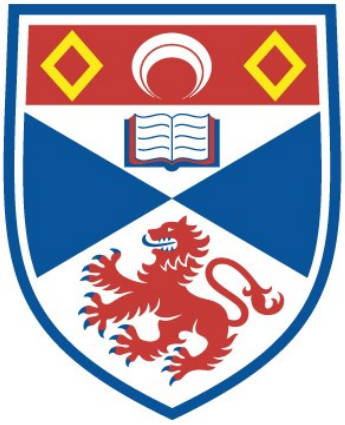
# DIVERGENT TIMESCAPES:
## TRACKING A TEMPORAL REVOLUTION THROUGH THE LONG NINETEENTH CENTURY (1750-1914)

Marie Jeanette Ventura

A Thesis Submitted for the Degree of PhD
at the
University of St Andrews



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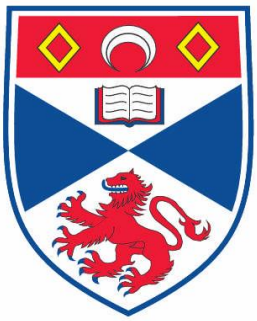

This thesis is submitted in partial fulfilment for the degree of PhD

at the University of St Andrews

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# TABLE OF CONTENTS

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# PROJECT ABSTRACT

Did nineteenth-century Britain experience a temporal revolution? If so, how can the course and impact of such a complex, primarily mental upheaval be effectively analyzed from a focused, historical perspective?

This project investigates these questions from eight distinct angles by adapting the physics notion of *timescapes* as a method of historical analysis. Each of the four main chapters focuses on two contemporaneous, yet differing temporal worldviews (*timescapes*), defining their nature and attributes then investigating key catalytic conflicts that fed the transition from one prevailing temporal outlook to another. Drawing on primarily British and American sources, the aim is to demonstrate, not only the ongoing significance of the nineteenth century's temporal revolution, but also the viability of *historical timescapes* as a methodological, structural, and analytical tool – one that can complement, rather than displace, the traditional chronological structure of history.

Ultimately, this project argues that Britain's nineteenth-century temporal revolution was not indicative of a sharp, irreversible break in linear time between the pre-industrial and industrial world but, rather, of a multi-phased, ongoing conflict between layers of coexisting yet divergent *timescapes*: culturally informed spatiotemporal archetypes that, once supplanted, did not fade but continue to influence our current experience, use, and expectation of time.

## INTRODUCTION: TEMPORAL REVOLUTIONS

Of all the revolutions that convulsed nineteenth century Europe, the temporal revolution must rank as one of the most significant, and most overlooked – particularly in the field of history. Taking place between the dawn of the industrial revolution and the outbreak of World War I (roughly 1750 to 1914), this primarily mental upheaval witnessed the advent and eventual assimilation of mechanical, industrial time into the structure, rhythms, and pacing of daily life: a deep, perceptual transition that fundamentally altered Western society's relationship, expectation, and experience of time and timekeeping. As it advanced from stage to stage, generation to generation, this layered revolution transformed the preconceived shape of time: the observed cycle of the seasons and the motions of heavenly bodies were contrasted with abstracted, isochronous beats of mechanical timekeepers; the short biblical timescale juxtaposed against the vast expanse of time required for geological and evolutionary change; synchronized time zones overlaid with myriad, subjective layers of individual temporal experience. Each stage, each conflict, had direct and life-altering effects, forcing significant changes in how people thought and communicated, how they traveled, worked, played, experienced, scheduled, and timed their lives. This development has long been acknowledged by scholars, but the transition from a pre-modern to a modern temporal outlook is still most often cited in history texts as a piggyback issue, riding the coattails of the industrial revolution, urban development, and globalization or appearing as an element of other topics, such as nineteenth-century scientific development, class struggle, or gender related issues.[1]

[1] The following is a brief cross-section of a much more expansive list of detailed, diverse works featuring time as a piggyback issue rather than a specific object of historical investigation: Judy Lown, *Women and Industrialization: Gender at Work in Nineteenth-Century England*, (Cambridge, 1990); Maxine Berg, *The Age of Manufacturers, 1700-1820: Industry, Innovation, and Work in Britain*, (London, 1994); Tom Standage, *The Victorian Internet: The Remarkable Story of the Telegraph and the Nineteenth Century's Online Pioneers*, (London, 1998); Frank McKenna, *The Railway Workers 1849-1970*, (London, 1980); Rosemary Sanderson, *The Herring Lassies: Following the Herring*, (Banffshire Maritime Heritage Association, 2008), e-book; Helen Clark and Elizabeth Carnegie, *She Was Aye Workin': Memories of Tenement Women in Edinburgh and*

This project aims to bring the temporal revolution to the forefront of historical analysis for this period, showing that beyond the inauguration of reliable maritime chronometers, factory clocks, train schedules, and burgeoning international time zones lies a fundamentally human story of deeply layered conflicts that has yet to be fully explored through its own lens as a distinctive historical topic. It supports the argument that *nineteenth-century Britain experienced a temporal revolution and that, rather than being indicative of a sharp, irreversible break in linear time between the pre-industrial and industrial world, this temporal revolution can be described in terms of a multi-phased, ongoing conflict between layers of coexisting, yet divergent, timescapes.*

## *REVOLUTIONS OF THE MIND?*

Unlike the American or French Revolutions or, indeed, any other political revolution, the temporal revolution did not take place on a battlefield, or erupt in the streets, inciting rippling cascades of violence. It did not evoke patriotic fervor, utopian dreams, or the nobility and tragedy of young soldiers and quibbling politicians. This revolution, which this project aims to trace and reconstruct, took place in the minds of individuals, the upheaval leaving their everyday understanding and experience of time profoundly and permanently transformed. Although it did have its own heroes and villains – its idealistic leaders and perceptive planners, stalwart opposition and defiant speechmakers – even they were not fully aware of their role in what was, essentially a hidden, almost silent revolution: a fundamental transitional shift in thought, mentality, understanding, experience, and expectation that cast its subtle, pervasive influence on almost every facet of daily life, from work habits to sleep

*Glasgow,* (Oxford, 2003); JoAnne Weisman Deitch, ed, *The Lowell Mill Girls: Life in the Factory*, Second Edition. Perspectives on History Series, (Carlisle, 1998).

patterns.[2] But, if this is an invisible revolution, a revolution of the mind, how can we tell it was a real event and not a construct of historical hindsight?

Reflecting back on the twentieth century from the turn of the millennium, historian Felipe Fernández-Armesto noted a "great upheaval" in the way modern science has come to represent time, and the subsequent effects that new representation has had on historians. He dated the upheaval to 1905,

> when Einstein emerged, like a burrower from a mine, to detonate a terrible change. The realisation that time is not objective or absolute, but that every observer has his own time, which varies according to his speed and vantage point…had a belittling effect on the kind of chronological researches in which historians traditionally engaged. The fashion for experimentation with chronology – or perilously neglecting it – is among its liberating or confusing effects…The order in which we perceive events – and therefore the structure of cause and effect we infer from this order – is negotiable.[3]

Yet, in 1882, science author Grant Allen made a comparable assertion regarding the impact Charles Darwin's work made on evolution several decades before:

> In 1859, the *Origin of Species* at last appeared... It was nothing less than a revolution; it marks the year 1 of a new era, not for science alone, but for every department of human thought… [I]n its immediate influence upon the world the *Origin of Species* was the real proximate cause of the great mental revolution of the present century. There were many auxiliary forces, but Darwin was the general who led them to victory… [T]he influence of his thought upon the thought of the age has far outweighed any influence ever before exerted by a single man during his own lifetime. He has revolutionised, not biology alone, but all science; not science alone, but all philosophy; not philosophy alone, but human life. Man, his origin and nature, his future hopes and realisable ideals, all seem something different to the present generation from their seeming to the generations that lie behind us in the field of time.[4]

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[2] Such leaders, their causes, conflicts, and continuing influence will be examined in later chapters. They include John Harrison, Charles Darwin, Charles Dickens, W.F. Allen, and Albert Einstein. Regarding changing sleep patterns: A. Roger Ekirch, "Sleep We Have Lost: Pre-Industrial Slumber in the British Isles," *The American History Review*, Vol. 106, No. 2, (April 2001), pp.343-386.

[3] Felipe Fernández-Armesto, "Time and History," in *The Story of Time*, edited by Kristen Lippincott, et al., (London, 1999), p.249.

[4] Grant Allen, "Obituary: Charles Darwin," *The Academy*, Vol. 21 No. 521 (29 April, 1882): pps.306-7, at John van Wyhe, *The Complete Work of Charles Darwin Online*, http://darwin-online.org.uk/, (last accessed 28/3/15).

And, H.G. Wells described the transitional mentality of his time in 1901: "It is as if a hand had been put upon the head of the thoughtful man and had turned his eyes about from the past to the future."[5]

In each of these passages, these very different authors from very different times describe a very similar paradigm shift: a socio-temporal transition that is often alluded to but rarely discussed directly or at length by historians. According to Allen, this "mental revolution," was so powerfully uprooting, it detached the present worldview from that of the past, thereby resetting the clock of Western intellectual progress to "year 1," starting with the publication of Darwin's book.[6] Fernández-Armesto cast Einstein as a mold-shattering revolutionary, exploding the comfortable, chronological structure of history and leaving historians scrambling after the scattered pieces. Yet, while Darwin may have been a general, and Einstein the physics equivalent of a rock blaster, each was just one leader in a vast mental revolution that had been transforming Britain's relationship with time since the emergence of consistently reliable mechanical timekeepers, a revolution often intuited by reflective authors like Wells, but never explicitly defined: the temporal revolution.

Revolutions are generally triggered by some level of dissatisfaction with the way things are, and all revolutions result in a shift in mentality among the affected populations. This project endeavors to demonstrate that, despite the numerous shifts in mentality and outlook that took place during the temporal revolution, previously dominant *timescapes* do not disappear once they have been superseded by a contrasting temporal paradigm. They carry on, influencing a population of increasingly diverse ideas, truths, and worldviews that often refuse to mingle, resulting in a stew rather than a melting pot of temporal perspectives.

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[5] H.G. Wells, *Anticipations of the Reaction of Mechanical and Scientific Progress Upon Human Life and Thought*, (London, 1902), http://www.gutenberg.org/files/19229/19229-h/19229-h.htm (last accessed 28/3/15).

[6] Allen, "Obituary," pp.306-7.

Time goes on after paradigms change, leaving adherents to earlier temporal worldviews with a strange, transitional sense of transcendental homelessness. And it is here, at these vital, transitory moments of self-reflection, where sources can be found – sources that find their authors asking: Now what? How are we supposed to think? Who are we supposed to be?[7] Such sources must be individuals because, ultimately, it is their minds that are being changed through direct experience with the paradigm-shifting catalysts, whether it be a new publication endorsing evolutionary over biblical time, leaving a traditional agricultural community for a factory job in the city, or experiencing train travel for the first time.[8] But, can a long-term series of predominantly mental paradigm shifts, no matter how fundamentally life altering, be called a revolution, or is that stretching the term too far?[9]

Arno Borst challenged the notion of a temporal revolution, arguing that the changes in the European concept of time that began in the eighteenth century "were too uneven, too slow in forming, to be described as part of a revolution."[10] Similar criticism has been applied to the term *industrial revolution* and its stages.[11] But, even if the changes were slow to be

[7] This is evidenced in a wide range of contemporary writings, for example, the self-reflective works of Charles Dickens, H.G. Wells, and Virginia Woolf: Charles Dickens, *Selected Journalism 1850-1870*, (London, 1997); Wells, *Anticipations,* http://www.gutenberg.org/files/19229/19229-h/19229-h.htm (last accessed 28/3/15); Virginia Woof quoted in Philipp Blom, *The Vertigo Years: Europe, 1900-1914*, (New York, 2008), p.277.

[8] All of which will be discussed in detail in Layers One to Four.

[9] Studies have argued revolutions are much more than quick, convulsive disruptions. They also include periods of adaptation and continuity, bridging and grounding the more violent jolts – periods that require a wide-angled, telescopic lens to observe and trace. For example, François Furet argued the French Revolution, which erupted in 1789, took approximately a century to conclude, writing: "only the victory of republicans over monarchists in 1876-7 provided modern France with a regime that established in lasting form the full range of the principles of 1789…By establishing the state, through universal suffrage in the name of the equality of its citizens, the republicans of the 1870s managed to entrench the law on a lasting basis in the sovereignty of the people. Thus they at last completed the task begun in 1789," while Foucault advocated the adoption of "sufficiently broad fields and scales that are chronologically vast enough" to provide a broad perspective of past and prevailing scholarly discourse on historical topics. See: François Furet, *Revolutionary France: 1770-1880*, (Oxford, 1993), pp.ix-x; Michel Foucault, *The Archaeology of Knowledge*, translated by A.M. Sheridan Smith, (London, 2004), p.33; Charles Tilly, *European Revolutions, 1492-1992*, (Oxford, 1993).

[10] Arno Borst, *The Ordering of Time: From the Ancient Computus to the Modern Computer*, (Chicago: 1993).

[11] Even *industrial* has been disputed as an adequate descriptor of this heavily multilayered upheaval. In *The Industrious Revolution: Consumer Behavior and the Household Economy, 1650 to the Present*, Jan de Vries examines what he terms a "background" revolution in "household behaviors" – an *industrious* revolution that

widely acknowledged, I would argue that the impact of these new ideas and new experiences of industrialized time on people's lives and ways of thinking was immediate and jarring, even revolutionary, on a personal level – an argument repeatedly borne out by primary sources.[12] Thomas Kuhn argued any new theory – scientific, industrial, temporal, or otherwise – is "seldom or never just an increment of what is already known. Its assimilation requires the reconstruction of prior theory and the re-evaluation of prior fact, an intrinsically revolutionary process that is seldom completed by a single man and never overnight."[13] Therefore, in this context the term *temporal revolution* can be used to indicate those jarring, worldview-altering shifts in the general population's use and understanding of time that piggybacked the multi-phased industrial revolution.

Yet, even if these shifts can be fairly termed *revolutionary* and both primary and secondary literature indicate the temporal revolution to be a real event with significant and lasting effects, how can historians expect to identify and trace its development?

## *TIMESCAPES I: A FLEXIBLE ANALYTICAL FRAMEWORK*

One of the most persistent challenges facing this project has been how to approach and frame a topic as intricate and expansive as the temporal revolution: how to trace a predominantly mental revolution and find relevant primary source examples left by the people who lived through it; how to organize the project effectively without constantly having to backtrack or make awkward temporal jumps to track and explain concurrent developments; and how to

stretched from 1650-1850, a period "spanning the British Industrial Revolution and the French and American political revolutions." The long timespan allows the author to trace, compare, and contrast consumer behaviors in different phases of the long-term development of industrial society. Jan de Vries, *The Industrious Revolution*, (Cambridge, 2008), p.x.

[12] As will be seen in all four chapters of this project.

[13] Thomas S. Kuhn, *The Structure of Scientific Revolutions, Third Edition*, (Chicago, 1996), p.7.

avoid losing the thread in the convoluted historical tapestry woven by contemporaries and subsequent historians. Because of the topic's complexity, I decided the most effective approach would be to investigate the nineteenth-century temporal revolution, not as a timeline, but as a spectrum of *timescapes* organized, not strictly by chronology, but by theme.

But, what is a *timescape*? How do *timescapes* relate to the familiar historical timeline? And, if *timescapes* can effectively structure an investigation into the temporal revolution, could they be beneficially adapted to other historical investigations?

In this project, *historical timescapes* are defined as culturally informed spatiotemporal archetypes: time-based paradigms, or worldviews, specific to a historical period, group, or individual that, once supplanted, did not fade but continue to influence the contemporary experience, use, and expectation of time. Each of the project's four main chapters, or overlapping layers, identifies then investigates two divergent, yet concurrent, *timescapes* and key catalytic conflicts that fed the transition from one temporal outlook to another: conflicts that characterized contemporaries' changing concept, experience, expectation, and practical use of time. I labeled these transitions: Seasonal to Mechanical; Retrospective to Progressive; Private to Public; and Sequential to Simultaneous.[14]

Time is a subtle, if omnipresent, agent intrinsic to how we experience and recount our history. The familiar metaphor of time as a river, or current, illustrates the perceived unidirectional effects of time, buoying our history and moving it forward while whittling away at our lives, just as flowing water patiently erodes the landscape. And, just as shifting *landscapes* can influence the local development of a culture or society, this project will demonstrate that shifting *timescapes* can also have great effects on a society's attitudes toward each other, ideas, and the larger world. Different *landscapes* influence how people

[14] This will be discussed in detail in the section "Navigating Scales," starting p.26.

live: the structures they build, the crops and livestock they produce, their relationship to their environment and their neighbors. Different *timescapes* influence how people think: how they understand and use their time and how they respond to new technologies and ideas.[15]

There is a concept in relativity theory called *Eigenzeit*, or Proper Time: the notion that every individual, clock, or system possesses its own, unique experience of time.[16] This experience is not a constant, shared by everyone, but singular and relative to all others.[17] For example, a measured duration of exactly fifteen minutes may seem an eternity to a patient in a hospital's waiting room, but a mere instant to an overworked nurse.

