the Better Humiliation of the People", p.130.

⁸⁹ Rosemary O'Day, *The English Clergy: The Emergence and Consolidation of a Profession, 1558-1642* (Leicester, 1979), pp. 168-169; Patrick Collinson, *Godly People: Essays on English Protestantism and Puritanism* (London, 1983), pp. 475, 489.

⁹⁰ Samuel Clarke op. cit. Collinson, *Godly People*, p. 475.

⁹¹ Durston, "For the Better Humiliation of the People", p. 130.

⁹² James Cant, *The Muses Threnodie: Or, Mirthful Mournings on the Death of Mr Gall* (Perth, 1638), p. 110.

amend their lives, and every one of them to abstain from their domestic sins.’⁹³

Across the Atlantic, prayers for rain gained troubling associations with indigenous American rainmaking rituals.⁹⁴ When the English met the brutal North American climate, it was not surprising that colonisers appealed for divine aid. Simultaneously, considering the entrenched associations between demonism and weather magic in Europe, the same colonists were concerned by the parallels between shamanism and witchcraft. In *Good Newes from New England*, Edward Winslow compares the ‘soft, sweet, and moderate showers’ brought by English weather prayers and the ‘stormes and tempests’ made by the Indians. Winslow was, in his own words, ‘shewing the difference betweene their conjuration, and our invocation on the name of God for rayne.’⁹⁵ As with the previous discussion of the Protestant wind, our writer here manipulates atmospheric conditions to suit a strictly confessional bias. When the English appealed for rain, it was a blessing; for the Indians, a curse.

Throughout the Personal Rule, ecclesiastical authorities viewed individual attempts to win divine favour through fasting with great distrust and fears of subversion. Laud complained that the omission of prayer for seasonable weather from the most recent Book of Devotions ‘caused the Shipwracks and the Tempests, which followed.’ He concludes by speculating that the ‘the Prayer for fair Weather was left out of the Book for the Fast; therefore the Prelates intend to bring in Popery.’⁹⁶ Evidently, in the wrong hands a weather prayer can manifest as a curse. Laud himself, like many of his contemporaries, saw climatic strain within a matrix of political and social concern which plagued the Personal Rule of

⁹³ Cant, *The Muses Threnodie* (1638), p. 110.

⁹⁴ Sam White, “‘Shewing the difference betweene their conjuration, and our invocation on the name of God for rayne’: Weather, Prayer, and Magic in Early American Encounters”, *The William and Mary Quarterly*, 72 (2015), pp. 33-56.

⁹⁵ Winslow, *Good Newes from New-England*, p. 50

⁹⁶ John Rushworth, ‘Laud’s speech at the Censure of Burton, Bastwick and Prynne, 1637’, in John Rushworth (ed.) *Historical Collections of Private Passages of State: Volume 3, 1639-40* (London, 1721), pp. 116-133. *British History Online*. Accessed 7 February 2019 <<http://www.british-history.ac.uk/rushworth-papers/vol3/pp116-133>>

Charles I. In June of 1625, ‘the extraordinary wet weather threatened a famine’ inspiring the following prayer from Archbishop Laud:

The pestilence spreads in our streets, and so as if it sought whom to devour. No strength is able to stand against it, and it threatens to make families, nay cities, desolate. While the pestilence eats up Thy people, we hear the sound of war, and the sword calleth for such as it would devour. In the meantime, the heavens are black over us, and the clouds drop leanness; and it will be famine, to swallow what the pestilence and the sword shall leave alive, unless Thou send more seasonable weather to give the fruits of the earth in their season. Our sins have deserved all this, and more, and we neither do nor can deny it..... Clear up the heavens over us, and take not from us the great plenty with which Thou hast crowned the earth: but remember us.⁹⁷

On 23rd June the House of Lords and House of Commons presented a petition for a general fast ‘observing that God hath already laid his hand upon us, by pestilence and unseasonable weather, threatening a famine.’⁹⁸ Though fast days had become a regular feature of the liturgical calendar during the reign of Charles I, Oliver Cromwell continued the practice with an amended narrative. After being made Lord Protector in 1653, the first day of special worship called by Oliver Cromwell was in response to an ongoing drought and a particularly arid four years. The fast was to be observed in London, Westminster and outlying Parishes on Friday 24 March and Friday 7 April 1654 elsewhere in England and Wales. Predictably, Church authorities blamed the drought on the sins of the people: mainly drinking, lack of godliness and revelry. Lastly, the drought and ensuing fast is blamed on ‘the neglect of the

⁹⁷ William Laud, *The Private Devotions of Dr William Laud* ed. Rev. Frederic W. Faber, (Oxford, 1838), p. 204

⁹⁸ ‘House of Lords Journal Volume 3: 23 June 1625,’ in *Journal of the House of Lords: Volume 3, 1620-1628*, (London, 1767-1830), pp. 440-442. *British History Online*. Accessed March 6, 2019 <<http://www.british-history.ac.uk/lords-jrnl/vol3/pp440-442>>

Magistracy.⁹⁹ A month following the fast, a further day of special worship was ordered by Cromwell, this time to celebrate a peace treaty with the Dutch and the end of the drought. As well as giving thanks for peace, Englishmen and women were to remember God's mercy in sending rain. 'Consider also the way whereby the Lord imparted this mercy on us ... was it not by stirring up our hearts to seek the same by prayer, and that immediately before the Lord vouchsafed us this mercy?'¹⁰⁰ Yet, royalist preachers also took the opportunity of thanksgiving for good weather to admonish the new Lord Protector. According to a newsletter, some preachers used the day of thanksgiving as an opportunity to call for the assassination of Cromwell and the restoration of the Crown.¹⁰¹ Writing two days after the official fast, the Venetian Secretary in England wrote to his French Counterpart:

Only the day before yesterday, kept as a holiday to celebrate the peace and pray for rain some of the preachers spoke to that effect, a like tone being taken by the public press. God grant it be confirmed, but the point of religion may not weigh enough with this nation, which is more prone *to ambition and vainglory*.¹⁰²

To the secretary, English appeals for divine favour were transparent and self-satisfied. As tempting as it may be to believe these efforts were only cynical attempts to divert political scrutiny or buttress authority, these actions were also calculated and well-established attempts to influence divine agency in earthly affairs.

The consistent production of weather prayers and special ordinances reveals an aspect of early modern political life that few political and environmental historians have thought to consider. Though contemporary political histories would emphasise concern over dynastic,

⁹⁹ Oliver Cromwell, *The writings and speeches of Oliver Cromwell*, ed. W.C. Abbott (Cambridge; Mass., 1937-47) vol. 3, pp. 225-228.

¹⁰⁰ Cromwell, *The writings and speeches of Oliver Cromwell*, pp. 225-228.

¹⁰¹ *Ibid.*, pp. 289-291.

¹⁰² Allen B. Hinds (ed.), *Calendar of State Papers Relating To English Affairs in the Archives of Venice, 1653-1654* (London, 1929), Vol. 29, p. 274. *British History Online*. Accessed 26 July 2019. <<http://www.british-history.ac.uk/cal-state-papers/venice/vol29>>

territorial and ideological conflict, it should be acknowledged that climate played a significant role in political life in the early modern period. Collective sin explained punishments against the nation, such as war and disease, but also climatic hardship, drought and inclemency.¹⁰³ If we are to subscribe to Parker's 'fatal synergy' between climatic adversity and human rebellion, we may also assume that early moderns held similar concerns. If sin explained dearth, God rewarded collective godliness with good weather and hence bountiful harvests. It was deeply within the public interest that wars and rebellions were not only acknowledged with spiritual atonement and thanksgiving but also by natural occurrences. Prayers for rain, or against dearth, constituted political action and should be recognised as such.

'How few lay any of gods judgements to heart': Providence, Public Worship and the Thames

Frost Fairs

Throughout the diary of Ralph Josselin, weather serves as a constant source of daily reflection.¹⁰⁴ The significance of weather in the everyday life of the vicar was twofold: as a farmer, his livelihood was defined by a timely, bountiful harvest. From a materialist perspective, Josselin's vigilant record-keeping was a reflection of concerns over food scarcity, fuel prices and excessive labour hours. As a vicar, he also regarded the weather in explicitly providential terms. Climate served as a spiritual barometer for Josselin, his family, his parishioners and even his country at large.

Upon every fast, countrymen and women were also required to suspend regular

¹⁰³ Mears, 'Public Worship and Political Participation in Elizabethan England', p.22.

¹⁰⁴ Alan MacFarlane (ed.), *The Diary of Ralph Josselin, 1616-1683* (Oxford, 1976). Throughout Josselin's diary, weather is mentioned approximately 600 times.

working hours and attend their local parish church for prayer.¹⁰⁵ According to a parliamentary ordinance from 1643, this was a time of public confession for ‘Nationall Sins being most agreeable to Nationall Judgements under which the land groanes and most likely to be effectual for the removing of them.’¹⁰⁶ Some were more enthusiastic about special occasions and fasts than others were. A series of four fast days in the space of a year were proclaimed at the very beginning of the Restoration, two of which explicitly concerned weather.¹⁰⁷ The final fast of the period concerned a period of unusually warm weather and observed on Wednesday 15 January 1662 in London, Westminster and Southwark and on Wednesday 22 January elsewhere in England and Wales. Many relished this public occasion. A day after the public fast, John Evelyn noted ‘a general fast through the whole nation, and now celebrated in London, to avert God's heavy judgments on this land. Great rain had fallen without any frost, or seasonable cold, not only in England, but in Sweden, and the most northern parts, being here near as warm as at midsummer in some years.’ He went on to give further detail of accompanying services held for the House of Commons at St Margarets by the Dean of Windsor, Bruno Ryves. The Dean, Evelyn recalled, ‘preached on Joshua, viii. 12, showing how the neglect of exacting justice on offenders (by which he insinuated such of the old King’s murderers as were yet reprieved and in the Tower) was the main cause of God’s punishing a land.’¹⁰⁸

Writing at the time of the nationwide fast, Ralph Josselin observed the ‘public fast to seek god in respect of the warm moist unkindly winter threatening a greater famine and

¹⁰⁵ Durston, “For the Better Humiliation of the People”, p. 135.

¹⁰⁶ C. H. Firth and R. S. Rait (eds.), *Acts and Ordinances of the Interregnum, 1642-1660* (London, 1911) vol. 1, pp. 80-82.

¹⁰⁷ A fast day to commemorate the Regicide of King Charles I on Wednesday 30 January 1661; a fast to bless the meetings of Irish, English and Scottish Parliaments on Thursday 2 May 1661; a fast during heavy rains on Wednesday 12 June 1661; and a fast during unseasonable weather and fears of scarcity on 15 January 1662. Mears, et al. (eds.), *National Prayers*, pp. 647-657.