I argue this individualized experience of time also applies to history. Individuals, cultures, entire civilizations experience time in their own unique way, relative to all others. Time itself may be ubiquitous, but the experience of time is dependent on deeply embedded socio-cultural attitudes that are not constant the whole world round.[18] This is one aspect of the notion of the *historical timescape* put forward in this project. But, to be a practical analytical tool, such abstract, experiential concepts must have the ability to be visualized and

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[15] British physics writer Paul Davies wrote: "Just as we can survey space as a landscape [a physical environment] spread before us, so we can survey time (in our mind's eye at least) as a *timescape* timelessly laid out." Paul Davies, *About Time: Einstein's Unfinished Revolution*, (London, 2006), p.72.

[16] Albert Einstein, *The Meaning of Relativity Third Edition, Including The Generalized Theory of Gravitation*, (Princeton, 1950), p.1.

[17] According to Davies, Einstein and Minkowski's notion of "Block time [four-dimensional spacetime] suggests we represent time after the fashion of space... [Einstein's] theory of relativity interweaves space and time in a rather precise and intimate way," as it "does not permit us to separate time from space by taking spatial, or equal-moment, slices through spacetime in an absolute and universal way. Each observer will have his or her own particular slicing, but they will not in general agree." Davies, *About Time*, p.72.

[18] For example, Navajo Indians have a circular understanding of unbroken time that can conflict with Western values of punctuality, while some post-colonial African communities may reject or profess no use for Western temporal structures or symbols, such as strict schedules and watches. This does not touch on ongoing time zone issues or various religious, secular, and dynastic calendars that have been and still are in use around the world. See: Mark Charles, "Time Perception Among Navajo American Indians and its Relation to Academic Success," on Wirelesshogan, http://wirelesshogan.com/key_issues/navajo_time_perception (last accessed 24/2/2016); "Teacher-Aide Guide for Navajo Area," http://people.uncw.edu/martinezm/documents/navajo_way.pdf; Javier Fesser, *Binta and the Great Idea*, Magnolia Pictures, 2004, 31 minutes, https://www.youtube.com/watch?v=lE8-QeON93Q (last accessed 24/2/2016) ; Brad Lendon, "Double Your Birthday Fun After Samoa Time-Zone Move," *CNN*, May 9, 2011, http://news.blogs.cnn.com/2011/05/09/double-your-birthday-fun-after-samoa-time-zone-move/ (last accessed 14/5/2015)

dissected – just as the linear timeline has been dissected into chronological and subjective periodizations.

As stated above, the temporal revolution altered the preconceived shape of time in overlapping stages, unrolling the seasonal cycles of death and rebirth into a unidirectional line of progress and decay that gradually expanded to encompass everything from the big bang to the entropic heat death of the universe. That straightforward, if abstract, timeline has since branched into a vast, multifaceted spatiotemporal continuum of relative observational experience. This is the image that shapes our culture's current interconnected, digitalized, globalized experience, expectation, and use of time. It is here that we find *timescapes*.

Adapted to history as a means of supplementing the strict, chronological nature of the timeline, a *timescape* becomes, literally, a *slice* of history – of the spatiotemporal experiences of a specific culture, group, or even individual – the angle and scope of which is determined by discrete and separable perspectives evidenced in surviving source materials.[19] These *timescape* slices form a layered continuum which can simultaneously include and transcend accepted periodizations and encompass a variety of analytical scales, from the micro to the macro, allowing various coexisting temporal perspectives to be compared and contrasted within a sequential historical framework by adding a layered dimension to the linear timeline.[20] This is how I organize my project, but the flexible structural framework afforded

[19] For example, the capability or incapability to trust mechanical timekeepers over astronomical observations. See: Layer One.

[20] Some philosophers and scientists have argued against the apparent "spatialization" of time, postulating that if Einstein's Special Theory of Relativity is correct and past, present and future "are merely observer-dependent notions and all events in the spacetime manifold are equally existent and actual," there is no objective difference between them and we are left with a "tenseless" theory of time (what Cambridge philosophers J.M.E. McTaggart and D.H. Mellor termed B-Theory, as opposed to the tensed A-Theory of time).[20] I would argue that a seemingly "static" timescape can be a useful and dynamic historical tool when used in conjunction with the traditional linear timeline. The added dimension allows for a methodological structure incorporating a temporal flexibility that could greatly aid sociocultural studies involving concurrent or overlapping historical ideas, events, and themes, such as those addressed in this project. William Lane Craig, *The Tenseless Theory of Time: A Critical Examination*, (London: 2000), p.3.

by *timescapes* has great potential as a means of organizing other complex, non-sequential or nonlinear historical investigations, from the monumentally diverse histories of the Roma to the contrasting, yet entirely concurrent, experiences of combatants, noncombatants, and watchers on all sides of any contemporary or past military conflict.

The structure of this project, therefore, serves as something of a demonstration, showing how employing *timescapes* as a flexible analytical tool can allow scholars to organize and investigate parallel or overlapping historical developments at any scale without abandoning the familiar historical timeline. *Timescapes* exist together, each individual perspective a single slice of a much larger, more complex continuum of human temporal experience. By their very nature, they circumvent the inherent complications of rigid, unbendable chronology. Adapting *timescapes* to history, the directional nature of the linear historical timeline, like the big bang theory in physics, continues to allow for the experiential distinction between past, present, and future and, thus, for the investigation of historical change.[21] In this way, *timescapes* can, and will, provide a practical structure for a historical study of the layered nature of changing temporal experience.

[21] According to Newton's formulae, there seems to be no mathematical reason why time should only flow forward. If all forces, vectors, etc. are accounted for, events (like smashing an egg) can be mathematically modeled forwards and backwards. Einstein's notion of the spacetime continuum presents a model where the experience of time is relative to motion, distance, direction, and individual perceptions (*Eigenzeiten*). Only *entropy* (the measure of disorder in a system. Low entropy implies the system has a great deal of available energy; high entropy implies it has less energy) requires time to have direction – evidenced by the fact that the universe had much lower entropy shortly after the big bang than it has now and will have in the future. Entropy is, therefore, sometimes called 'Time's Arrow,' and is why eggs, once smashed, do not unsmash. The Second Law of Thermodynamics states the entropy of a closed system can only increase, allowing for an observable differentiation between past, present, and future. In the context of this project, *historical timescapes* are like Einstein's spacetime continuum, and the traditional historical timeline serves as time's arrow. See: Davies, *About Time;* Brian Greene, *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory,* (New York, 1999); John Gribbon, *In Search of Schrodinger's Cat: Quantum Physics and Reality,* (London, 1991); Stephen Hawking, *A Brief History of Time: From the Big Bang to Black Holes* (New York, 1988).

## *TIMESCAPES II: PRECEDENTS AND PREDECESSORS*

Although the method of adapting *timescapes* to history as a flexible analytical tool proposed above is an aspect of my own investigation into the temporal revolution, the term *timescape* is not unique to this project; it has often been used in science and science fiction to describe the notion of a four-dimensional spacetime continuum in which all events – past, present, and future – are equally real, as put forward by Einstein's Special Theory of Relativity.[22] This concept, following Einstein's assertion that "the distinction between past, present and future is only an illusion, even if a stubborn one," views time, not as a linear track where the past fades from the present and the future is yet unwritten, but as a continuum in which events and moments exist together "all at once" across a span of time.[23]

Taken into the realm of historical investigation, I believe this notion of layered simultaneity has the potential to afford historians a very special kind of autonomy: the autonomy to recognize and step back from their own temporal preconceptions and dissect time as a historical subject in and of itself: separating out and analyzing various current and historical understandings of time along social, cultural, theoretical, and other topic or theme-based lines.[24] This would allow them to make important differentiations between various socio-culturally informed attitudes toward time; psychological, biological, neurological, or other scientific notions of time-perception or time-awareness; and the development and influence of temporal concepts and theories rooted in different temporal constructs, such as pre-industrial calendars or the abstract Newtonian timeline, which views time strictly as an orderly sequence of events. Such differentiations are quite difficult to achieve and maintain

[22] Einstein, *Relativity*, pp.30-31.

[23] Ibid.

[24] The issue of 'timescape bias' in historical works will be discussed in Layer One.

when relying solely on a strictly chronological model for analytical structure.[25] By contrast, the layered nature of *timescapes* provides a flexible, practical means of stacking, comparing, and contrasting simultaneous developments along varying scales without continually running into the frustrating temporal conundrums inherent to the strictly linear timeline.

But, if *timescapes* have so much potential, have social disciplines managed to effectively adapt these more flexible temporal frameworks to their analyses? Where are the precedents for this kind of study?

Time, as a distinct historical subject, has not received much direct attention from historians.[26] The search for relevant historical works on this topic has confirmed the existence of a significant gap in the available literature.[27] There is a great deal of pertinent information out there, but it must be gleaned though broad reading into a wide array of disciplines, subjects, and types of source materials. Most secondary literature that professes to investigate the history of time tends to focus on acknowledging the fact that the

[25] See: Osterhammel**,** *The Transformation of the World: A Global History of the Nineteenth Century*, translated by Patrick Camiller, (Princeton, 2014), pp.45-76.

[26] For example: Hendrik Floris Cohen, *The Scientific Revolution: A Historiographical Inquiry*, (Chicago, 1994), p.353-354. Near the end of the section "Revolution in Time: Landes and Koyre," Cohen wrote: "may not the very existence of the mechanical clock, as a little pocket of relative yet unique precision in the midst of a still by and large traditional society, have contributed its share to the emergence of early modern science as the embodiment of the quest for precise and reliable knowledge?" After quoting Lewis Mumford's notion that "by its essential nature [the clock] dissociated time from human events and helped create the belief in an independent world of mathematically measurable sequences," the author stated: "To my knowledge, such promising possibilities have hardly been explored yet."

[27] The gap is often highlighted by attempts to skirt or bridge the larger, structural issue, albeit indirectly, usually by reformatting how the historical record is defined, organized, subdivided and taught even though most of these attempts retain a dependence on a linear, rather than nonlinear, framework. One of the more recent, and controversial, attempts is the Big History Project funded by Bill Gates which extends the historical timeline beyond human civilization, yet maintains its linear, chronological structure. Another is an attempt to teach history without chronology. It is my hope that timescapes, by employing a nonlinear approach, can allow for and encourage attempts to more directly acknowledge and address the gap without abandoning the structure chronology provides. Big History Project, https://www.bighistoryproject.com/home (last accessed, 9/3/2016); David Christian, "What Is Big History," in *Huffpost Impact*, updated 24/3/2014, http://www.huffingtonpost.com/david-christian/what-is-big-history_b_4661765.html (last accessed, 9/3/2016); Katherine Edwards, "Why the Big History project funded by Bill Gates is alarming," *The Guardian*, 10/9/2014, http://www.theguardian.com/commentisfree/2014/sep/10/big-history-bill-gates-uk-state-schools-education (last accessed, 9/3/2016); Joseph M. Adelman, "Teaching History Without Chronology," https://earlyamericanists.com/2016/01/19/teaching-history-without-chronology/ (last accessed, 21/3/2016).

mainstream notions of time we currently hold were not always the accepted standard, and chronologizing related calendrical and technological innovations, rarely anything deeper.[28] This includes horological and scientific works that address the invention of mechanical clocks and the measurement of time. These are often highly technical and do not place the inventions discussed or their impact into a broader historical context.[29] Literary works from the periods in question can serve as valuable and illuminating sources, filling in where diaries, newspapers, court records, and other documentary indicators of the historical mindset may be thin, but their status and purpose as fictional pieces must always be taken into account.[30] To find precedents, therefore, we must turn to history's sister social sciences. But, turning to other social sciences for methodological examples can be something of a quagmire in itself. Anthropological or sociological studies use models and structures that can be adapted to history but, like statistics, such models often work best when applied to the specific case they were designed to analyze and some, like those of Herbert Spencer or Karl Marx, were heavily influenced by the values and biases of their day.

[28] Such sources include but are not limited to: Steel, *Marking Time*, (Kindle e-book, 1999); Robert Poole, *Time's Alteration: Calendar Reform in Early Modern England*, (London, 1998); Gerhard Dohrn-van Rossum, *History of the Hour: Clocks and Modern Temporal Orders*, translated by Tomas Dunlap, (Chicago, 1996); David Ewing Duncan, *The Calendar: The 5,000 Year Struggle to Align the Clock and the Heavens – and What Happened to the Missing Ten Days*, (London, 1998); B. Richmond, *Time Measurement and Calendar Construction*, (Leiden, 1956); E.G. Richards, *Mapping Time: The Calendar and Its History*, (Oxford, 2000); Bernard Capp, *Astrology and the Popular Press*, (London, 1979); and Alain Corbin, *Village Bells: Sound and Meaning in the Nineteenth-Century French Countryside*, translated by Martin Thom, (London, 1998).

[29] For example: Donald Whyte, *Clock and Watchmakers of Aberdeen and North East Scotland, 1453-1900*, (Aberdeen, 2002); Joella G. Yoder's *Unrolling Time: Christian Huygens and the Mathematization of Nature*, (Cambridge, 1988); and Penelope J. Corfield, *Time and the Shape of History*, (New Haven, 2007); and also popular physics works such as Davies, *About Time*, p.72; Gribbin, *Schrödinger's Cat*, and *Schrödinger's Kittens and the Search for Reality*, (London, 1996); Greene, *Elegant Universe*, and *The Hidden Reality: Parallel Universes and the Deep Laws of the Cosmos*, (New York, 2012); Michio Kaku, *Hyperspace: A Scientific Odyssey Through Parallel Universes, Time Warps, and the Tenth Dimension* (Oxford, 1995); Hawking, *Brief History of Time*; and Lee Smolin, *Time Reborn: From the Crisis of Physics to the Future of the Universe*, (London, 2013), among others.

[30] Such as works by Charles Dickens, H.G. Wells, Virginia Woolf, James Joyce, and other popular authors.

Still, time is a popular subject for modern social theorists, and their insights and comments on the sense of acceleration and alienation inherent to the development of the modern twenty – twenty-first century pace of life, or the complex relationships between time and various environments, can be quite useful, if not specifically focused on the nineteenth century's temporal revolution.[31] In fact, social scientists, like Barbara Adam, have long engaged with the notion of *timescapes* as a means of analyzing interactions between the complex environmental, economic, political, and socio-cultural stresses, rhythms, and developments that have helped shape, not only the modern world, but the modern mind. In *Timescapes of Modernity*, Adam depicts the environment as a *timescape* in an attempt to address environmental problems and environmental change from a temporal perspective, using time to make ordinarily invisible or taken-for-granted conflicts arising from and within industrialized lifestyles visible and explicit. In this context, Adam adapts the concept of *Eigenzeit* to "the multiple intersections of the times of culture and the socio-physical environment," using *timescapes* to link the linear abstractions inherent to mechanical clock time with the myriad overlapping rhythms of the natural world – evidence that *timescapes* can and have been used as a practical analytical framework for complex, multilayered studies within the realm of the social sciences.[32]

[31] For example: Hartmut Rosa, *Alienation and Acceleration: Towards a Critical Theory of Late-Modern Temporality*, (Malmö, 2010); Zygmunt Bauman, *Liquid Times: Living in an Age of Uncertainty*, (Cambridge, 2007); Barbara Adam, *Timescapes of Modernity: The Environment & Invisible Hazards*, (London, 1998); *Time and Social Theory*, (Cambridge, 1994); *Timewatch: The Social Analysis of Time*, (Cambridge, 1995); and Helga Nowotny, *Time: The Modern and Postmodern Experience*, translated by Neville Plaice, (Cambridge, 1996), among others.

[32] Adam, *Timescapes of Modernity*, pp.4, 9.

## *TIME AND HISTORY*

Western society has long harbored the notion that the past has passed and history is fixed. But, the customary image of history drawn as a vast, linear arrow – an infinite, abstract timeline on which great events and important dates dangle on carefully ordered hangers, like clothes in a closet – is relatively new. History as a discipline was only developed in its current form during the 1830s by historians like Leopold von Ranke, and is quite dependent for its structure on the absolute, abstract timeline developed, in large part, by Isaac Newton and Joseph Priestly. Their flat, sequential, timeline has since become intrinsic to how we conceptualize, discuss, and periodize history.[33] From the mid-nineteenth through to the early twenty-first centuries, the pervasive influence of the straight, historical timeline has shaped the structure of historical works and provided firm scaffolding for the concepts and theories of the discipline's frontrunners, from Braudel to Foucault and beyond. When it comes to the challenge of tackling the temporal revolution, however, the timeline that has provided history such a solid backbone for so long simply cannot bend enough to accommodate the strain.