¹⁰⁸ William Bray (ed.), *Diary and correspondence of John Evelyn* (London, 1854) vol. 1, pp. 360-361

pestilential diseases.’ He also reprimands ‘how few lay any of gods judgements to heart.’¹⁰⁹ Samuel Pepys recounts his obliviousness to the same fast in London, held on 15th January. In a diary entry from the same day, he describes going to breakfast with his physician Mr Berkenshaw who ‘after we had eaten, asked me whether we had not committed a fault in eating to-day; telling me, that it is a fast day ordered by the Parliament, to pray for more seasonable weather.’¹¹⁰ Public fatigue, it would seem, was starting to set in. The enduring popularity of public fasting is brought into question when taking into account contemporary testimony produced from the Civil War onward when the country fasted on a monthly basis. ‘Notwithstanding the just and pious ordinances of parliament for the strict observation of the Lord’s Day and the monethly fast,’ petitioned one group of godly ministers in West Sussex in 1644, ‘the looser sort of people doe grossly profane the Lord’s Day and refuse to observe the monethly fast.’¹¹¹ In the following September, the minister Matthew Newcomen complained of how his monthly fast had fallen into disrepute and ‘degenerated into loathsome formalities’ with fasts ‘as much contemned as ever.’¹¹²

As the century progressed, providential arguments met increasing ambivalence from Englishmen and women who often found revelry in extreme weather conditions, notably during the many Thames Frost fairs of the seventeenth century.¹¹³ Throughout the period, the Thames had frozen over ten times, most notably during the Great Frost of 1683-4. Though the Thames had frozen over five times in the sixteenth century, Londoners held their first ‘Frost Fair’ in 1607. A contemporary pamphlet captures the carnivalesque spirit of the occasion, observing:

¹⁰⁹ Alan MacFarlane (ed.), *The Diary of Ralph Josselin, 1616-1683* (Oxford, 1976), p. 486.

¹¹⁰ Richard Lord Braybrooke (ed.), *Diary and Correspondence of Samuel Pepys* (London, 1848), p. 313.

¹¹¹ Anthony Fletcher, *A County Community in Peace and War: Sussex 1600 – 1660* (London, 1975), pp. 113-14.

¹¹² Matthew Newcomen, *A Sermon Tending to set forth the Right Use of Disasters* (London, 1645), pp. 11, 39.

¹¹³ Cavert, ‘Winter and Discontent in early modern England’, pp. 114-134.

There might be seen spic'd cakes, and roasted Pigs,
Beere, Ale, Tobacco, Apples, Nuts, and Figs,
Fires made of Char-coles, Faggots, and Sea-coles,
Playing and couz'ning at the Pidg'on-holes:
Some, for two Pots at Tables, Cards, or Dice:
Some flipping in betwixt two Cakes of Ice:
Some going on their businesse and affaires,
From Bank-side to Pauls, or to Trig-staires.¹¹⁴

In his analysis of the poem, Joseph Ward draws attention to the last two lines: 'Some going on their businesse and affaires, From Bank-side to Pauls, or to Trig-staires.'¹¹⁵ During the deep freeze, two otherwise distinct cultural areas – the pleasure grounds of Southwark and the pious St Pauls – were united by temporary climatic change. The 'metamorphosis of the river Thames', eulogised by Taylor, was not, however, only an environmental transformation, but a cultural one. Though disruptive, the frozen Thames had created a liminal space where citizens could act out seasonal frivolities. The sophistication of these celebrations reached an apex by the Great Frost of 1683-84, which saw the Thames transform into a makeshift bullring, food court and even football pitch. One onlooker described the scene:

The water-Men as busie are as Bees,
Or as some Welch men cramming toasted Cheese.
Instead of Waves that us'd to beat the shore,
There Bears and Bull, loudly do now roar.¹¹⁶

¹¹⁴ John Taylor, *The Colde Terme: Or the Frozen Age: Or the Metamorphosis of the River of Thames* (1621)

¹¹⁵ Joseph P. Ward, 'The Taming of the Thames: Reading the River in the Seventeenth Century', *Huntington Library Quarterly* 71 (2008), pp. 55-75, p. 61.

¹¹⁶ Anon., *Thamasis's advice to the painter, from her frigid zone, or, Wonders upon the water* (1684).

While Londoners freely enjoyed festivities on the ice, natural philosophers mounted new challenges to providential readings of the frozen Thames. Remarking on the state of the frozen river in 1665, Robert Boyle described ‘the ditches betwixt Southwark and Redderiff had acquired an exceeding thickness of ice, caused by the flowing of the water in them at full Tide.’¹¹⁷ Rather than attributing the spectacle to the workings of providence, Boyle accounts for the natural process whereby ice accumulated around London Bridge. His logic, it would turn out, was correct. As recent evidence presented by Morgan Kelly and Cormac Ó Gráda has shown, the frequent frost fairs were made possible by the combination of climate fluctuations and poor engineering. During the more pronounced winters of the seventeenth century, the medieval London Bridge effectively formed a dam: the river flow obstructed by the bridge’s twenty narrow arches.¹¹⁸ Thomas Hobbes remarked of the same process after the river froze in 1677: ‘in the Thames the Ice is first made at the banks where the Tide is weak or none, and broken by the stream comes down to London, and part goes to the Sea floating till it dissolve, and part (being too great to pass the Bridge) stoppeth there and sustains that which follows, till the River be quite frozen over.’¹¹⁹ Along with the increasing scepticism of natural philosophers, Ward attributes the gradual disenchantment of the Thames to the waterway’s developing importance as a centre of global trade; in other words, ‘Londoners came to appreciate that the Thames was, after all, *only* a river, and rivers were for carrying trade.’¹²⁰

This nascent utilitarianism was far from unanimous, however. Even though poets like

¹¹⁷ Robert Boyle, *New experiments and observations touching cold* (London, 1665), p. 51.

¹¹⁸ The last frost fair was held in 1815, as the old London Bridge was replaced in 1831 with a granite structure formed of five arches. In 1815 the French travel writer described the state of the outgoing bridge: ‘Nothing can be uglier than London bridge; every arch is of a size different from its next neighbour; there are more solid than open parts; it is in fact like a thick wall, pierced with small holes here and there, through which the current, dammed up by this clumsy fabric, rushes with great velocity, and in fact takes a leap, the difference between high and low water being upwards of 15 feet.’ *Journal of a Tour and residence in Great Britain during the Years 1810 and 1811 by a French Traveller* (Edinburgh, 1815) vol. 2, pp. 262-263. Morgan Kelly and Cormac Ó Gráda, ‘The Waning of the Little Ice Age’, *Journal of Interdisciplinary History* 44 (2014), pp. 322-323.

¹¹⁹ Thomas Hobbes, *Decameron physiologicum, or, Ten dialogues of natural philosophy* (London, 1678), p. 65.

¹²⁰ Ward, ‘The Taming of the Thames: Reading the River in the Seventeenth Century’, p. 74. Italics preexisting.

Taylor acknowledged the celebratory atmosphere of the first frost fair, that is not to say his pamphlet altogether dismissed a providential reading of the winter of 1608. Specifically, Taylor takes it upon himself to admonish the behaviours of many city workers whose greed had supposedly incurred the wrath of God. The poem sequentially rebukes parsons, attorneys, usurers and brokers for their heartlessness in the face of poverty. To Taylor's dismay, this divine judgment amounted to a business boom. 'In this gnashing age of Snow and Ice,' during which time many perished for lack of heat, Taylor scorns 'the Wood-mongers did mount so high their price.' He concludes the poem on a cynical note with a further attack on profiteering:

Amongst the Whores there were hot commings in,
Who euer lost, they still were sure to win.
They in one houre so strangely did heat men,
That all the Frost they scarce were coole agen.
The Vs'rers Bonds, and Landlords Rent came on,
Most Trades had something to depend vpon;
Only the water men just nothing got,
And yet (by Gods good helpe) they wanted not:
But all had coyne, or credit, foode and fire,
And what the neede of nature did require.
So farewell Frost, if *Charity* be liuing,
Poore men shall finde it, by the rich mens giuing.¹²¹

According to Taylor, avarice was at once the origin and result of the frost. Almost eighty years later, John Evelyn issued a similarly ambivalent take on the frost which both seemed to

¹²¹ John Taylor, *The Colde Terme: Or the Frozen Age: Or the Metamorphosis of the River of Thames* (1621)

be a bacchanalia, or triumph, or carnival on the water, whilst it was a severe judgment on the land.’¹²² The duelling images of poverty and merriment inspired a cognitive dissonance amongst many writers, who failed to reconcile the moral paradox of extreme weather. One broadside ballad admires the: ‘street of booths built from the Temple to Southwark, where were sold all sorts of goods imaginable, namely, cloaths, plate, earthenware, meat, drink, brandy, tobacco, and a hundred sorts of commodities not here inserted,’ before reflecting on the public acceptability of their behaviour: ‘it being the wonder of this present age and a great consternation to all the spectators.’¹²³ The same poem that found ‘Welch men cramming toasted Cheese’ in 1684, also warns:

Hard times the good and righteous God hath sent,
For our more hardened hearts, as punishment;
From Heav’n the Scourge is sent us for our pride;
We’re plagu’d with Ice, because we do backslide.
The only way these things for to redress,
Is that each one, his Sins to God confess;
Let every one sweep clean and neat his door,
And let our hearts be softned to the Poor.
Honour the King, and all your neighbors love,
And then Heav’ns these Judgments will remove.¹²⁴

To return to the definition of climate given by Mike Hulme in the introduction, ‘there may be “good” or “benign” climates and “bad” or dangerous climates, but only in the sense that climates acquire such moral categories through human judgements – judgements that suit

¹²² E. S. De Beer, (ed.) *The Diary of John Evelyn*, 6 vols. (Oxford, 1955) vol. 4, pp. 359-366.

¹²³ Anon., *Great Britains Wonder: or, Londons Admiration* (London, 1684).

¹²⁴ Anon., *Thamasis’s advice to the painter, from her frigid zone, or, Wonders upon the water* (1684).

our convenience or our capabilities'.¹²⁵ The reason that Evelyn describes the Great Frost as both a 'severe judgement' and a 'carnival on the water' is precisely because weather confounds moral classification. As much as the Church of England attempted to cultivate a dominant reading of nature, the same interpretations are as unsteady as the confessional divides they purported to uphold. To return to Edward Winslow's interpretation of Native American weather magic, when do 'soft, sweet, and moderate showers' become 'stormes and tempests'? The answer depends on human judgement, Hulme contends, but more specifically to the early modern period, the interpretation of 'good' and 'bad' weather was subject to confessional ideology.