Following the French Annales School, historical events take place in different timeframes. There are short-term changes, like political revolutions; long-term sociocultural, economic, and geological shifts that can span multiple lifetimes, administrations, and empires; finally, there is the history of mentalities: a facet of historical analysis built on the notion of the *longue durée* proposed by Fernand Braudel.[34] In this context, changing attitudes, worldviews, and mindsets are viewed along very long timeframes tracing very gradual changes.[35] But, since both the short timeframes and the "long periods of time and

[33] Daniel Rosenberg, "The Trouble with Timelines," in *Histories of the Future*, edited by Daniel Rosenberg and Susan Harding, (Durham, 2005), pp.283-295.

[34] Fernand Braudel, "History and the Social Sciences: The *Longue Durée,*" in *On History*, translated by Sarah Matthews, (London, 1980), pp.25-52.

[35] For example, Philippe Ariès's works on childhood and death: *The Hour of Our Death*, translated by Helen Weaver, (Middlesex, UK: 1983); *Centuries of Childhood*, translated by Robert Baldick, (London: 1962).

imperceptible evolutions" of the past inherent to the *longue durée* are structurally informed by the linear, Newtonian timeline, this puts quick ruptures, or revolutions, and long-term shifts in mentalities or worldviews in separate, even contradictory timeframes.[36] Such contradictions make it nearly impossible to reconcile the intricate, individualized layers of the temporal revolution using a strictly linear historical framework, be it Braudel's *longue durée*, Emmanuel Le Roy Ladurie's history of mentalities, or the notion of the *Sattelzeit*, proposed by Reinhart Koselleck to indicate a particularly transitional historical period.[37]

Michel Foucault, saw historical events, and the historical interpretation of events, as social constructs: as a complex "series of social interactions rather than isolated events."[38] He put forward the notion that each historical period was characterized by underlying principles that governed how contemporaries thought and how they established valid knowledge. His term for the sum total of the intellectual "rules" that governed each period's process of establishing valid knowledge was "episteme."[39] In Foucault's view, epistemes were blocks of time dominated by specific modes of thinking, and the shift from one episteme to another was often characterized by deep periods of crisis, such as revolutions, that could provoke fundamental, irreversible structural changes in a society.[40] Yet, while the transition from one episteme to another may have been marked by crisis, conflict, and

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[36] Jacques Revel and Lynn Hunt, *Histories: French Constructions of the Past*, Postwar French Thought, Vol. I, (New York, 1995), p.22.

[37] Reinhart Koselleck, *The Practice of Conceptual History: Timing History, Spacing Concepts*, translated by Todd Samuel Presner, et al, (Stanford, 2002), p.x.

[38] Paul Oliver, *Foucault –The Key Ideas*, Teach Yourself, (London, 2010), p.20; Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception*, translated by A.M. Sheridan Smith, (London, 1973).

[39] Ibid., p.21; Michel Foucault, *The Order of Things: An Archaeology of the Human Sciences*, kindle e-book.

[40] Ibid.

violence, the epistemes themselves were relatively homogenous periods of general intellectual consensus.

Contrastingly, the temporal revolution was characterized by intellectual frictions; by layered series of conflicts coexisting on multiple scales, from the individual to the global. What prompted and fed these conflicts? How did these conflicts, and their aftereffects, manifest in the lives of those affected? How did the temporal revolution alter Western society's relationship with their time on an individual, national, international, and global scale?

As stated above, this project contends that the temporal revolution took place on multiple levels simultaneously, every quick, jolting individual experience adding to the thickly layered strata of tense, nearly invisible mental conflicts that impacted almost all aspects of society as one dominant temporal paradigm superseded another, each revolutionary skirmish becoming a building block in a long-term, multilayered, multigenerational revolution in temporal experience. This is why, in order to view this revolution as a whole, and to break down its parts, I propose a more flexible temporal approach is required, even if it must be adopted from outside the discipline.

During the 1950s, when social theories were in high demand, it was acknowledged that history seemed to lag behind its sister social sciences in adopting and adapting new methods, theories, and frameworks that could more readily handle complex, multidimensional subjects, such as sociocultural habits, institutions, objects, emotional perspectives, and practices – many of which have since been tackled, to some extent, by cultural historians.[41] The reasons behind this lag were attributed to the structure, nature, and

[41] Alain Corbin, *The Lure of the Sea: The Discovery of the Seaside in the Western World, 1750-1840*, translated by Jocelyn Phelps, (Cambridge, 1994), p.vii. See also Corbin's *Time, Desire and Horror: Towards a History of the Senses*, translated by Jean Birrell, (Cambridge, 1995) and *Village Bells: Sound and Meaning in the Nineteenth-Century French Countryside*, translated by Martin Thom, (London, 1998).

aims of history as a discipline. Historians tend to act as observers and narrators of human events. As such, they tend to be drawn to specific events or movements "in all their complexities."[42] They identify ruptures, political, social, and cultural upheavals, "and then seek frameworks to help make sense of their material."[43] Much of the secondary literature that does address time as an historical topic reflects this, taking the form of brief articles or broad survey texts that focus more on the development of calendars, timekeepers, and timekeeping methods than the changing human experience, expectation, and use of time. Mental revolutions, such as the nineteenth-century's transitioning experience of time, while important and even world-changing, tend to be far more subtle and individualized.[44] But, as historians' authority comes from stringently sourced documents, it is acknowledged that historical analyses and objectivity would only suffer if tied to elaborate theories or mechanistic approaches valued in other social sciences.[45] The inductive nature of history often means abstruse subjects, like time, tend to be either acknowledged as facets of more tangible movements and events, such as changing patterns of travel and trade, or ignored.[46]

The latter half of the twentieth century, particularly from the 1970s and 1980s onward, did witness a number of changes as historians began to experiment with different approaches, adapting and adopting methods and techniques from other social sciences, such as anthropology, ethnography, and sociology, to expand the range of topics viewed as suitable for historical study.[47] Social history, with its emphasis on the experiences of

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[42] Ludmilla Jordanova, *History in Practice, Second Edition*, (New York, 2006), p.67.

[43] Ibid.

[44] Osterhammel**,** *Transformation*; Vanessa Ogle, "Whose Time Is It? The Pluralization of Time and the Global Condition," *American History Review*, (December, 2013), pp.1376-1402.

[45] Jordanova, *History*, p.67.

[46] Fernánzez-Armesto, "Time and History," p.249.

[47] An example being the second to third generations of the French Annales School.

ordinary people, experienced rapid development during the 1960s-70s, attracting young, socially conscious scholars eager to investigate the stories of ethnic, economic, urban, and rural groups that had been long overlooked or underrepresented in older forms of political, economic, and social history. Social history was more deductive, more theory-inspired, turning away from 'elitist' texts and toward statistical methods and other quantitative frameworks to historicize the lives and records left by townsfolk, farmers, urban workers, minority groups, and women. It worked to place individuals into the social structures and long-term trends that shaped their time, emphasizing class struggle and class structure as a means of interpreting subjects like interpersonal relationships, materialism, and consumerism – an approach that, as the 1970s wore into the 1980s-90s, was increasingly criticized as being 'reductionist,' ignoring the assumptions and judgements inherent to culture and language that shape human experience.[48]

From the 1980s on, this theory-driven approach was challenged by the rise of cultural history, which sought to take cultural interpretations, understandings, beliefs, and assumptions into account, and also by microhistory, which more directly confronted and criticized the generalizations made by social history.[49] In some respects, this swung the pendulum back to the inductive method and an emphasis on actors and empirical source-based analysis rather than trends and structures, while maintaining interdisciplinary borrowing and adaptation with other social sciences, like anthropology and ethnography. These developments, summed up here briefly and rather schematically, have succeeded in making the theory, practice, and scope of history more inclusive: focusing on a microcosm of

[48] Miri Rubin, "Cultural History I: What's In A Name?" in *Making History* hosted by the School of Advanced Study, University of London, http://www.history.ac.uk/makinghistory/resources/articles/cultural_history.html, (last accessed 28/3/15).

[49] Carlo Ginzburg, *The Cheese and the Worms: The Cosmos of a Sixteenth-Century Miller*, translated by John and Anne Tedeschi, (Baltimore, MD, 1992); *Clues, Myths, and the Historical Method*, translated by John and Anne Tedesckhi, (Baltimore, MD, 1989); *History, Rhetoric, and Proof*, (Hanover, NH, 1999); Sigurdur Gylfi Magnusson, "What Is Microhistory?" in George Mason University's *History News Network* (2006), http://historynewsnetwork.org/article/23720, (last accessed 28/3/15).

society and branching outward, or investigating from a globalizing perspective and narrowing in on specific cases in an attempt to reconcile highly local, individual, cultural experiences with more sweeping social, political, economic, geographic, and global developments. Yet, when it comes to investigating time – the scaffold that links these scales together – only a handful of scholars have approached it from a historical perspective and, for the most part, the majority of these, such as J.T. Fraser, G.J. Whitrow, Stephen Kern, Anthony Aveni, and David S. Landes, have provided what are essentially broad survey texts or sweeping interdisciplinary studies written from more of a scientific or sociological perspective than a distinctly historical angle.[50]

This is why I would argue it is necessary for historians to engage more directly with time as an object of study rather than just a chronological scaffold. Recent developments in social, cultural, micro, and transnational history have so expanded the scope and scale of viable, meaningful topics of historical study that the traditional, linear timeline on its own is no longer a sufficient temporal framework for complex, multilayered historical analyses – a situation that also applies to methodological approaches dependent on the linear timeline for their format and structure. This is a fundamental temporal/structural crisis faced by current

[50] Julius T. Fraser, *The Genesis and Evolution of Time: A Critique of Interpretation in Physics*, (Amherst, 1982) http://www.questia.com/PM.qst?a=o&d=8963836; J.T. Fraser, F.C. Haber and G.H. Muller, ed. *The Study of Time: Proceedings of the First Conference of the International Society for the* Study *of Time, Oberwolfach (Black Forest), West Germany, Aug 31-Sept 6, 1969*, (New York, 1972); J.T. Fraser, N. Lawrence, D. Park, ed. *The Study of Time III: Proceedings of the Third Conference of the International Society for the Study of Time, Alpbach, Austria 1976*, (New York, 1978); J.T. Fraser ed., *Time, Science, and Society in China and the West.* The Study of Time V, (Amherst, 1986), http://www.questia.com/PM.qst?a=o&d=88825799; J.T. Fraser, *Time, The Familiar Stranger*, (Amherst, 1987), http://www.questia.com/PM.qst?a=o&d=99061709; J.T. Fraser, "Whose Past is Our Prologue?" *Kronoscope*, Volume 9, 2009; Gerald James Whitrow, *The Natural Philosophy of Time*, (Oxford: 1980); G.J. Whitrow, *The Nature of Time* (Middlesex: 1975); G.J. Whitrow, *Time in History: Views of Time from Prehistory to the Present Day*, (New York, 1988); Stephen Kern, *The Culture of Time and Space 1880-1918*, (Cambridge, MA, 1983); Anthony F. Aveni, *Empires of Time: Calendars, Clocks, and Cultures*, (London, 1990); David S. Landes, *Revolution in Time: Clocks and the Making of the Modern World*, (Cambridge, MA, 1983).

historians, and it is one of the most significant reasons why so little secondary literature specifically addresses time as an historical object.

And so the question must be asked: in this post-'postmodern' era where history, instead of being interpreted as "one meaningful process," is understood as "a pluralism of narratives touching on the existential life experiences of many different groups," is the timeline that shaped the discipline of history back in the nineteenth century still the best way to go…or, in some ways, has it begun to hold the discipline back?[51] Is there a practical way to address this temporal crisis without threatening the fundamental structure of history? With this project, I will show how supplementing the historical timeline with individualized *timescape* slices, or layers, could be one potential route.

## *A Temporal Crisis?*

Scholars have long argued that the modern discipline of history is in crisis; that it has "lost the past."[52] In a very real sense, the historian's sense of linear time shattered after Einstein and history has not yet recovered from the blow. Fernández-Armesto argued that, although

> "the linear concept of time is practically useful…its influence on historians has long been undermined, and all the teleological constructions of the past, which it formerly encouraged, have been abandoned. Current fashions in historical writing reflect instead a concept of time which has no direction at all – neither linear nor cyclical. [Historical time] is imagined in a state of chaotic, directionless flux; or it is classified as a mental construct which can safely be omitted from any attempted account of an objective world."[53]

This has led to historical writings that have "shied away from traditional objectives and become more like imaginative literature," embracing the "counter-factual, the self-

[51] Georg Iggers, *Historiography in the Twentieth Century: From Scientific Objectivity to the Postmodern Challenge,* (Middletown, CT, 1997), p.143; Bauman, *Liquid Times,* (Cambridge, 2007).

[52] Fernández-Armesto, "Time and History," p.249.

[53] Ibid.

reflexive, the representational…the causeless…the implicit."[54] If this is so, if history has lost its grasp on time, the *timescape* may be one way to bring back a sense of temporal structure.

As discussed in the previous section, the rarified image of history as a timeline of events, dividing Western history up into a series pedagogical chunks, is most useful in situations where history is to be understood essentially "as a repository for…anecdote or chronology."[55] But, history is more than a static, orderly timeline of ended events. History, like time, *is a complex spatiotemporal continuum; a spectrum of layered, overlapping, intersecting timescapes that, together, encompass the whole of recorded human experience – including the experiences and interpretations of historians and their ever-evolving methods and historiographies.*

Helga Nowotny observed "…time hardly takes account of the drawing up of disciplinary and other boundaries…" and acknowledges that "the discursive exchange about time is underdeveloped… It is as if language absorbs only with delay what social experience seeks to confide to it. And it is as if time, filtered through institutions and regulated in temporal systems, conveyed through machines and means of transport, confronts us as 'a very strange thing'…which is able to exert a curious compulsion over people… [T]he contribution of individuals to society is neglected."[56]

Like Nowotny's book, this study is inspired by the question: "how does time change?"[57] But, it includes the qualification: how does time change *in history*? As complex historical trends are identified and traced in terms of changing temporal experience, must historical models and methods adapt to handle the strain?

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[54] Ibid.

[55] Kuhn, *The Structure of Scientific Revolutions,* p.1.

[56] Nowotny, *Time,* pp.6-7.

[57] Ibid., p.7.

Because of its broad, encompassing, and observational nature, it is rather expected that history should stand back from, and even lag slightly behind, the rapid developments occurring in its sister social sciences, like sociology, anthropology and even literary analysis. After all, the purpose of history is not to construct identities but to analyze them.

As interest in microhistories and the lives of ordinary people continues to compete with more traditional narratives of great leaders, warfare, and violent political revolutions, the linear, chronological timeline that has served as history's backbone since the 1830s is increasingly becoming too inflexible for studies that may follow simultaneous case studies, or sources that temporally overlap – such as studies of migration-, gender-, unemployment-, or wartime-related temporal experiences, transnational globalization, or the nineteenth century's temporal revolution. Historians facing these temporal conundrums have chosen to organize their studies along thematic lines, or as anecdotal narratives, thus bypassing the problems inherent to the timeline and the debates that have grown up around the 'important date' or 'age' based method of historical periodization.[58] But, as noted above, bypassing the problem with narrative techniques does not address the underlying temporal crisis. On the contrary, history has been criticized for losing coherence and meaning, accused of becoming "just one more foundationless, positioned expression in a world of foundationless, positioned expressions."[59]

The ongoing problem of how to approach historical time explains, in large part, why it is that, while many researchers have investigated developments in the Western use and understanding of time from a variety of angles, so few have focused on this shift from a

[58] For example, in his 2002 biography of John Adams, David McCullough used numerous literary techniques, including a chronologically disjointed, anecdotal structure, making the work read almost like a novel. David McCullough, *John Adams*, (London, 2002). See also Osterhammel**,** *Transformation*, pp.45-76.

[59] Keith Jenkins in Iggers, *Historiography*, p.150.

historical perspective. Hartmut Rosa acknowledged the lack of discussion regarding time as a topic, writing:

> One way of examining the structure and quality of our lives is to focus on the temporal patterns. It is not just that virtually all aspects of life can be insightfully approached from a temporal perspective…temporal structures connect the micro- to the macro-level of society, i.e., our actions and orientations are coordinated and made compatible to the 'systemic imperatives' of modern capitalist societies through temporal norms, deadlines and regulations. …modern societies are regulated, coordinated and dominated by a tight and strict temporal regime…modern subjects…are tightly regulated, dominated, and suppressed by a largely invisible, de-politicized, undiscussed, under-theorized and unarticulated time-regime.[60]

This naturally begs the question, if time is so vitally important and formative a feature in our lives, why have so few historians made time an object of study? To take the question further: given its complex, ubiquitous, yet intangible nature, can time even be made an object of historical study?