This idea is neither specific to the early modern period. Though it might seem an intellectual stretch to compare our current environmental circumstances with the past, it is useful to reflect on the commonalities between these two distinct historical moments. In the same way that anthropogenic climate change forces a re-evaluation of day-to-day practices and efforts at living sustainably, peccatogenic beliefs encouraged a similar vigilance. 'Unlike the sins against the environment in our own age, which are blamed for nature's punishment or even "revenge"', Behringer describes how 'theologians of the sixteenth and seventeenth centuries expected punitive action on the part of a personal God.'¹²⁶ In his *Cultural History of Climate*, Behringer refers to the same tendencies as 'sin economics'. Like the 'peccatogenic outlook' envisaged by Parker, Behringer argues that 'early modern theologians of every denomination interpreted climatic extremes, hailstorms, floods, harvest failures, pestilence, shortages and hunger crises as God's punishment for man's sins.'¹²⁷ 'Sin economics' is used by Behringer to indicate a scale on which sin was proportionate to its punishment. Behringer

¹²⁵ Mike Hulme, *Why We Disagree About Climate Change: Understanding Controversy, Inaction and Opportunity* (Cambridge, 2009), p. 3.

¹²⁶ Wolfgang Behringer, *Cultural History of Climate* (Cambridge, 2010), p. 133.

¹²⁷ *Ibid.*

argues that this mode of thinking emerged in early modern theology as an attempt to ‘convert the classical argument of divine retribution into a system of constantly updated calculation.’ It was through these loosely defined ‘sin economics’ that Behringer describes how meteorological events acquired their social significance in the period. By this logic, every disturbance in nature was the result of some moral transgression: ‘the greater the sins, the greater the punishment’, as Behringer puts it. Peccatogenia (or ‘sin economics’) comprised a cognitive agenda that not only acknowledged causal reciprocity between human action and climatic feedback but the explicit culpability of human sin or transgression. As a cosmological framework for human behaviour, the ubiquity of providential belief did not, however, cultivate consensus. Providence did represent an ‘ingrained parochial response to chaos and crisis,’ though this response was mediated and disseminated from above.¹²⁸ If peccatogenia did consist of a framework that explained climatic change, it was far from consistent. Providence promoted a divisive interpretation of climate, which was entirely subject to the prevailing political and ecclesiastic culture of the time.

¹²⁸ Walsham, *Providence*, p. 3.

CONCLUSION: HUMANISING CLIMATE

As I was writing the conclusion to the thesis in mid-April 2019, it was at the end of the most significant environmental demonstration in the history of the United Kingdom. Extinction Rebellion, hereafter XR, had occupied the centre of London: public transport was brought to a halt in many places, schoolchildren abandoned their classes, Waterloo Bridge was blockaded, and activists glued themselves to places of interest. Further strikes had been threatened and there were rumours that Heathrow Airport would be the target of XR's next protest. By the end of the 11 day protest, a total of 1,130 people were arrested.¹ In the immediate aftermath of the demonstrations, the political impact of the demonstrations was limited. The precocious Swedish activist Greta Thunberg was invited to address members of parliament during the strikes, but the urgent demands made by XR were dismissed as naive and unrealistic. While it may be 'too soon to say', as Zhou Enlai said, how effectively this mass demonstration will inspire change, the fact remains that for better or worse the movement ignited a conversation about climate change which had been confined to academic and scholarly corridors. Though climate 'awareness' appears the kind of gnostic, pithy saying that a radical movement like XR would instinctively abhor, the significance of the dialogue initiated by these protests and the historical moment represented by 2019 should not go unrecorded.

The historical, environmental and political context in which this thesis was written has shifted dramatically since the first inception of the project in September 2015. The work was conceived as a chance to evaluate the changing definition of climate during a period commonly recognised as a period of meteorological instability. A lot has changed since 2015:

¹ Ella Willis and Olivia Tobin, 'Extinction Rebellion activists gather in Hyde Park to mark end of disruptive protests with "closing ceremony"', *London Evening Standard*, 25 April, 2019. Accessed 5 May, 2019. <<https://www.standard.co.uk/news/london/extinction-rebellion-protesters-gather-in-london-to-mark-end-of-demonstrations-with-closing-ceremony-a4126796.html>>

the United Kingdom voted to exit the European Union, Donald Trump was elected President of the United States of America, and the rise of countless far-right movements across the world have destabilised national and environmental priorities. The Paris Agreement (2016), a flimsy, legally non-binding treaty criticised by many environmentalists had at least seemed to reach a kind-of global consensus – until President Trump announced his intention to withdraw from the agreement as soon as possible. One thing is clear: the idea of climate is more polarised than ever. Though climate change has always acted as a political football between left and right, the rhetoric which characterises ‘discussions’ of climate change is marked by open hostility between rival camps. Even the language of climate change itself has evolved to mirror this tension. Shortly after the XR demonstrations, *The Guardian* made the editorial decision to start using ‘climate crisis, emergency or breakdown’ in place for ‘climate change’. Editor-in-chief, Katherine Viner explains ‘the phrase “climate change”, for example, sounds rather passive and gentle when what scientists are talking about is a catastrophe for humanity.’² Around the same time, Jeremy Corbyn, Labour Leader of the Opposition, urged the House of Commons to declare a ‘climate emergency’, stating: ‘we are living in a climate crisis that will spiral dangerously out of control unless we take rapid and dramatic action now.’³ On the opposing aisle of the climate debate are those who denigrate activists as po-faced, self-important, middle-class, university-educated Corbynistas. In an interview with a participant in the XR protest, the Sky News anchor Adam Boulton accused his guest of ‘fascistic obstruction’. He confronts the activist as one of many ‘incompetent middle-class, self-indulgent people’ who ‘want to tell us how to live our lives. That’s what you are, aren’t