With this project, I propose it can, and that a possible resolution to the historical discipline's loss of touch with its foundational temporal framework lies with *timescapes* and the added dimension they can lend to historical analyses when used to supplement the traditional linear timeline and its inherent sense of chronological directionality. In this way, the flexible, individualized nature of relative time, or *Eigenzeit*, can be effectively incorporated into historical analysis as a structural method and as a means of reconstructing and interpreting past experiences, assumptions, and expectations without forsaking the historical discipline's narrative framework and chronological structure – both of which were already in place by the time history began to be institutionalized in Western universities as a scholarly profession in the 1830s.

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[60] Hartmut Rosa, *Alienation and Acceleration: Towards a Critical Theory of Late-Modern Temporality*, (Malmö, 2010), p.8.

## *NAVIGATING SCALES: TIMESCAPES IN ACTION*

This project's four main chapters, or overlapping layers, are designed to identify, then investigate two divergent, yet related, *timescapes* and key catalytic conflicts that fed the transition from one temporal outlook to another: conflicts that characterized contemporaries' changing concept, experience, and practical use of time. I labeled these transitions: Seasonal to Mechanical; Retrospective to Progressive; Private to Public; and Sequential to Simultaneous. For the purposes of this project, libraries, archives, and museums across the UK as well as, to a lesser extent, in the US, were scoured for examples that revealed transitional triggers: the defining skirmishes and battles of the nineteenth-century's temporal revolution. The result was the identification of the eight main temporal worldviews, or *timescapes*, listed above, along with numerous primary source examples of how and why the proponents of each came into conflict. Because this project's focus spans the nineteenth century, with some spillover into the eighteenth and twentieth, these case studies cannot be and do not aim to be exhaustive regarding the subjects' lives and works. Rather, they are specific examples grounding a necessarily broad framework.

Britain was chosen as the primary focus of this study because it has long been recognized as the birthplace of the industrial revolution and, therefore, the first nation to be directly influenced by industrial time. But, like the industrial revolution, the temporal revolution was not limited to Britain. During the nineteenth century it spread, along with the industrial revolution, through Europe and the United States, provoking comparable experiences across national borders as factory life, trains, trans-oceanic shipping and travel, and telegraphic communication came to fuel a global need for an international standard time system.[61] Examples and case studies for this project will, therefore, not be limited to Britain,

[61] C.A. Bayly, *Birth of the Modern World, 1780-1914: Global Connections and Comparisons*, (Malden, MA, 2004); Standage, *Victorian Internet*, (London: Phoenix, 1998); Dwayne R. Winseck and Robert M. Pike,

but will reflect the international influence of the temporal revolution to better highlight the shared human experience of this complex, multilayered paradigm shift – particularly in the US, which gained its independence from Britain during the early stages of the temporal revolution and shares the temporal structure and presumptions inherent to the English language as well as a proactively innovative nineteenth-century industrial experience. Because of that cultural, technological, and linguistic tie, the geographic scope of this project will be limited, for the most part, to British and American source materials.

This project aims to demonstrate, not only the ongoing significance of the nineteenth-century's temporal revolution, but also the viability of *historical timescapes* as a methodological, structural, and analytical tool: one that can complement, rather than displace, the traditional chronological structure of history. By employing *timescapes* to help identify and examine the various stages in which nineteenth-century Britain's shifting understanding of time became explicit – and even revolutionary – it is my position that a deeply and repeatedly studied period can be viewed and analyzed from a fresh angle, supporting the argument that Britain's nineteenth-century temporal revolution was not indicative of a sharp, irreversible break in linear time between the pre-industrial and industrial world but, rather, of an ongoing conflict between layers of coexisting yet divergent *timescapes*.

Each chapter, or layer, of this project is subdivided into two main sections and framed by three guiding "Signposts" – brief subsections defining and outlining the purpose of each main section, explaining the key research questions to be addressed and, ultimately, outlining significant implications and conclusions. The first main section will outline the nature of the two *timescapes* to be discussed and the conflict between them. The scope and breadth of

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*Communication and Empire: Media, Markets, and Globalization, 1860-1930,* (London: Duke University Press, 2007) and Ogle, "Whose Time Is It?", (December, 2013).

these spacetime slices, or *timescape* layers, is determined by the recorded experiences of contemporaries. The second main section zooms in on a case study of a contemporary individual, or individuals, whose experiences exemplify the complex and layered nature of each shift – individuals who, in some significant way, straddle the divide between the two divergent *timescapes* in question, often becoming a focal point of contention for proponents on both sides.[62] The structure of these chapters will demonstrate the usefulness of *timescapes* to historical investigations into highly subjective, often invisible or overlooked topics like time and temporal experience.

[62] A recent microhistorical example demonstrating how "zooming in" on specific cases can illuminate wide-ranging histories is: Tonio Andrade, "A Chinese Farmer, Two African Boys, and a Warlord: Toward a Global Microhistory," *Journal of World History*, Vol. No. 4, 2010, pps.573-591.

## LAYER ONE: FROM SEASONAL TO MECHANICAL

*SIGNPOST 1*

This project supports the position that Britain did experience a temporal revolution, and that the nineteenth-century phase of this revolution can be traced in stages from Britain's 1750 calendar reform through to Einstein. This first chapter identifies and investigates two concurrent, yet conflicting temporal worldviews (*timescapes*) that characterize the pre- and early industrial understanding, expectation and use of time: temporal worldviews I have termed the *seasonal timescape* and the *mechanical timescape* for the purposes of this study. This chapter also explores the question of *timescape bias* in an attempt to investigate the premise that individuals educated in one *timescape* tend to distrust the time sense and timekeeping methods inherent to other temporal worldviews and that this distrust can affect their openness to new or different technologies, ideas, and theories, thereby feeding the conflicts that drove the various stages of the temporal revolution. This chapter will show educated individuals raised in a predominantly *mechanical timescape*, as we are today, tend to presume mechanical clock-time is superior to observational, or seasonal, time, leading to a rather negative view of the pre-industrial time sense and timekeeping methods (and their proponents) as backwards, or primitive. This strongly indicates a radical shift in mentality has occurred, a shift that can be traced back to a phase of the temporal revolution triggered by the invention and introduction of truly reliable mechanical clocks, the first and arguably most famous of these being the maritime chronometers John Harrison invented to solve the problem of finding longitude at sea.

The first section, *Conflicting Timescapes: The British Calendar Reform of 1750-52* investigates the origin of the Calendar Riot myth and its subsequent interpretations in modern history texts, highlighting the differing time senses, modern and pre-modern, that allowed this myth to take root and gain credibility. The popular historical myth of the British Calendar

Riots will be used to contrast post-industrial interpretations of Britain's transition from the Julian to the Gregorian calendar with contemporary publications describing popular, pre-industrial attitudes prevalent at the time of the shift. Putting the distinction between the traditional, seasonal time sense and the more abstract civil calendar into sharp relief, this calendar reform illustrates one of the earliest and most prominent clashes of Britain's nineteenth-century temporal revolution: a conflict between those who understood time as a natural rhythm and those who understood it as a malleable social, economic, and political tool; the effects of which would continue to resonate into the twentieth century.

The conflict over the calendar shift and the question of Britain's "lost" eleven days — cut during the process of bringing the British civil calendar into synch with Europe (which had adopted the Gregorian calendar some two centuries before) — took place in the context of the *seasonal timescape*, but that context was altered when the story was retold and reinterpreted by products of the later *mechanical timescape*. The question is: why the alteration? Why repeat a story emphasizing the supposed temporal ignorance and irrationality of the pre-industrial world when, as a number of primary sources indicate, contemporary concerns regarding the calendar transition were quite practical? The answers point to misunderstandings and misinterpretations based in assumptions inherent to a *mechanical timescape* (*timescape* bias): evidence of a significant shift in temporal understanding and expectation that took place during the temporal revolution of the long nineteenth century.

### *CONFLICTING TIMESCAPES: THE BRITISH CALENDAR REFORM OF 1750-52*

In most general histories of Britain, the Calendar (New Style) Act of 1750, or Chesterfield's Act, rates barely a passing mention, save for one curious and colorful anecdote. The basic story is usually quite close to the account given by British science historian G.J. Whitrow:

> ...in 1752, when the British government decided to alter the calendar, so as to bring it into line with that previously adopted by most other countries of Western Europe, and decreed that the day following 2 September should be styled 14 September, many people thought that their lives were being shortened thereby. Some workers actually believed that they were going to lose eleven days' pay. So they rioted and demanded 'Give us back our eleven days!' (The Act of Parliament had, in fact, been carefully worded so as to prevent any injustice in the payment of rents, interest, etc.) The rioting was worst in Bristol, in those days the second largest city in England, where several people were killed.[63]

Whitrow used this story to illustrate the strange and complex nature of the human relationship with time; specifically, the unsettling, displaced sensation we feel when civil time conflicts with our intuitive sense that time is unchanging, "something universal and absolute."[64] In the eighteenth century, that disorientation occurred when Britain dropped the traditional Julian calendar, long known to have been in error, and adopted the corrected Gregorian calendar.

Taken as read, this account of the British calendar riots does seem to offer a rare insight into how people in Britain understood time shortly before the accelerating influence of the Industrial Revolution took effect. Yet, for author and reader to accept and pass on this story and its implications without at least a grain of salt presupposes a wider presumption that the popular notion of time in pre-industrial eighteenth-century Britain was so insular and steeped in tradition and superstition that modifying the civil calendar was enough to provoke widespread mob violence. As is usually the case with such tales, the reality was far more complex. But, the presence of this account in popular texts, like Whitrow's, is a prominent

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[63] Whitrow, *Time In History*, p.3.

[64] Ibid, p.4.

example of, what I have termed, *timescape bias*: temporal assumptions that can influence how minds raised in one temporal landscape (*timescape*) interpret the temporal understandings, concepts, expectations, and values of another.

While the occurrence of this story in texts such as Whitrow's; *The Encyclopedia Britannica*; and the *Oxford History of England* could easily encourage an assumption of veracity, it has not gone unchallenged. Scholars like Robert Poole and Paul Alkon also write their arguments from the perspective of the modern *timescape* – removed from the temporal landscapes and understandings of the past – but their interpretations are different: contesting the story's hand-me-down nature and offering extensive lists of modern references to the calendar riots while decrying the "vagueness about the exact time and place of such outcries" as well as their "tantalizing lack of documentation."[65] Backtracking these listed sources reveals only brief references in older general texts rather than primary, contemporary accounts of calendar-related mob violence – further evidence that the influence of *timescape* bias has played a role in taking and repeating the story as fact for so long.[66]

Quentin Skinner wrote: "it will never be possible simply to study what any writer has *said* (especially in an alien culture) without bringing to bear our own expectations and pre-judgements about what they are saying."[67] We are, essentially "programmed" by our past

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[65] Paul Alkon, 'Changing the Calendar,' *Eighteenth Century Life* VII (1982), p.13; Poole, *Time's Alteration*, p.4.

[66] The following was listed in Poole, *Time's Alteration*, p.4, and substantiated in the course of researching this project at Cambridge University Library: The fifteenth edition of the *Encyclopedia Britannica*, "There was much public misunderstanding, and in Britain rioters demanded 'give us back our eleven days.'" Basil Williams' *The Whig Supremacy 1714-1760, p.381,* "For some time the most popular cry in the country was 'give us back our eleven days!'" W.A. Speck's *Stability and Strife: England 1714-1760*, p.255, "The resultant outcry 'give us back our eleven days' is often dismissed as the blind reaction of an ignorant mob; but in fact the change gave reasonable grounds for concern at all levels of society, necessitating nice calculations about rents, leases, debts and wages, as well as superstitions about saint's days and holy days which were exploited by almanac makers, who devised calendars showing the "old" as well as the new days for some years ahead," the 1909 work *Leadam, The History of England 1702-60, p.423,* "Polite society readily accepted a reform introduced under such auspices; but the pious shuddered at the prospect of tampering with saints' days, and the commonality grudged that their lives should be shortened by act of parliament," and Samuel Shellabarger's *Lord Chesterfield*, p.264, which claimed the continental Gregorian calendar "represented the cosmopolitanism of France as opposed to British insularity."

[67] Quentin Skinner, *Visions of Politics* (New York, 2002), p.58.

experiences to "perceive details in a certain way."[68] Skinner was discussing texts in the context of the history of ideas, but his words also apply to concepts of time. Could the story of the calendar riots actually be a myth? If so, what did happen, and how did this myth arise?

Poole argued that the story of Britain's infamous calendar riots may, in fact, be derived, not from contemporary accounts of actual rioting, but from a commonly repeated misinterpretation of two very different sources, both of which were published well after the calendar reform had taken effect. Significantly, these misinterpretations drew few queries before the mid-twentieth century and were not generally acknowledged for at least another thirty years – a fact that reveals more about modern assumptions about the past than about eighteenth-century reality.[69]

Poole's interpretation of the myth and its longevity rests on issues of popular politics and a "rebellious traditional culture" as working people clung to their traditional seasonal markers and the wealthy, educated gentry, further alienated from the popular festive calendar following the calendar reform, found their interest in once traditional customs and sports reignited as the political climate shifted and the century began to turn.[70] This project, while fully acknowledging the significance of that broader cultural, political, and social aspect, has a different focus: identifying and tracing the phases of the temporal revolution and where this myth fits into its long, layered story – a story that gains new overlapping layers every time it

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[68] Ibid.

[69] Robert Darnton, *The Great Cat Massacre and Other Episodes in French Cultural History* (New York, 1984), pp.75-104. While history's unidirectional arrow can foster an image of continuity and flow when it comes to a culture's development, the Great Cat Massacre of the Rue Saint-Séverin indicates that there can be some significant divergences. Popular practices, ceremonies, symbols, and even humor can change drastically from one generation to the next. What current sensibilities may view as a befuddling atrocity against innocent pets, contemporaries would have understood in an entirely different light, steeped in folklore that, no longer current, has faded from memory. To unpuzzle the motives, meanings, and significance of such an act, historians must acknowledge their own cultural/temporal bias and delve deep into the cultural context of the past. Through the notion of timescape bias, this chapter argues that unpuzzling a past culture's time sense is no exception.

[70] Robert Poole, 'Give Us Our Eleven Days!: Calendar Reform in 18th Century England,' *Past & Present* (1995), p.136.

is revisited and reinterpreted. How does this myth highlight the differences between a seasonal temporal mentality based on close observation of natural and astronomical change and the more abstracted time sense that characterizes our modern understanding, expectation, and use of time?

The calendar riot story depicts average, pre-industrial people as being unable to understand the technicalities behind the calendar's reform, reacting to the change in their traditional timekeeping system by becoming disoriented, fearful, and irrational.[71] Terrified that shortening the calendar year had, consequently, shortened their own lifespans while simultaneously docking their hard-earned pay by eleven full days, they lashed out at those they felt had tried to put themselves above God's time.

While a latent elitism may hold some influence over the prevailing interpretation, this section will argue that another significant factor behind the story's spread is *timescape* bias, a key element in the mental attitudes that helped shape and drive the nineteenth-century's temporal revolution. The calendar riot myth and its spread illustrates how far modern temporal sensibilities – informed by a *mechanical timescape* mapped by the isochronous beats of our ubiquitous clocks – have diverged from the observational time sense of the *seasonal timescape* prevalent in the pre-industrial world.

According to Poole, who was one of the first to indicate the potential mythical character of the British calendar riots, the two sources most likely to have originated the calendar riot myth are, first, one picture in a series of prints by the eighteenth-century British artist William Hogarth satirizing the 1754 general election in Oxfordshire and, second, a brief reference made by the prosecutor James Scarlett during the 1820 trial of radical political speaker Henry Hunt following the Peterloo Massacre that took place in St Peter's Field in

[71] Such sources include Whitrow's *Time in History*; the *Oxford History of England; The Encyclopedia Britannica* and Ronald Paulson, *Hogarth, His Life, Art, and Times,* Studies in British Art, (New Haven, 1971).

Manchester.

The Oxfordshire election Hogarth lampooned was a rowdy, corrupt affair that gained a great deal of attention in the contemporary press. Traditionally, the parliamentary seats in question were unopposed, filled either through compromise or back-room appointment, but in this case two Whig candidates, Sir Edward Turner and Lord Parker – son of Lord Macclesfield, the respected astronomer who had helped draw up Chesterfield's Calendar Reform Bill and supported it in Parliament – stood against the entrenched Tories in an expensive battle involving extravagant bribes, rich feasts, and the organization of non-voters into threatening mobs by supplying them with bribe money as well as alcohol.[72] Hogarth did not directly spear the Oxford candidates in his prints, instead creating a generalized depiction of political corruption and self-interest, but his references were clear enough to those familiar with the election and its smear tactics.[73] Each of his *Four Prints of An Election*, which he produced between 1755-1758, depicted a specific phase of the election: *An Election Entertainment* (1755), *Canvassing for Votes* (1757), *The Polling* (1758), and *Chairing the Members* (1758). It is quite likely that the first of these, *An Election Entertainment*, was the initial source of the cry "Give Us Our Eleven Days!" as well as the riotous mob scene associated with it.[74]

But, this is an imagined mob made up of caricatures carefully placed for satirical purposes. Their banners and signs reference not only calendar reform, but other even more

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[72] In Jenny Uglow, *Hogarth: A Life and a World* (London, 1997), pp.549-550: The 1761 *St James Chronicle* listed the items ordered for one of these extravagant election breakfasts: "31 Pigeon Pies, 34 Sirloins of Beef, 6 Collars of Beef Diced, 10 Cold Hams, 244 Chickens to the Hams, 6 Dozens of Tongues sliced, 10 Buttocks of Beef, 56 Pounds of Cheese, 8 Pounds of Chocolate, 5 Pounds of Coffee, 20 Dozen Bottles of Strong Beer, 10 Hogsheads of ditto, 3 Ditto of Wine, 2 Ditto of Punch." The bullying tactics of the rival parties were skewered in the 1754 *Oxford Journal*: "A receipt to make a vote...take a cottager of 30 shillings a year, tax him at 40; swear at him; bully him, take your business from him; give him your business again; make him drunk; shake him by the hand; kiss his wife; and HE IS AN HONEST FELLOW."

[73] Ibid., pp.550-551.

[74] Poole, *Time's Alteration*, p.14.

controversial and divisive Acts, such as the Marriage Act and the Jewish Naturalisation Bill. The sign reading "Give Us Our Eleven Days!" lies on the floor, broken and battered, under the boot of a Whig "bruiser (said to be based on a local boxer, Teague Carter, paid to fight in the Oxford campaign);" a seized Tory placard criticizing the inconveniences caused by the Whig-driven calendar reform put forward by one candidate's father.[75] Taken out of context, this crowded, riotous image could certainly appear to be an allusion to actual mob violence and contemporary fears related to losing eleven calendar days. But, it is important to note that a deeper analysis of the image and its numerous political references indicates that this was not the artist's intent.[76]

The story depicted here is of two rival political parties using various controversial Acts as ammunition against each other in a heated smear campaign run on bribes and intimidation. The inconveniences caused by cutting eleven days from the calendar are just one bullet in a fully loaded chamber. Ironically, Hogarth's print, rather than verifying the riots, instead corresponds with contemporary accounts which indicate that, while calendar reform was widely met with confusion, complaints, and the scorn of the educated toward those who clung to seasonal, agricultural calendar markers, such as holidays and the fairs and markets associated with them, this irritation did not reach the level of angry, murderous violence.[77] In fact, after tracing Poole's sources and scouring numerous university libraries and several newspaper and journal archives, it seems that no study of available contemporary sources has so far unearthed any direct evidence of these riotous mobs, in Bristol or anywhere else.[78]

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[75] Uglow, *Hogarth*, p.551.

[76] Poole, *Time's Alteration*, p.14; "Give Us Our Eleven Days!" p.132.

[77] Poole, "Give Us Our Eleven Days," pp.120-126.

[78] Numerous newspaper references indicate varied levels of irritation and sarcasm regarding the calendar change, and concern that the change, its history, and its practical implications (such as rent payments) are understood correctly by readers, while advertisements for almanacs and calendars emphasize that they feature

This includes the second noted source, spoken by James Scarlett during Henry Hunt's trial – a source even further removed in time, place, and purpose from Chesterfield's Act and its immediate effects. In this source, it is apparent that Scarlett's purpose was to parallel what he portrayed as the laughable time-ignorance of the uneducated eighteenth-century mob with the alleged gullibility, volatile emotionality and simplistic misunderstandings of the reformer groups and curious citizens who had gathered in St Peter's Field in Manchester on 16 August, 1819 to hear Hunt's radical speeches. Scarlett said:

> ...when the mob got hold of a grievance, they were apt to consider it as the great source of all their evils, and they were at length led to believe that the removal of that alone would operate as an effectual panacea to cure the whole of their complaints. The ridiculous folly of a mob had been exemplified in a most humourous manner by that eminent painter, Mr. Hogarth. It was found necessary many years ago, in order to prevent a confusion in the reckoning of time, to knock eleven days out of the calendar, and it was supposed by ignorant persons that the legislature had actually deprived them of eleven days of their existence. This ridiculous idea was finely exposed in Mr. Hogarth's picture, where the mob were painted throwing up their hats, and crying out "Give us back our eleven days." Thus it was at the present time; that many individuals, who could not distinguish words from things, were making an outcry for that of which they could not well explain the nature.[79]

Contrary to Scarlett's depiction, however, the masses gathered at St Peter's Field to hear Henry Hunt talk on Parliament and voting reforms had been more than an ignorant, reactive mob.[80] The event had been mostly peaceful; a pre-arranged gathering of reformist

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both the old and new style calendars for convenience of use and the education of children, but there are no indications of violent reactions in the cities, towns, or surrounding farms. These sources include: *London Evening Post*, February 28-March 2, March 9, 1751; *General Evening Post*, February 19-21, 26, 1751; *Old England*, Saturday March 9, 1751; *London Advertiser and Literary Gazette*, Tuesday March 12, 1751; *Rambler*, Tuesday March 26, 1751, Issue 109, among many others. *British Newspapers 1600-1950*, http://find.galegroup.com/bncn/start.do?prodId=BNWS&userGroupName=stand (last accessed, 21/3/2016).

[79] *The Trial of Henry Hunt, Esq...For an Alleged Conspiracy to Overturn the Government, &c. Before Mr. Justice Bayley, and a Special Jury, at the York Lent Assizes, 1820.*, http://www26.us.archive.org/stream/trialofhenryhunt00huntiala/trialofhenryhunt00huntiala_djvu.txt (last accessed, 21/3/2016).

[80] John Gardner, *Poetry and Popular Protest: Peterloo, Cato Street and the Queen Caroline Controversy* (New York, 2011), pp.13-20. Contemporary writings, ranging from Percy Shelley and Samuel Bamford's poetry to Henry Hunt's *An Address to the Reformers of Manchester and its Neighbourhood*, encouraging 'every friend of real Reform and Rational Liberty" to come "armed with NO OTHER WEAPON but that of a self-approving conscience," despite the understanding that "Our Enemies will seek every opportunity…to excite a riot…SPILLING OUR BLOOD" indicates the speakers and attendees alike were quite politically conscious, self-aware, and cognizant of what was occurring and its significance (p.15).

groups wishing to address topical concerns of the day, from women's rights to universal suffrage and voting by ballot. Yet, as the day wore on, the crowds, radical topics, and banners alarmed the local magistrate, who called on the Lancashire militia to break up the meeting and arrest Henry Hunt. The appearance of the cavalry riding over and hacking its way through the crowds and troops armed with bayonets blocking the escape routes led to an outbreak of vicious violence.[81] As the local shoemaker, John Chadwick, testified at the same trial:

> When the cavalry came in I was rather alarmed, but not before. 'Peter's field was full of people, who were all standing peaceably. I saw nothing to the contrary. They remained so till the cavalry began to go down. As they were going to the stage I quitted the field. They came in with their swords drawn, and in a sort of a trot. I went away because I thought there would be danger. There were many others running as well as me.[82]

Like the "mob" at Peterloo, the eighteenth-century's understanding of time was far more complex and sophisticated than credited by Scarlett, but it was his theatrical, simplified characterization of mob ignorance and unstable volatility that was picked up by subsequent histories. When Scarlett referenced Hogarth's satiric "Eleven Days" slogan in a literal manner to deride the masses that had gathered to hear Hunt's orations, he was not reinforcing the veracity of the calendar riots. Rather, he conscious was becoming one voice in a long chain latching onto Hogarth's famous print to create "not so much a single canard as a whole school of red herrings."[83]

But if, as the historiography of the riots indicates, the calendar riots are a modern myth extrapolated from a series of noncontextual misinterpretations, of what use can it be to

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[81] *Official Report into the Peterloo Massacre*, http://www.bl.uk/learning/histcitizen/21cc/struggle/chartists1/historicalsources/source1/peterloo.html (last accessed, 10/10/2015).

[82] *Henry Hunt*, http://www26.us.archive.org/stream/trialofhenryhunt00huntiala/trialofhenryhunt00huntiala_djvu.txt. Also excerpted in part in Poole, *Time's Alteration*, p.14.

[83] Poole, *Time's Alteration*, p.14.

scholars aiming to gain a fuller understanding of eighteenth-century time-awareness?

The significance of the calendar riot myth lies in common post-industrial assumptions that the pre-industrial time-sense was, somehow, backwards or uninformed – assumptions that allowed this myth to proliferate, essentially unquestioned, in history texts for the better part of two centuries. In other words, the myth, its origins, and its repetition highlights significant differences between the modern, mechanically informed *timescape* and the *seasonal timescape* that characterized eighteenth-century Britain's expectations of, relationship with, and use of time. These differences in temporal outlook and understanding separate the post-industrial mindset from common pre-industrial assumptions regarding their own lives and their relationship with their world as surely as the modern physical environment of digital media, automobiles, and electric light separates the current Western lifestyle from the horse-drawn coaches and fire-warmed hearths of the eighteenth century. *The calendar riot myth shows that, if left unrecognized, differences in timescape can influence how the symbols, satire, and popular issues of the past are interpreted and passed on by subsequent generations: the very basis of timescape bias.*

Just as interlocking landscapes form a complex, layered topography, multiple *timescapes* create a similarly complex representation of a period's layered time culture. *The significance of the calendar riot myth lies in its description of several of these unique spacetime slices, and the confusion that ensues when different timescapes intersect.* The modern, *mechanical timescape* became dominant during the industrial revolution and is, for the most part, defined by the clock. The pre-*mechanical timescape* was informed by celestial observation, local folk and festive traditions, and the calendrical tables and weather forecasts readily found in local almanacs – ubiquitous, utilitarian handbooks that came out near the end

of each year and were purchased by nearly every social group.[84]

The calendar riot myth feeds a common assumption that the pre-*mechanical timescape* was unsophisticated and superstitious; as backward and unrefined in its own way as the notion of a flat earth. Yet, contemporary evidence suggests that, not only was the pre-*mechanical timescape* sophisticated, it could also be surprisingly accurate.[85]

Before the nineteenth century, all social groups of all levels of education experienced time as a natural flow; the slow movement of a shadow over a sundial rather than the isochronous tick-tock of mechanically measured duration. This was because, at that time, mechanical clocks were notoriously inaccurate and required a great deal of attention and effort to maintain.[86] Whether they were tall tower clocks in a town square or church, a mantle clock in a wealthy home, or a carefully calibrated pendulum clock in a scientist's laboratory, these early clocks were primarily viewed more as convenient alarms, symbols of wealth, or scientific tools than a reliable and accurate means of timing daily life.[87] Pre-mechanical time was partly the realm of astronomers, diligently observing the celestial motions of the Heavenly Clock of stars and planets, moon and sun; partly the realm of religion, of dating

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[84] Capp, *Astrology*, p.63; Emmanuel Roy Ladurie, *Carnival: A People's Uprising at Romans 1579-1580*, translated by Mary Feeney (London, 1980), pp.158, 171, 182, 185, 189-92, 316, 319: Although the British calendar riots may be a myth, there was a violent outburst in Romans, France shortly after the change from a lunar to a solar calendar was enacted. But, this calendar shift was just one aspect of a complex transitional juncture that found expression in a two week revolt at the February 1580 Mardi Gras festival. The author stated the winter Carnival of 1580 was "a comprehensive, dynamic, oppositional description of a society" perched precariously at the cusp of change, and the revolt took place in the context of long-simmering secular, religious, economic, and social strife, incorporating ritual symbols, satire, and the tradition of Carnival Role Reversal.

[85] See eighteenth-century publications such as: *The World; Gentleman's Magazine; London Evening Post*; G*eneral Evening Post*; *Old England*; *London Advertiser and Literary Gazette*; *Rambler*; and various almanacs.

[86] Although clocks intended for scientific purposes, like Christian Huygen's revolutionary pendulum clock, could keep time to the nearest second, before the nineteenth century most timekeepers were usually only reliable to the closest quarter hour rather than to the minute or second, and many had to be regularly wound, set, and oiled. Some clocks had only one hand. Carlene E. Stephens, *On Time: How America Has Learned to Live by the Clock* (New York, 2002), p.47.

[87] Alain Corbin, *Village Bells: Sound and Meaning in the Nineteenth Century French Countryside* (London, 1998); Gerhard Dohrn-van Rossum, *History of the Hour: Clocks and Modern Temporal Orders,* (Chicago, 1996).

holy feasts and defining the hours of prayer; and partly the realm of personal experience, the demands of the marketplace, and close observance of seasonal changes in animal habits and beneficial plants, from food crops to timber.[88] The almanac was the place where civil, religious, and individual times met.

Almanacs had been a mainstay in Britain since the 1500s, and statistical tables derived from analyzing the distribution of almanacs in Britain in the 1660s indicate that "sales averaged about 400,000 copies annually," adding up to more annual sales than the Bible, "a figure which suggests that roughly one family in three bought an almanac each year."[89] Such large distribution figures presume a high level of understanding from the consumer base, who regularly turned to almanacs as guides for such various needs as planting, care of livestock, the phases of the moon, the astrological constellations, and weather patterns as well as for finding the dates of fairs, festivals, holy days, the proper readings for and times of daily prayer, and dating deeds and leases.[90]

The Julian calendar Chesterfield's Act sought to reform certainly represented that intense relationship with seasonal and religious time. It was a convergence of scientific and religious values: reverential, complicated, and not lightly questioned.[91] But, it was also a product of history and long tradition. The Julian calendar (named after Julius Caesar, who introduced it to Rome in 46 B.C.) had been adopted at the Council of Nicaea, held in 325 A.D., as the official calendar of European Christendom. By the middle ages, however, the accumulated errors of about a millennium had caused that calendar to slip out of synch with the observable motions of the sun and stars. Those who sought to correct those errors, such

[88] Capp, *Astrology*, pp.63-66.

[89] Ibid., p.23 and endnote.

[90] Ibid., p.63; *London Evening Post* (London), March 9, 1751; Issue 3649, *British Newspapers 1600-1950,* http://find.galegroup.com/bncn/start.do?prodId=BNWS&userGroupName=stand (last accessed, 21/3/2016).

[91] Alkon, "Changing the Calendar," p.6.

as the English scholar Roger Bacon (ca. 1219-1292), rarely saw anything come of their suggestions until Pope Gregory XIII, concerned over the proper dating of Easter – a complex issue that had contributed to the divide between the Eastern and Western Church – implemented the needed changes in 1582. As part of the reform, Gregory's reformers cut ten days from the civil calendar and, although Bacon was left uncredited, they also implemented many of the improvements he had suggested three centuries before.[92]

That same year, 1582, the English scientist and philosopher John Dee "commended Bacon to Queen Elizabeth as one who had 'instructed and admonished' the 'Romane Bishopp,' who was now 'contented to follow so neare the footsteps of veritye,'" yet, despite that endorsement, Protestant Britain refused to accept the "popish" Gregorian calendar and instead clung to the outdated Julian system for another two hundred years.[93] Meanwhile, calendar time in Britain continued to drift further out of synch with Europe until, by 1750, the two time systems had become eleven days out of step.[94]

This time-gap did not directly affect the local concerns of the average urban or rural worker. The sun defined their task-oriented *timescape*, which meant their time was intensely local, bounded by sunrise and sunset and broken by daily seasonal tasks and the alarm bells of the tower clock. As one eighteenth-century source, writing in the guise of fictional

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[92] *Complete Dictionary of Scientific Biography* (2008), p.383. Bacon asserted that accumulated errors in the Julian calendar caused the length of the year to be off by a full day every 130 years. This calculation was more accurate than Ptolomy's calculations and even the Alphonsine tables compiled after Bacon's work was published – tables that implied the Julian error came to one day in about 134 years. (The correct figure for Bacon's time was later found to be one day in a little over 129 years. This meant the uncorrected Julian calendar gained an extra day once every 129 years, slowly bringing the civil year out of synch with natural and celestial observations.) To correct for this irregularity, Bacon suggested a reformed calendar should remove one day every 125 years – a recommendation that, while left uncredited, was later applied to the Gregorian calendar, which ignores three leap years every four centuries. *London Evening Post*, February 28, 1751 – March 2, 1751, Issue 3645, *British Newspapers 1600-1950*, http://find.galegroup.com/bncn/start.do?prodId=BNWS&userGroupName=stand (last accessed, 21/3/2016).