² Damian Carrington, ‘Why the Guardian is changing the language it uses about the environment’, *The Guardian*, 17 May, 2019. Accessed 1 June, 2019. <<https://www.theguardian.com/environment/2019/may/17/why-the-guardian-is-changing-the-language-it-uses-about-the-environment>>

³ Peter Walker, ‘MPs endorse Corbyn’s call to declare climate emergency’, *The Guardian*, 1 May, 2019. Accessed 1 June, 2019. <<https://www.theguardian.com/environment/2019/may/01/declare-formal-climate-emergency-before-its-too-late-corbyn-warns>>

you?’⁴

Amidst the cacophony of denial and petty name-calling, it seems that no common ground can be found in an endless debate filled with straw men, non-sequiturs and ad hominem attacks. It is easy to feel disillusioned, as many do, by current inaction and to question the vitality of the humanities and history in a post-truth, post-Trump, post-Brexit world. From the beginning of this thesis, I have made clear that the humanities – more specifically histories – cannot subscribe to a scientific or statistical understanding of climate if they are to reconcile the ethical and creative challenges posed by climate change. Nor can we imagine that history offers unheralded or overlooked solutions to our contemporary crisis. What history can show us, however, is the germination and evolution of this conflict over multiple centuries.⁵ ‘Climate change’ might not have existed as either a rhetorical or material reality in the early modern period, but the same recurrent anxieties around health, identity and politics characterise historical discussions of climate.

To draw genuine insight between these two historical epochs, the early modern past and the contemporary world, we return to question the social meaning of climate. In the introduction to this thesis, I argued that our conversations about climate reveal so much more than daily weather predictions. The reason that protestors incite such levels of fury is little to do with the scientific fact of climate change. Since the origins of the modern environmentalist movement, mention of climate change as a global threat has been interpreted as an attack on

⁴ Andrew Griffin, ‘Sky News’ Adam Boulton accuses climate protesters of “fascistic disruption”, *The Independent*, 19 April, 2019. Accessed 1 June, 2019. <<https://www.independent.co.uk/news/uk/home-news/extinction-rebellion-protests-sky-news-adam-boulton-climate-change-london-traffic-a8877921.html>>

⁵ A similar point is made by ecocritical scholars, including Marcus Rockoff and Simon Meisch, who pronounced that: ‘Dealing with early modern literature cannot provide today’s contemporaries with practical or normative knowledge of action. But they can irritate those societal and epistemic models perceived as self-evidently given and thereby make them visible and disputable.’ Marcus Rockoff and Simon Meisch, ‘Climate change in Early Modern literature: Which Place for Humanities in the Sustainability Sciences?’, *Ethics of Science in the Research for Sustainable Development*, (ed.) Simon Meisch, Johannes Lundershausen, Leonie Bossert and Marcus Rockoff (2015), pp. 269-298, p. 291.

individual lifestyles and choices. Adam Boulton's blustering rebuke of a peaceful protestor masks a deep insecurity held by many. Ultimately, climate change represents an intervention in 'how to live our lives.' But the threat of climate change and the idea of 'climate' is not the product of one's individual actions; it is the result of culturally entrenched ideas about the environment which can be only understood by looking deep into the past.

The title of this conclusion, *humanising climate*, represents the broadest aim of this thesis: to explore the social and cultural meanings of climate in a period when ecological agency was only vaguely understood. This is a human history, not a statistical dataset. Even when historians defend against a determinist critique, their work can perpetuate culturally specific ideas of calamity and impending crisis. A recurrent criticism of the climate change movement is based on the inscrutable and abstract nature of 'climate change'. Because of this inscrutability, activists and historians often cast the idea of climate as a disembodied, malevolent entity. In contrast, this thesis has shown how the experience of climate was transactional and embodied. What happened in the macrocosm was reproduced in the microcosm, and *vice versa*. Daily practices mediated the experience of climate: through sensorial encounters with diverse airs, domestic creativity and gardening, prayer and worship, travel and diet. Structured according to five interconnected themes, this thesis has critically examined the cultural history of climate in early modern England. As a result, it has not offered a linear understanding of climatic changes over time or a causal argument linking social change and climatic fluctuations. Using a collection of sources usually ignored by environmental historiography, it has instead elucidated the dominant myths and narratives that contribute to the historical idea of climate. Referencing pre-existing narratives from religious, cultural, environmental and colonial history, the work has revealed the otherwise forgotten role played by climate in the social, political and cultural lives of Englishers. It has shown

how climate was positioned at the centre of early modern debates around human, environmental and divine agency and has evidenced the manifold ways in which Englanders sought to mitigate these competing factors. The insights gained can be summarised as follows.

In chapter one, we learnt that rather than deriving from meteorological instruments, a consensual idea of climate was forged around the four humours. The beginning of the chapter focused on the intriguing early history of the thermometer; an invention beset by epistemological and operational problems since its first invention. Using the thermometer as an emblem of this conundrum, the chapter showed how the enduring influence of Galenic and Hippocratic theory continued to signify the primary lens whereby physicians and natural philosophers understood changes in temperature. Through the matrix of humoral medicine, the role of the individual will was dwarfed by a concept of environmental agency which ascribed bodily and metaphysical changes to delicate changes in the atmosphere. It examined a body of popular health regimens from the period to demonstrate how climate became entangled in a medical culture that was already predisposed to fears of airborne contamination and disease. As the chapter goes on to explain, this bred competing anxieties about the mental and physical condition of the English in the context of changing weather. Significantly, the chapter also suggested a modified understanding of early modern England's emotional landscapes and the seasonal rhythms which were thought to induce melancholy.