[93] Ibid.

[94] *London Evening Post*, February 28, 1751, *To The Printer, British Newspapers 1600-1950*, http://find.galegroup.com/bncn/start.do?prodId=BNWS&userGroupName=stand (last accessed, 21/3/2016).

housewife Patience Meanwell, complained after a service of public bells was implemented in Newport, Rhode Island (then, still a British colony), "before the bell rang at one o'clock, if my husband came home and his victuals were not ready as neither he nor I really know the time of day, I could easily make an excuse."[95] She requested that the "authorities either skip the one o'clock bell or add one at eleven to alert housewives to begin meal preparations."[96]

For Patience, and people like her, the traditional Julian calendar still performed its required local functions, despite the eleven-day gap. The problem came with dealings abroad. Britain's erroneous calendar became something of an embarrassment to British statesmen and businessmen who realized an eleven-day time-gap that affected foreign affairs, communications, and foreign trade threatened to cost them not only prestige, but also profit.

The eleven-day difference allowed to grow between the Julian and Gregorian calendrical systems lies at the heart of the calendar riot myth, but that was only one aspect of what was really a three-fold problem. Before 1750, the United Kingdom had two separate New Years. In Scotland, the year began on the same date as it did on the Continent: the first of January. But, in the rest of Britain the legal year traditionally commenced on the twenty-fifth of March, the spring equinox – a difference of nearly three months.[97] If calendar reform was to take place, not only would the eleven extraneous days have to be cut, but the start of the year would have to be shifted from March to January, with the confusing effect of displacing September, October, November, and December from their namesake positions on the traditional calendar as December (formerly the tenth month) became the twelfth and closing month of the year. Add to this the question of correctly calculating the dates of

[95] Patience Meanwell opinion in *Newport Mercury*, 27 July 1772, in Stephens, *On Time*, p.45.

[96] Ibid.

[97] *The Earl of Macclesfield's Speech in the House of Peers on Monday the 18th Day of March, 1750. At the Second Reading of the Bill, For Regulating the Commencement of the Year, &c.* (Dublin, 1751), pp.5-7.

moveable feasts, such as Easter, and the issue of calendar reform became even more complex.

As the eighteenth century wore on and Britain's concerns and holdings abroad expanded, calendar differences that had previously been a mere inconvenience became an increasingly blatant hindrance to business and political interests. Lord Chesterfield, the gentleman responsible for bringing the Calendar Reform Act to Parliament, wrote of his frustration to his son:

> [I]t was notorious, that the Julian calendar was erroneous, and had overcharged the solar year with eleven days. Pope Gregory the Thirteenth corrected this error; his reformed calendar was immediately received by all the Catholic powers of Europe, and afterward adopted by all the Protestant ones, except Russia, Sweden, and England. It was not, in my opinion, very honorable for England to remain, in a gross and avowed error, especially in such company; the inconveniency of it was likewise felt by all those who had foreign correspondences, whether political or mercantile. I determined, therefore, to attempt the reformation; I consulted the best lawyers and the most skillful astronomers, and we cooked up a bill for that purpose.[98]

In his speech before the House of Lords supporting that very bill, the Earl of Macclesfield, acknowledged by Chesterfield in his letters as "one of the greatest mathematicians and astronomers in Europe" as well as the man "who had the greatest share in forming the bill," pointed out that although

> the Dates according to one Calendar or Account may, without any great Difficulty, be reduced to those of the other...it must still be a Matter of some Trouble, and the Loss of some Time, to make such reductions; and that the Number of the Same, where Dealings are large, and Correspondence extensive, will be considerably increased: It will surely be well worth the while intirely[sic] to remove an Inconvenience, from the which there may possibly arise, if the greatest Exactness be not constantly observed, more Mistakes and Confusion than a little Time and pains would be sufficient to rectify; and which might even sometimes occasion such real Losses, as could never again be retrieved.[99]

These contemporary voices represent the attitudes of much of eighteenth-century Britain's wealthy scientific, mercantile, and political elite. To them, the British calendar was

[98] "Letter to his Son, CXXXV," *Lord Chesterfield and the Gregorian Calendar*, http://penelope.uchicago.edu (last accessed 8/8/2012). Referenced in part in Poole, "Give Us Our Eleven Days!"

[99] Ibid.; Macclesfield, "Speech," p.7.

a malleable document, a useful organizing tool scientifically informed by celestial observation and careful calculation and amenable to contemporary needs, and the longer it remained out of step with the rest of Europe, the greater the danger that important deals, correspondence, and material profit could be lost, missed, or mismanaged. Yet, although many elites acknowledged reforming the calendar was necessary, that did not mean the Lords in Parliament fully understood the science and mathematical calculations behind the reforms they were being asked to pass. Chesterfield admitted he "did not understand one word" of the astronomical jargon that made up most of the Act. "However," he wrote,

> it was absolutely necessary to make the House of Lords think that I knew something of the matter; and also to make them believe they knew something of it themselves, which they do not. For my own part, I could just as soon have talked Celtic or Sclavonian to them as astronomy, and they would have understood me full as well: so I resolved to do better than speak to the purpose, and to please instead of informing them...This succeeded, and ever will succeed; they thought I informed, because I pleased them; and many of them said that I had made the whole very clear to them; when, God knows, I had not even attempted it...This will ever be the case; every numerous assembly is mob, let the individuals who compose it be what they will. Mere reason and good sense is never to be talked to a mob; their passions, their sentiments, their senses, and their seeming interests, are alone to be applied to. Understanding they have collectively none, but they have ears and eyes, which must be flattered and seduced; and this can only be done by eloquence, tuneful periods, graceful action, and all the various parts of oratory.[100]

This passage indicates that Chesterfield's concern over calendar reform had less to do with a desire for scientific correctness than it did with a desire to bring a stubborn, insular Britain in line with cosmopolitan Europe and European trade.[101] Still, with or without a deep understanding of the scientific specifics involved in calculating the year, Parliament recognized the practical need of the reforms and passed the bill. The changes were made and, over the course of two years, British (and British colonial) business, trade, shipping, and record keeping were gradually brought into synchronization with the European continent.[102]

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[100] Chesterfield, CXXXV.

[101] Alkon, "Changing the Calendar" pp.1-18.

[102] LXXXIX. Statua 24 Georgii II, c.23(2). A.D. 1751 *An Act for regulating the Commencement of the Year,*

But, as necessary and desirable as calendar reform may have been to business and political interests, Parliament was not the only "mob" whose passions, sentiments, and senses had to be addressed. For most ordinary citizens, the reform was not merely an academic or political matter. It was a social matter, with deep ties to religion and folk tradition. The changes to the civil timekeeping system touched everyone, no matter their social status, striking a deep, emotional chord that shook the people's connection with the traditional festive calendar that informed the pre-*mechanical timescape*.

In contrast with the myth of the eighteenth-century calendar riots, which imply that common citizens had a limited, unsophisticated, and highly superstitious understanding of time (a myth layered with temporal and cultural biases, not unlike the story of the Great Cat Massacre or the spin Scarlett put on Peterloo), contemporary sources indicate that the common people of Britain were actually quite time-aware – if not necessarily in the abstracted sense that allowed Parliament to view the civil calendar as malleable, then in a strong seasonal, observational sense.[103] In this almanac-dominated *timescape*, the real reasons for contemporary protest had to do with practical concerns regarding the displacement of traditional holidays and related confusion in dating and recordkeeping, as illustrated by this contributor to eighteenth-century journal *The World*:

> In so enlightened an age as the present, I shall perhaps be ridiculed if I hint, as my opinion, that the observation of certain festivals is something more than a mere political institution. I cannot, however, help thinking that even nature itself concurs to conform my sentiment...My readers no doubt are already aware that I have in my eye the wonderful thorn of Glastonbury...Near two years ago the popish calendar was brought in...certain it is that the Glastonbury thorn has preserved its inflexibility, and observed it's old anniversary. Many thousand spectators visited it on the parliamentary Christmas day — Not a bud was to be seen! — On the true nativity it was covered with blossoms. One must be an infidel indeed to spurn at such authority...instead of turning the calendar

*and for correcting the Calendar now in use.*

[103] See: Whitrow, *Time in History*; Poole, *Time's Alteration*; Gardner, *Poetry and Popular Protest*; Darnton, *The Great Cat Massacre*; *The Trial of Henry Hunt, Esq...1820.* http://www26.us.archive.org/stream/trialofhenryhunt00huntiala/trialofhenryhunt00huntiala_djvu.txt (last accessed, 10/10/2015).

> topsy-turvy by fantastic calculations, I should have proposed to regulate the year by the infallible Somersetshire thorn, and to have reckoned the months from Christmas-day, which should always have been kept as the Glastonbury thorn should blow.[104]

Another contemporary journal noted: "Yesterday being Old Christmas Day, the same was obstinately observed by our country people in general, so that (being market day according to the order of our magistrates) there were but a few at market, who embraced the opportunity of raising their butter to 9d. or 10d. per pound."[105] In London, bankers reportedly protested the confusion caused by the calendar reform by withholding their taxes, usually paid on the old New Year's date of 25 March, for eleven days, paying instead on 5 April, 1753.[106]

Many more popular contemporary newspapers and publications, such as *The World*, *Gentleman's Magazine, The London Gazette, The London Evening Post* and *The Ladies Diary, or Woman's Almanack* published similar instances in articles, essays, and even poems regarding the calendar change and their readers' reactions during the transitional period between 1771 and 1774. Most were supportive explanations striving to assuage confusion, others tongue-in-cheek criticisms displaying more humor than anger. One anonymous poem, "The Tears of Old May-Day" playfully laments the shift of May Day from its traditional date, comparing the old, neglected festival to an aging beauty being trumped by a younger rival: "for now a younger rival claims/My ravish'ed honors, and to her belong/My choral dances, and victorious games,/To her my garlands and triumphal song."[107]

Even the Church of England backed the reform with its slogan "The New Style, The True Style," citing the work of Englishman Roger Bacon as a compelling reason to support

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[104] Adam Fitz-Adam, "The World," Number X, Thursday, March the 8th, 1753, p.57.

[105] Duncan, *Calendar*, p.315.

[106] Ibid. Britain's fiscal year still ends 5 April and begins 6 April.

[107] Fitz-Adam, "World," p.57.

what had for the past three centuries been denounced as a "popish" calendar.[108]

The main complaints had to do with what some considered the irreligious effrontery of changing the date of saints' days and confusion regarding legal and monetary records. The Act had taken the issue of rents, leases, taxes, debts, etc. into account, but reality proved more complicated. Historian William Coxe summarized the confusion:

> In practice, this innovation was strongly opposed, even among the higher classes of society. Many landholders, tenants and merchants, were apprehensive of difficulties, in regard to rents, leases, bills of exchange and debts, dependent on periods fixed by the Old Style... Greater difficulty was, however, found in appeasing the clamour of the people against the supposed profaneness, of changing the saints' days in the Calendar, and altering the time of all the immoveable feasts.[109]

Available evidence suggests that, rather than rioting in the streets, the people did what came naturally to them in times of temporal confusion: they turned to their almanacs, and to their local authorities to help them sort out the confusion.[110] Almanacs in Britain and the American colonies printed New and Old Style calendar tables for years and, after the initial transition period had passed and the new calendar had settled into the comfortable invisibility that comes with normality, the eighteenth-century's pre-*mechanical timescape* continued as it always had, until challenged by the industrial revolution's demands for increased speed, efficiency, and punctuality.[111]

Yet, the sources also reveal the complex, varied, and deeply layered nature of the late pre-industrial sense of time.[112] Literacy being far from universal, most of the eighteenth-

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[108] *A Letter from Dr. John Wallis…*Oxford, June 13, 1699; *General Evening Post*, February 26-28, 1751, Issue 2689, *British Newspapers 1600-1950,* http://find.galegroup.com/bncn/start.do?prodId=BNWS&userGroupName=stand (last accessed, 21/3/2016).

[109] Quoted in Duncan, *Calendar*, p.312.

[110] Newspaper ads for almanacs and calendars for 'youths' (1751-1760), *British Newspapers 1600-1950,* http://find.galegroup.com/bncn/start.do?prodId=BNWS&userGroupName=stand (last accessed, 21/3/2016).

[111] This will be discussed in Layer Three, along with the rise of factory time and train schedules.

[112] Such sources indicate the dichotomy between traditional religious and seasonal time and the abstracted rationality of clocks and the public time of work and trade was a prominent theme in eighteenth century life. "Crudely put, time in the eighteenth century can be depicted as either 'baroque', pre-industrial, dominated by the seasons, the sun and the irregular routines of farming, the small workshop and the patterns of the Catholic

century articles, newspaper editorials, and even ads discussing, debating, and capitalizing on the calendar change were written by the educated elite: a class of politicians and businessmen who understood time as a flexible tool and displayed a somewhat derogatory and, at times, even mocking attitude toward the workers, farmers, and other country folk who continued to view time as an immutable natural, religious force.[113] This admittedly presents historians with a rather distorted mirror, refracting the outlook of the ordinary people off the presumptions and attitudes of an educated minority, but that very distortion highlights the temporal conflict that existed, and continues to exist, between divergent, contemporaneous *timescapes*.[114] The calendar riot myth therefore represents something of an early skirmish of the oncoming nineteenth-century temporal revolution, while its propagation in modern texts demonstrates the significance of *timescape* bias in the analysis of past temporal attitudes and reforms.[115]

The myth of the calendar riots shows that minds raised in the modern, *mechanical timescape* tend to find a closer affinity with those who understood time to be flexible, allying them, almost subconsciously, with those who advocated calendar change, and with the notion that those who maintained their former temporal traditions held fast to a backward, even primitive, time sense.[116] Yet, the concerns raised by the change were practical, addressing a

year, or as a period of transition toward what E.P. Thompson has termed 'industrial work time…'" The importance of calendrical structure and its layered religious and cultural connotations was highlighted during the French Revolution, which prompted experimentation beyond mere standardization to chronicle a new, very self-aware revolutionary age. Matthew Shaw, *Time and the French Revolution: The Republican Calendar, 1789-Year XIV* (Suffolk, 2011), p.17.

[113] Sources include: *London Evening Post*, February 28-March 2, March 9, 1751; *General Evening Post*, February 19-21, 26, 1751; *Old England*, Saturday March 9, 1751; *London Advertiser and Literary Gazette*, Tuesday March 12, 1751; *Rambler*, Tuesday March 26, 1751, Issue 109, *British Newspapers 1600-1950*, http://find.galegroup.com/bncn/start.do?prodId=BNWS&userGroupName=stand (last accessed, 21/3/2016).

[114] Fitz-Adam, "World," p.57.

[115] Whitrow, *Time In History*, p.3.

[116] The dichotomy between traditional religious and seasonal time and the abstracted rationality of clocks and the public time of work and trade was a prominent theme in eighteenth century life. "Crudely put, time in the eighteenth century can be depicted as either 'baroque', pre-industrial, dominated by the seasons, the sun and the

perceived threat to the economic, political, religious, social, and cultural status quo. Parsing out the layers of this reaction reveals disparate temporal worldviews that fundamentally differ from each other, and from the modern understanding and expectation of time – worldviews that would inevitably clash. The results of that clash, while tumultuous on a mental level, were not outwardly violent. The notion that they could have been, that the threat of cutting eleven days from the British calendar could lead to mob activity and even deaths, indicates just how deeply ingrained these mental attitudes toward time were and how their bond with socio-cultural identity and tradition was strong enough to provoke a defensive reaction among each affected social group – a reaction that indicates the alteration of Britain's calendar incited an early skirmish of the nascent temporal revolution.

irregular routines of farming, the small workshop and the patterns of the Catholic year, or as a period of transition toward what E.P. Thompson has termed 'industrial work time…'" The importance of calendrical structure and its layered religious and cultural connotations was particularly highlighted during the French Revolution, which prompted experimentation beyond mere standardization to chronicle a new, very self-aware revolutionary age. Shaw, *Time and the French Revolution*, p.17.

*SIGNPOST 2*

The following section, "Man or the Moon: Harrison, Maskelyne, and the Longitude," takes the clash between the seasonal and *mechanical timescapes* further by studying the opposing positions of two men whose personal and professional conflicts personified the differences inherent to these two concurrent, yet incompatible worldviews: John Harrison, credited with inventing the maritime chronometer, and Nevil Maskelyne, the astronomer responsible for compiling and publishing the British *Nautical Almanac*. As before, the conflict between the divergent seasonal and *mechanical timescapes* are used as an analytical framework – in this case, to examine the history of John Harrison's struggle with the Board of Longitude over his claim to the Longitude prize in the context of the temporal revolution. Since Harrison's story is admittedly well-trodden ground, investigating the conflict from a temporal angle emphasizes the value of *timescapes* as a flexible analytical tool and the significance of the temporal revolution and its long and short term impact.