The second chapter introduced a new understanding of pre-modern pollution by collapsing the modern distinction between cultural and environmental pollution. The chapter questions current understandings of the history of pollution and the tendency amongst historians to ignore pre-modern conceptions of climate, urbanisation and atmospheric change. It summarised the etymological and legal evolution of 'pollution', which was originally tied

to notions of individual morality and was used in a wider legislative context in cases against adultery, murder and sacrilege. As well as critiquing John Evelyn's attempt to cleanse London's air as a form of social engineering, the chapter provided an overview of pre-modern pollution and its supposed effects. Using Mary Douglas and Aaron Wildavsky's definitions of technical and non-technical pollution as a starting point, 'organic pollution' was used to describe the diverse effects that human exhalations had on air quality. It found that as well as smoke, behaviours disregarded by environmental historians, including the effects of passive smoking, swearing and halitosis, were conceived of and treated as pollutants. By analysing a handful of contemporary warnings on the dangers of smoking and passive smoking, the chapter found clear figurative parallels between public and private health. Debates around smoking represented wider concerns about the susceptibility of the English constitution to foreign vice: i.e. the threat of non-native ingredients and fears of ethnic transformation.

The third chapter explored how fears of pollution and extreme weather affected the configuration of the early modern home and garden. The chapter extended existing knowledge of pre-modern green infrastructure and gave new evidence to detail early attempts at mechanical air-conditioning. Along with the 'organic pollution' previously described, the chapter gives a sense of the manifold situational concerns which influenced ideas of climate in early modern England. Herbals and botanicals are used extensively throughout the chapter to examine the everyday attempts to alleviate pollution, plague and other unwanted miasmas. The garden is foregrounded as a primary site of environmental mitigation, concentrating on the specific and underrepresented expertise of women in a horticultural context. Whereas John Evelyn, John Beale, and contemporaries from the Hartlib circle are often identified as the progenitors of environmentalism, this chapter argued that their ideas were simply larger manifestations of domestic practices and knowledge usually associated with women. The

chapter moves on to consider various other architectural changes made in the context of the so-called 'Great Rebuilding' which were concomitant with the stresses caused by the English climate. The advent of modern glassmaking techniques and indoor heating are factored into a broader discussion about 'selective design' in early modern England. Finally, the chapter uncovered a hitherto unacknowledged premodern history of air conditioning in England. These primitive, early attempts at manufacturing a temperate indoor climate were pioneered by members of the Royal Society and also the natural-philosopher-cum-occultist Cornelius Drebbel, who first conceived of a method for renewable energy spurred by London's unwholesome smoke.

During the penultimate chapter, the role of climate in determining England's national identity and the success of colonial prospects was examined. Concurrently, the chapter raised the gendered implications of persistent cold and referenced anxieties of sexual transformation. Original geographical works and voyages to the New World had undermined the fallacious estimations of ancient philosophers who predicted that new overseas colonies would be physically intolerable. New theories of climatic influence openly denied the characterisation of the English climate as barbarous and uncivil, instead forging a new Anglocentric hierarchy of complexion that revolved around a resilient, intrepid idea of Nordic identity. The chapter evidenced the multitude of ways that the idea of climate was manipulated to bolster a new definition of English identity as well as claims to territories abroad. It showed how climate was interpreted in a socially divisive context: to signify cultural and ethnic difference before the advent of modern racism. The division of labour in the New World followed ideas espoused by new English geographers and colonists, who supposed that black bodies were naturally inclined to manual work in hot climates.

The final chapter illuminated a religious history of climate in post-Reformation

England. During a period of confessional conflict, it showed how ecclesiastical authorities fashioned a 'peccatogenic' interpretation of climate to castigate confessional enemies and social deviants. The influence of both Luther and Calvin are examined, as well as the legacy of pre-Reformation practices. Though weather rituals had been mostly expunged from the liturgical calendar by the late-sixteenth century, the Church of England endorsed the continuing worship of climate in several new devotional formats. As well as the weather prayers and prayers for atonement referenced toward the beginning of the chapter, the latter half of the work analysed moments of public worship, atonement, and thanksgiving in the face of extreme weather. Two case studies are analysed in detail: the so-called 'Protestant Winds' of 1588 and 1688. In both instances, English Protestants memorialised their God-given climate which had driven away the Catholic scourge. In the reproduction of medallions, ballads and poems, the 'Protestant Wind' became a national myth that transcended the early modern period. Finally, the chapter considers the ambiguities of public worship in moments of climatic adversity. Though providence constituted the dominant reading of climatic events in the period, reactions to state sanctioned fasting during drought or 'bad weather' could be muted. Though providential readings of nature could ignite a sudden zeal within a town or city, they could also inspire ambivalence and inaction. This antagonism is the subject of the final section of this chapter, which uses the famous Thames Frost Fairs as an example. Despite many pamphleteers regarding their weathers as a warning from God, the Frost Fairs were famous as sites of revelry and bacchanalian indulgence. Reaction was characterised by an acute cognitive dissonance between a 'peccatogenic' interpretation of God's wrath and hedonistic pleasure-seeking. The providential reading of these events was unanimous, though the public reaction was divided.

Aside from the themes that have been already assessed in great detail throughout the

main text, two ideas have occupied the background of this thesis. The first is based on the uniqueness of English attitudes to climate and the environment; the second raises the question of chronology and the early modernity of 'climate'. To tackle this latter point first, it is worth bringing attention to the disproportionate weight of environmental history which is constricted to the modern period. As suggested in chapter two, debates around pollution, fossil fuel usage and respiratory health have been almost entirely confined to the nineteenth-century onwards. If not for the recent work of William Cavert and older scholarship by Peter Brimblecombe, the history of early modern pollution would have been all but ignored. More broadly, the environment and climate in particular, is considered a condition of modernity. Most works on climate history orient their chronology after the Enlightenment for good reason: this was a period in which humanity self-consciously defined itself as an agent of environmental change. The 'age of improvement', as it is sometimes called, ushered a new understanding of man's relationship with nature.⁶ To generalise, older ideas of environmental custodianship were replaced with a retrospectively harmful idea of 'improvement'.

Deforestation, urbanisation, industrialisation and pollution defined this age, as industrialists and politicians imagined the social and fiscal profits of rapid environmental change. This is also the period which is commonly identified as the start of the Anthropocene: a period when humanity established itself as a geological agent. Though this thesis has not been concerned with disputing the chronology of the Anthropocene, it does raise questions about the underrepresentation of the early modern period in environmental historiography. It is often believed that concern for the 'environment', as well the term itself, is a distinctly modern phenomenon. As this thesis has made clear, this was most certainly not the case. Though a definitive vocabulary of environmentalism had yet to emerge, early modern

⁶ See Asa Briggs, *The age of improvement, 1783-1867* (London, 1959)

concepts of sustainability were scattered throughout daily life. During this period, the post-Enlightenment, post-Cartesian man-environment dualism had yet to overcome a view of nature which was structured around balance and reciprocity. This thesis challenged the chronology of this process, extending our understanding of environmental and climatic attitudes beyond modernity. Simultaneously, it has not attempted to construct a new teleological understanding of climate. On the contrary, I have argued that the many contexts in which climate was negotiated reveal a fractured and fluctuating idea of environmental influence.

The second reason that historians have tended to structure their work around modern history has been alluded to throughout this thesis: the availability of sources. One of the defining goals of this thesis has been to reconstruct a pre-modern idea of climate before the arrival of discernibly ‘modern’ instrumentation and standardised weather measurements. In the first chapter, I was critical of the limitations of seminal datasets, including Gordon Manley’s CET which can only provide a statistical representation of climate from 1659 onward. For modern historians, no such limitations affect their scholarship. The ensuing boom of popular meteorology in the centuries following the end of this study has produced an unlimited resource of weather-diaries, personal almanacs and official weather records for the modern historian. The lack of ‘traditional’ sources of documentary evidence for the early modern period has allowed this thesis to go beyond comparable studies of climate history, to look for the climate in culture.

This study has not been without its limitations. The subject at hand permits a broad overview of many disparate historiographies, considering that no such attempt at a similar cultural history of climate in early modern England has been attempted. As argued throughout the introduction and chapter one, the range of sources pertaining to climate is often limited to

printed material and works that would have not been readily accessible to lower-born citizens. Geographically, this thesis is confined to England. Scotland, as well as Ireland, are mentioned in passing, though there is an overriding sense of Anglocentricism in the sources consulted. Though climate change warrants a historical perspective beyond national borders, the uniqueness of England is worth acknowledging in this story. The subsequent colonisation and imperial domination of the ‘New World’ was also justified on the grounds that the Anglo-Saxon body was imbued with a constitution which made it fit to rule over the immoderate environments of India, North America and Australia.⁷ Though other European countries vied with the similar climatic conditions in their pursuit of overseas colonies, the ideological precepts of their missions differed greatly. At the same time, this is not to say that other national responses to climatic change are not worth studying. In the recent historiography of climate, there has been a shift toward a comparative European perspective on the Little Ice Age, though this is clearly a fertile ground for further research.⁸ Though this study has emphasised England’s unique situation, there are doubtless opportunities to conduct a similarly structured analysis of other European nations in the throes of social, religious, and territorial change.

The history of climate in early modern England, let alone the early modern world, is by no means complete. As evidenced by the recent works referenced throughout this thesis, it is written during a time of revival for environmental history in the early modern period. Along with the newer works referenced throughout the main text, this thesis has argued for a reformulation of climate in history. From the divine to the mundane, this thesis has explained the multiple contexts in which climate was discussed and managed. It has acted to show the

⁷ Mark Harrison, *Climates & Constitutions: Health, Race, Environment and British Imperialism in India, 1600-1850* (Oxford, 1999)

⁸ John Morgan and Sara Migletti's (ed.) *Governing the Environment in the Early Modern World* (2016); Wolfgang Behringer, *A Cultural History of Climate* (Cambridge, 2010).

diverse intersections between daily life and the idea of climate that has been hitherto unappreciated in environmental and cultural histories of early modern England. Working between the gaps of these two historiographies, it has identified a corridor of undisclosed conversations about climate that have had a tangible impact on political decision making and daily life. The physical impact of climate on history has been discussed *ad infinitum*, yet the idea of climate and its multiple contexts has eluded mainstream historical discussion until comparatively recently. It is time for our histories to reflect a holistic idea of climate: the discussions, debates and denial that characterised and continue to characterise this changing idea.

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