This section investigates the premise that an individual's understanding and expectations of time and timekeeping methods – his *timescape* – can directly impact his attitude toward and degree of openness to accepting and assimilating new technologies and ideas. In this case, Harrison's contempt for the astronomical lunar-distance method of finding longitude is contrasted with the apparent inability of the members of the Board of Longitude, including Nevil Maskelyne, to accept Harrison's mechanical chronometer as a useful and practical solution to the pressing problem of determining a ship's longitude at sea. The question is, if Harrison's invention did pass the tests required to earn the Longitude Prize promised by the Act of Queen Anne, why did the Board never grant him the award? Why did Harrison have to turn to the King, then to Parliament to receive the money he so firmly believed he had earned? Was it a conflict of social class combined with pre-industrial mechanical ignorance? Or could the conflict be better characterized as a clash between

proponents of two equally forward-looking, yet inherently incompatible, divergent *timescapes*?

Building on the question of *timescape* bias addressed in the previous section, the popular modern portrayal of Harrison as a misunderstood genius stubbornly standing his ground against a wall of mechanically ignorant, backward-thinking, pre-industrial-minded astronomers will be contrasted with contemporary sources that indicate that the astronomical method of finding longitude was at least as scientifically innovative and advanced as Harrison's chronometers.[117] But, if that is so, then what was really at the heart of the conflict? Contemporary sources, such as the records kept by Lord Barrington, a prominent politician who acted as something of a liaison between the Board and Parliament, suggest it was a question of trust.

This chapter argues the astronomers of the Board were products of a *seasonal timescape*, trained to put their trust in observable, astronomical time – what they called "true" time. The Harrisons, and many of their supporters, were craftsmen, businessmen, and professionals, more inclined to put their trust in precision tools and instruments than the weather-reliant observations of an astronomer's "trained" eye. Products of a nascent, yet growing, *mechanical timescape*, the Harrisons disregarded the complex process of finding and tracking astronomical time as unnecessary when the abstracted estimations carried by meticulously crafted and regulated mechanical clocks could do the job without the constant need for astronomical observations and difficult calculations. Their willingness to accept the abstracted estimations inherent to clock-time indicates the rise and assimilation of the *mechanical timescape*, making Harrison's struggles with the Board of Longitude one of the most popularized, and significant, clashes of this phase of the temporal revolution.

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[117] Recent examples of the popular portrayal of Harrison as a lone hero include Dava Sobel, *Longitude: The Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time*, (New York, 1995); *Longitude*, (USA/UK: A&E Television Networks and Granada Film Productions, 2000), 250 minutes.

### *MAN OR THE MOON: HARRISON, MASKELYNE, AND THE LONGITUDE*

John Harrison's experience with the Board of Longitude was the experience of an individual caught between two very different, and rapidly transitioning, worlds. The same could be said of Harrison's chief "rival" for Britain's coveted Longitude Prize, the Reverend Nevil Maskelyne, who served as England's fifth Astronomer Royal from 1765-1811. An investigation into the lives and work of these two men shows them to be, essentially, complete opposites, in everything from their social pedigree, education, and world-views to their very different approaches to solving the age-old puzzle of finding longitude at sea: namely, Harrison's maritime chronometers and Maskelyne's *Nautical Almanac*. Yet, just as sailors found marine chronometers and nautical almanacs most practical when used together, the significant differences between these two men makes for a complimentary and comparative analysis. Together, the lives and experiences of the self-taught clockmaker and the classically educated astronomer embody the clash and gradual supplantation of the traditional *seasonal timescape* with the *mechanical timescape* that would come to dominate the burgeoning industrial revolution, revealing deep issues of class, education, scholarly tradition, and the pressing, practical needs of a growing, seafaring nation that drove a scientific and cultural transition – a temporal revolution that would help shape the modern mind.[118]

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[118] The opposing temporal worldviews held by Maskelyne and the Board of Longitude, and Harrison and Harrison's son, William, were chosen for this study not only because these contrasts are evidenced in their writings and letters, but because their positions inspired wider debate among those who read and contributed to popular publications such as *The World* and *Gentleman's Magazine*. The problem of finding longitude at sea was of great importance to international trade and travel, and incited great public and specialist interest. Both Harrison and Maskelyne published pamphlets defending their respective positions. The later interpretation of these positions in modern history texts, such as Sobel's *Longitude*, in turn help to illustrate modern temporal perspectives and values. See: Verax, "Letter," *Gentleman's Magazine,* 27 (December 1757), pp.544-546; Anonymous, "Letter," *Gentleman's Magazine* 28, (June 1758), p.254; *Astrophilus*, "Of the Inventions for discovering the Longitude," *Gentleman's Magazine* 31 (October 1761), pp.437-439; Appendix Numb.V to "An Account of the Proceedings in order to the Discovery of the Longitude: In a Letter to the right Honorable ******, Member of Parliament (London, M.DCC.LXIII); John Harrison, "Remarks on a Pamphlet Lately Published by the Rev. Mr Maskelyne, Under the Authority of the Board of Longitude," (London, W. Sandby in Fleetstreet, 1767); A Narrative of the Proceedings Relative to the Discovery of the Longitude at Sea, (London, Mr Sandby in Fleet-Street, 1765); Minutes of the Proceedings of the Commissioners Appointed by Act of Parliament for the Discovery of the Longitude at Sea, Their Meetings on the 25th, 28th, and 30th of May, and 13th

The story of the British longitude prize is long and filled with colorful stories of crackpot inventions and inane theories, but out of this frustrating morass two distinct camps took shape: two methods that promised to offer a truly practical solution to the longitude problem, if only the technological challenges could be met. These were the clock method and the lunar-distance method. In Britain, the carpenter-turned-clockmaker John Harrison became the face of the clock method camp while the Reverend Nevil Maskelyne became the face of the lunar-distance camp.[119]

The lives, work, status, and perceived competition between John Harrison and Nevil Maskelyne parallel a much larger and far more insidiously subtle conflict between two competing worldviews: the dominant seasonal, pre-industrial reality of Enlightenment science and the dawning, abstracted, *mechanical timescape* that would come to define the burgeoning industrial mindset.

Harrison was a middle-class craftsman from rural northern England with no formal scientific education. His learning in clockmaking and metallurgy came through practical experience and self-motivated, independent study and experimentation. Maskelyne, descended from a wealthy landowning family, was born in London and classically educated in mathematics and astronomy at the University of Cambridge. The scientific approaches

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of June, 1765; The Principles of Mr. Harrison's Time-Keeper, with Plates of the Same Published by Order of The Commissioners of Longitude, (London, W. Richardson and S. Clark, 1767); "Autobiographical notes in Dr. Maskelyne's own hand," transcribed in Derek Howse, *Nevil Maskelyne: The Seaman's Astronomer* (Cambridge, 1989), pp.214-224; William Harrison, MS 6026 2A, 19, (Guildhall Library).

[119] Neither of these approaches was new, but both had long been hindered by the limitations of technology. The origins of the lunar-distance concept can be traced back to ancient Greeks, such as Hipparchos of Nicaea, who recognized differences in longitude could be understood in terms of differences in local time. Centuries later, Claudius Ptolemy referenced and expanded on Hipparchos's lunar-eclipse idea in his *Geography*, but no significant advancements were made until the mechanical clock and the Italian sea chart were developed in the late thirteenth century. Yet, those early clocks were more useful as rough alarms than accurate timekeepers, and medieval sea charts – while helpful when sailing relatively enclosed areas like the Mediterranean – often lacked scales of latitude and longitude. The situation remained relatively unchanged until the Age of Discovery provided a new, urgent impetus for solving the ancient longitude puzzle. Howse, *Greenwich Time*, p.2-4.

these very different men took in their attempts to solve the age-old longitude puzzle were just as polarized as their backgrounds.

The question of longitude is, in essence, a question of time and timekeeping methods, and the competition to find a practical method of calculating longitude at sea provoked a direct conflict between two distinct timekeeping methods which, in turn, informed two distinct and divergent *timescapes*. The *seasonal timescape*, described in the previous section, was ascendant when Harrison brought his watch to be tested for the longitude prize. The *mechanical timescape*, by contrast, was a relatively new worldview, the nascent form of which can be dated back to the urbanized merchant and shipping cultures of Europe's late medieval and Renaissance cities – cultures whose profit increasingly relied on accurate timekeeping and a knowledge of differing local times.[120]

Following the prevailing mindset of his time, Maskelyne aimed to solve the puzzle by using celestial observations to develop a nautical almanac with companion tables, today recognized as his "greatest contribution to the improvement of navigation and astronomy – and to science as a whole."[121] Harrison, a hands-on craftsman who followed a more mechanically oriented mindset, sought to develop a machine accurate and reliable enough to negate the necessity of long hours of celestial observation and complicated calculations – a machine that could carry its own time from shore to shore in the form of precisely regulated isochronous beats that could be easily synchronized to correspond with any local time. The competition between these men for the British longitude prize, therefore, represents what has probably become the most publicized clash in Britain's long transition from a pre-mechanical to a *mechanical timescape*. The successes of Harrison's clock and the subsequent propagation of maritime chronometers evidences the early acceptance and spread of

[120] John Darwin, *The Empire Project: The Rise and Fall of the British World System, 1830-1970* (Cambridge, 2009).

[121] Howse, *Maskelyne*, p.85.

mechanical time – a fundamental perceptual change that would help shape nineteenth-century Britain's complex relationship with its own industrial revolution.

It can be argued that temporal revolutions share similar triggers with geospatial revolutions but, because they are less visible, they seem less immediate and, therefore, historians' general recognition and analysis of the symptoms of these highly transformative mental revolutions tend to lag behind the geographically, politically, or even economically mapable historical changes. The quest to develop a reliable, consistently accurate method for finding longitude at sea, and on land, had frustrated humanity's most brilliant scientific minds since ancient times, but the need to solve the seemingly impossible puzzle gained fresh urgency when Europe embarked on its Age of Discovery, a period of global expeditions between the fifteenth and seventeenth centuries that overhauled the European understanding of the world, its geography, and its peoples: aspects of a long geospatial revolution that set the sun at the center of the solar system and inflated a presumed flat earth in to a spinning globe.[122] During this period, oceanic voyages became increasingly frequent as seafaring nations sought to establish and broaden their economic and political influence abroad. Without a reliable method of finding longitude, however, ships found they were technically lost at sea the moment they lost sight of land.[123] But what made finding longitude so difficult?

Aside from seasonal fluctuations resulting from the Earth's approximately twenty-three degree axial tilt, those who live their lives in one location, or who only travel north-south, meet up with and depart from the sun's light at about the same time every day. Since

[122] Spanish author, Miguel de Cervantes, writing in the late sixteenth century, poked fun at those who sought to solve the longitude problem, describing it as an impossible task, like squaring the circle. Cervantes, *The Dog's Dialogue*, in Howse, *Greenwich Time,* p.12. The geospatial revolution will be discussed further in Layer Two.

[123] Harry Liebersohn, *The Travelers' World: Europe to the Pacific* (London, 2006); Derek Howse, *The Sea Chart: An Historical Survey Based on the Collections in the National Maritime Museum* (London, 1973); Sobel, *Longitude* (New York: 1995); Humphrey Quill, *John Harrison: The Man Who Found Longitude* (London, 1966).

they never move much out of kilter with their home meridian, the shift from day to night remains, for them, consistent, predictable and reliable. However, a traveler moving east-west across these meridians, or lines of longitude, discovers a confusing reality of divergent local times, seeming to go back an hour for each meridian crossed going west or move forward an hour for each meridian crossed going east.

Due to this quirk of a rotating planet, when a ship travels east or west, if the crew wants to determine how far they traveled from their home port, they must take into account not only their speed and the angle of the sun and stars (to plot their north-south position), but the time difference between where they are and where they were. To plot their east-west position, they need a way to measure and compare the current local time at their present location at sea with the current local time at their home port.

In a technologically-driven world of digital clocks, global positioning devices, and satellite-view maps, this does not seem much of a challenge. But, until the late eighteenth century, it was widely feared the difficulties involved would prove insurmountable. Desperate for a solution, seafaring nations like Spain and Holland began offering significant monetary prizes that stimulated respected scientists and crack-pots alike to try their hand at finding longitude.[124] Unfortunately, so many crack-pot inventions and theories were submitted that "finding the longitude" became a metaphor for an impossible task, like turning lead into gold.[125] The struggle did prompt the establishment of observatories across Europe, including Britain's Royal Greenwich Observatory, founded by King Charles II in 1675 with the aim of publishing comprehensive star charts to aid navigation.[126] It was not until the much-publicized Scilly disaster, however, that Britain truly became involved in the ongoing

[124] L.A. Brown, *The Story of Maps* (New York, 1951), p.209; Howse, *Greenwich Time*, pp.12-13, 52.

[125] Sobel, *Longitude*, p.8.

[126] Howse, Greenwich Time, p.28.

Longitude struggle: a tragedy of multiple shipwrecks just off the southernmost coast of Cornwall that took place on the night of October 22, 1707.[127]

More tragic than even this shocking loss was the fact that the Scilly disaster was far from an isolated incident. The inability to find longitude at sea could be more perilous to sailors than the fiercest storms. Storms could be ridden out, but without a practical and consistently reliable method of determining a ship's accurate position at sea, the horrors of scurvy, starvation, and shipwrecks were an all-too-frequent reality; a reality that dogged even the most frequently charted and heavily traveled oceanic trade routes from the earliest Portuguese explorers through the Napoleonic Wars into the nineteenth century.

Responding to letters, pamphlets, and repeated petitions to the House of Commons suggesting solutions and begging rewards for solving the problem of longitude, Parliament passed the Longitude Act of 1714, also known as the Act of Queen Anne, offering a fortune of twenty thousand pounds (approximately two million pounds in modern currency)[128] paid to whomever could prove a practicable and useful method of finding longitude with no more than one half degree of error.[129] Sir Isaac Newton, one of the technical experts recruited to advise the House of Commons on the matter, described four possible solutions, only three of which were potentially practical – projects that were "true in the Theory, but difficult to execute:

> One is, by a Watch to keep Time exactly; But by reason of the Motion of a Ship, the Variation of Heat and Cold, Wet and Dry, and the difference of Gravity in different Latitudes, such a Watch hath not yet been made:

[127] Sobel, *Longitude*, p.11.

[128] William E. Carter and Merri Sue Carter, "The British Longitude Act Reconsidered," *American Scientist*, Vol 100), p.102. The authors claim the prize would be "equal to more than $3 million today."

[129] *The Act of 12 Queen Anne, Chapter 15: An Act for Providing a Publick Reward for such Person or Persons as shall Discover the Longitude at Sea*, reprinted in full in Quill, *Harrison*, p.225.

> Another is, by the Eclipses of *Jupiter's Satellites*: But, by reason of the Length of Telescopes requisite to observe them, and the Motion of a Ship at Sea, those Eclipses cannot yet be there observed:
>
> A Third is, by the Place of the Moon: But her Theory is not yet exact enough for this Purpose: It is exact enough to determine her Longitude within Two or Three Degrees, but not within a Degree…
>
> In the Three first Ways there must be a Watch regulated by a Spring, and rectified every visible Sun-rise and Sun-set, to tell the Hour of the Day, or Night…In the First Way, there must be Two Watches; this, and the other mentioned above.[130]

Newton's speech to Parliament indicates that it was generally recognized and accepted early on that, no matter which method was supported, the development of accurate, portable mechanical clocks would be key to solving the longitude puzzle. The challenge any new clockmakers would face, the challenge Harrison would face, therefore, was not persuading out-of-touch astronomers that the clock-method was a valid and desirable solution, but convincing a wary Parliament-appointed scientific Committee that the previously unreachable maritime clock had finally made the practical and workable transition from hazy science fiction to trustworthy science fact.

John Harrison was twenty-one when the Longitude Act passed (unanimously), but he had harbored an interest and talent for clockmaking since before 1713 – the date of his earliest surviving pendulum clock.[131] Since very few records of his early life have survived, there has been a great deal of speculation about Harrison's early influences, growing up as he did far from Britain's urban centers. Dava Sobel viewed the origins of his clockmaking abilities as a mystery, writing, "Why he chose to take on this project [his pendulum clock] and how he excelled at it with no experience as a watchmaker's apprentice, remain

[130] *House of Commons Journal,* 17 (25 May, 1714) in Howse, *Greenwich Time*, p.51.

[131] Harrison's early wooden pendulum clock, on which he shares credit with his brother James, is displayed at the Guildhall Clock Museum.

mysteries… Historians wonder which clocks, if any, Harrison might have…studied before fashioning his own…no one can guess where the boy might have gotten such a thing…"[132]

The notion that Harrison's rural upbringing would have precluded him from studying contemporary clocks and clockmaking techniques has become central to his popular, modern portrayal as a "lone" genius fighting practically single-handedly for recognition against a backwards-thinking scientific establishment. It goes hand in hand with the common assumption that interest in and demand for clock-time was an urban phenomenon, something that had not yet fully penetrated the predominantly agricultural communities of the eighteenth century; an assumption that indicates the relevance of *timescape* bias as an analytical factor when comparing and contrasting the layered and ever-evolving mentalities that characterize the temporal revolution. Livingston argued that the notion that "scientific inquiry takes place in highly specialist sites," such as universities, scientific societies and clubs, and even urban coffee houses can often influence the dissemination and acceptance of theories and technologies, fostering both academic and public trust. [133] While Harrison was familiar with prominent London clockmakers and members of the Royal Society, such as George Graham, the issue of trust, not only in him but in his inventions, remained a notable factor in his struggles with the astronomers and scientists of the Longitude Board. In many ways, he was not a 'loner' because his rural background precluded access to the latest technologies, but because, rather than circulating within these specialized academic spaces, he worked with his hands in a craftsman's workshop.

Paul Glennie and Nigel Thrift argued Harrison's clockmaking was not as novel or precocious as had previously been thought, nor was he isolated from the clockmaking

[132] Sobel, *Longitude*, p.64.

[133] David Livingstone, *Putting Science in its Place: Geographies of Scientific Knowledge* (Chicago, 2003), pp.xi, 134.

trade.[134] Young though he may have been in 1714, as a working artisan Harrison was part of a much larger "community of practice," including not only clockmakers but "an actively interested lay community" – amateurs, clergymen, scientists, and ordinary customers who

> took an active role in deciding what clocks should do and how they should be, appear, or sound. Such customers…took active parts in the process of producing a clock, and were fascinated by seeing clocks or watches taken to pieces and reassembled, and by how timepieces performed. Their senses of clockmaking and time-telling as creative activities were…not uncommon: if most common among provincial Royal Society members, especially clergymen, they were also present among artisans.[135]

Harrison's own immediate circle included his younger brother James, who worked closely with him on some of his earliest wooden clocks (some of which are on display at the Guildhall Clock Museum in London), and records of Harrison's early commissions to repair and refurbish local turret clocks still survive, providing "strong evidence of reputation beyond the immediate locality, with all that implied for Harrison's previous activity and experience…even if this was more in terms of generic skills and a deep understanding of wood and woodworking, than solely and specifically as a clockmaker."[136] But, what might have inspired the young Harrison to pursue such work in the first place?

Printed works by Harrison's contemporary supporters, many of which aimed to explain the clockmaker's position and backstory to Parliament and the wider educated community, document the contrasting mentalities that characterized the escalating disputes between Harrison and the Board of Longitude. One of the more detailed and well known, "An Account of the Proceedings in order to the Discovery of the Longitude," discusses Harrison's motivations for delving into the frustrating problems of precision clock-making, implicating his innate curiosity as the primary factor that led him to investigate variables such

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[134] Paul Glennie and Nigel Thrift, *Shaping the Day: A History of Timekeeping in England and Wales 1300-1800,* (Oxford, 2009), p.359.

[135] Ibid., p.397.

[136] Ibid., p.398.

as "the Variation of Heat and Cold, of Moisture and Dryness, of the Friction of Bodies in Motion, and of the Fluidity of Oil…"[137] Coupled with that was the influence of living near a seaport (Barrow-upon-Humber near the great port of Hull, where he and his family had moved around 1700). There, a "sensational piece of news" like the fortunes being offered by the Longitude Act "would have spread like wildfire through those areas adjacent to the ports and seacoast."[138] Doubtless, such news further "induced" Harrison "to consider how to alter the Construction of his Clock, so as it might not be subject to any of the said Irregularities, even on Ship-board; and [he] did accordingly *construct a Machine* for keeping Time, which upon Trial, answered his Expectation."[139]

Although Harrison's early work was with wooden clocks, his observations of the effects of weather, temperature, friction, motion, and other factors that could affect the mechanisms' various functions led him to experiment with metallurgy. His understanding of the expansion and contraction of different types of metal under different temperature conditions (the coefficient of expansion) helped to inform his "Consideration of these Causes; and after various Expedients…[he] in Effect removed them all; and made a Pendulum-Clock that keeps Time so exactly with the Heavens, as not to err above one Second in a Month, for ten Years all together; an Invention not only admirable in itself, but of very great Use towards the Improvement of Astronomy and Navigation."[140]

Harrison achieved this with his gridiron pendulum, constructed of alternating layers of brass and steel rods; his silent grasshopper escapement; and roller bearings and anti-friction wheels that helped eliminate the need for oil and cleaning. Together, such innovations made

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[137] Appendix Numb.V to "An Account of the Proceedings in order to the Discovery of the Longitude: In a Letter to the right Honorable ******, Member of Parliament (London, M.DCC.LXIII), pp.19-20.

[138] Quill, *Harrison*, p.23.

[139] Appendix Numb.V, p.20.

[140] Ibid., pp.19-20.

the Harrisons "the first to invent and construct a device for overcoming errors in a timekeeper due to variations in temperature."[141] Put into practice, Harrison's land-based wooden clocks proved "so accurate…that Harrison had to draw up an especially elaborate table of the Equation of Time, in order that the clocks could be checked accurately by the Sun."[142] Once that was achieved, it seemed all that remained between him and the much-publicized Longitude Prize was a means of adapting the clock mechanism "so that its performance would be unaffected by the rolling and pitching of the sea" – a breakthrough Harrison believed he made when, in 1735, he completed his sea-clock, H-1.[143]

Like Newton's speech, Harrison's role as part of a broader, clock-literate community directly challenges Sobel's characterization of Harrison's clock-method solution as unique, highly modern, and almost brazenly daring in an era dominated by pre-modern, sky-and-almanac-obsessed astronomers which, in turn, characterizes the mentality and inherent assumptions of an established *mechanical timescape*. This *timescape* bias is evidenced in how closely her portrayal of Harrison's struggles with the Board of Longitude as a skewed battle with Harrison standing on one side and the self-interested, mechanically ignorant scientific establishment grouped against him on the other allies with that revealed in the printed works of the increasingly disgruntled Harrisons and their frustrated supporters, and it is a particularly valuable indicator of the significance of the far reaching, and ongoing, effects of the temporal revolution.[144] Sobel wrote:

> [Harrison's] every success…was parried by members of the scientific elite, who distrusted Harrison's magic box. The commissioners charged with awarding the

[141] Quill, *Harrison,* p.27

[142] Ibid., Fig.6: "A Table of the Sun rising and Setting in the Latitude of Barrow 53 degrees 18 Minutes; also of difference that should & will be betwixt ye Longpendillom & ye Sun if ye Clock go true." 1717.

[143] Ibid., p.24.

[144] William Harrison**,** MS 6026 2A, 19, (Guildhall Library); John Harrison, "Remarks on a Pamphlet Lately Published by the Rev. Mr Maskelyne, Under the Authority of the Board of Longitude," (London, W. Sandby in Fleetstreet, 1767).

> longitude prize – Nevil Maskelyne among them (considered by some to be Harrison's chief rival) – changed the contest rules whenever they saw fit, so as to favor the chances of astronomers over the likes of Harrison and his fellow "mechanics."[145]

This literary staging is quite evocative but, like the calendar riot myth, the heroic depiction of Harrison as a "lone genius" dueling for recognition against a technophobic Board of stodgy upper-class bureaucrats is more a modern interpretation influenced, perhaps inadvertently, by the biases and assumptions of a firmly established *mechanical timescape*, than a reflection of the far more complicated eighteenth-century reality. Contemporary publications, such as *The World* and *The Gentleman's Magazine,* as well as the notes Lord Barrington wrote in preparation for explaining Harrison's dispute to Parliament, indicate that Harrison's "magic" boxes were not distrusted for representing a radical departure from astronomical methods, but because they were the latest in a long line of clocks that had proved unsuccessful at finding accurate longitude at sea.[146] While individual members may have been hostile to Harrison on a personal level, Barrington's papers indicate the Board, far from snubbing or seeking to subvert or sabotage his invention, granted Harrison support and funding all through the ups and downs of their lengthy relationship with the inventor and his son, William.[147]

Works like Sobel's *Longitude* provide valuable insight into modern assumptions about the pre-mechanical mind. In *Longitude*, despite Harrison being portrayed as a lonely voice fighting a tide of negative opinion, his is clearly the voice of the future. His clock-method is presumed naturally superior from the start, evidencing the mentality of a modern author writing for a modern popular audience informed by a *mechanical timescape* where

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[145] Sobel, *Longitude*, p.9.

[146] *Barrington Papers*, Caird Library, Greenwich; Katy Barrett, "Explaining Themselves: The Barrington Papers, the Board of Longitude, and the Fate of John Harrison," *Notes & Records of The Royal Society,* 65, (January 12, 2011).

[147] *Barrington Papers*, Caird Library, Greenwich.

clock time is the, essentially, unquestioned standard. The pre-modern *timescape* of almanacs, star-charts, and telescopes is, by contrast, portrayed (much as Harrison – himself a pioneering proponent of the *mechanical timescape* – portrayed them) as unnecessarily complicated, archaic, and inaccurate while its proponents, the "lunars," are shown to have no "knowledge about the Watch or what made it run so regularly. They may have been incapable of understanding its mechanism…"[148] The "lunars" are depicted as something of a stuffy, stubbornly exclusive astronomer's club and Maskelyne as their "handpicked henchman," all bent on subverting the Longitude Act to hinder Harrison and favor their own methods.[149]

Sobel's *Longitude* is significant to this project because of its continuing influence on the current popular image of Harrison and his struggle with the Board of Longitude – a popular image that prompted scholars like Glennie and Thrift, who were largely inspired by Sobel's portrayals of Harrison and his background (which are not so much wrong as incomplete), to work their way through reams of horological and family records to piece together a more complete and contextually accurate picture of Harrison's youth. Their findings indicate that

> …depicting the Harrisons' early wooden clocks as very unusual novelties, central to casting him as clockmaking's 'creative outsider', neglects the long tradition of wooden clocks in northern England. Harrison's wooden clocks were less a novelty than a once-extensive but now almost lost knowledge. Woodenness aside, Harrison's early clocks indicate his familiarity with 'orthodox' clocks: the calculation of trains and the equation-of-time, the internal layout, the external decoration, and makers' signing practices. His clocks incorporate many prevailing practices, rather than ignoring them; he appears familiar with up-to-date elements in both domestic and turret clockmaking, alongside his own important innovations.[150]

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[148] Sobel, *Longitude*, p.123; MS 3972A *National Maritime Museum Microfilm of Harrison Book and Documents Property of Mr RL Corry.* (Guildhall Library, London); The Principles of Mr. Harrison's Time-Keeper, with Plates of the Same Published by Order of The Commissioners of Longitude, (London, W. Richardson and S. Clark, 1767); and "Autobiographical notes in Dr. Maskelyne's own hand," transcribed in Howse, *Maskelyne,* pp.214-224.

[149] Ibid., p.125.

[150] Glennie and Thrift, *Shaping the Day*, p.398.

*Longitude* is also significant, not only for serving to inspire historians to peel back the layers of the temporal revolution but also to the wider framework of ever-changing historiographies, because it represents a teleological historical perspective that, driven by antagonism between major players, focuses on the "winner's" story. This "whiggish" approach to the history of science has been widely criticized by theorists, sociologists, and historians like Steven Shapin and Simon Schaffer, following the argument that "Concepts of time and temporality have been transformed in the wake of theories of indeterminacy and chaos in the sciences and mathematics, of technological developments that affect the speed of travel and communication, and of a general questioning of teleology…"[151] No longer tied to "futurally directed progress in which events are causally related…postmodern theorists understand such grand narratives as reductive and exclusionary and as having negative social and economic implications for those groups whose 'stories' have been erased," minimized, or misinterpreted.[152]

This chapter endeavors to show that, by using *timescapes* as an analytical tool, teleological interpretations and *timescape* bias can be effectively investigated and incorporated into a fuller historical and historiographical picture. But, why was it so difficult for educated proponents of a *seasonal timescape* to trust abstracted clock time, and what were the virtues of the lunar-distance method?

Although Harrison is credited with finally cracking the longitude puzzle with his groundbreaking machines, as mentioned above the concept of using a mechanical clock to find longitude was hardly a novel notion. In fact, the idea can be traced back to a 1530 publication by Gemma Frisius – a cartographer, globe and instrument-maker, and

[151] Judy Lochhead and Joseph Auner, ed., *Postmodern Music/Postmodern Thought* (New York, 2001), p.6

[152] Ibid.; Steven Shapin and Simon Schaffer, *The Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, 2011).

mathematician from what is, today, the Netherlands – entitled *De Principiis Astronomiae Cosmographicae,* or *On the Principles of Astronomy and Cosmography, with Instruction for the Use of Globes, and Information on the World and on Islands and Other Places Recently Discovered.* In his chapter "Concerning a new method of finding longitude," Frisius wrote:

> In our age we have seen some small clocks skilfully produced which are of some use. These, on account of their small size are no burden to a traveller. These will often keep running continuously for up to 24 hours. Indeed if you help, they will keep running as if with perpetual motion. It is therefore with the help of these clocks…that longitude is found. …In this way I would be able to find the longitude of places, even if I was dragged off unawares across a thousand miles, and even though the distance of my journey was unknown. But then first of all, as always, the latitude must be learnt. …it can be found out by various methods of finding out the time. Then indeed it must be a very finely made clock which does not vary with a change of air.[153]

"Therefore," the 1553 edition of Frisius's publication added in what is possibly the first direct suggestion that mechanical timekeepers could be a preferred method of finding longitude at sea, "it would be useful on long journeys, especially sea-journeys, to use large clepsydras (that is water-clocks) or sand glasses, which will measure a whole day exactly, through which the errors of the other clock may be corrected."[154]

Richard Eden's 1555 English translation of Frisius's text then concluded, "And so shall the longitude bee founde. And by this arte can I fynde the longitude of regions althowgh I were a thou=sand myles owt of my attemp=ted course & in an unkno=wen distance, but the latitude must furste bee perfectly knowen. FINIS."[155]

Frisius was a popular and respected scientific author who used his publications to advertise his globes and scientific instruments, and the spread of updated and translated

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[153] This passage appeared in Chapter XVIII in the 1530 edition and Chapter XIX in the 1553 and later editions. Alexander Pogo, "Gemma Frisius, His Method of Determining Differences of Longitude by Transporting Timepieces (1530), and His Treatise on Triangulation (1533)," *Isis,* (Vol 22, Number 2, Feb 1935), p.472. Original Latin language source reprinted by Alexander Pogo, p.470. English translation of Frisius's original Latin text found in Howse, *Greenwich Time,* pp.9-10.

[154] Reprinted in Howse, *Greenwich Time,* p.10.

[155] Ibid., p.11.

republications of his works indicates that the clock-method (later termed the chronometer-method) of finding longitude at sea was internationally recognized as a very promising potential solution centuries before John Harrison first petitioned the Board of Longitude for support in developing his maritime clocks. The problem was no clocks of that time were accurate, reliable, or hardy enough to withstand sea travel, climate change, and bad weather. The hope of solving longitude with clocks was, therefore, put on hold until science had advanced enough that better models could be made and tested.

Christiaan Huygens believed he had developed that model when, in 1662, he turned his revolutionary pendulum clocks to the longitude problem. He was repeatedly defeated, however, by the multiplicity of physical variables his delicately balanced clocks were forced to face at sea – not just of weather, barometric pressure, corrosion, and the pitch and yaw of the waves, but shifts in Earth's gravity that affected the length and swing of his pendulums as the ship moved toward or away from the Equator. Huygens's failure to produce a viable marine clock proved a major setback for the practicality of the clock-method, and the theory was once again put on hold until Harrison was able to prove that "metallurgy, not mechanics, held the answer to longitude."[156]

Yet, while the clock-method languished in technological limbo, the astronomical approach had been enjoying numerous highly encouraging successes due to new discoveries and innovations by internationally respected scientists like Galileo (who, even while under house arrest, submitted tables of his observations and predictions of the regular eclipses of Jupiter's moons to be considered for several European longitude prizes before his death) and

[156] Michael S. Mahoney, "Christian Huygens: The Measurement of Time and of Longitude at Sea," *Studies on Christiaan Huygens*, ed. H.J.M Bos et al, (Lisse, 1980), p.270, http://www.princeton.edu (last accessed, 10/10/2015).

the German astronomer Johann Tobias Mayer (1723-1762), whose solar and lunar tables paved the way for Maskelyne's nautical almanac.[157]

Despite their modern portrayal as stuffy upper-class astronomers, not all those of the 'lunar' camp were of the social or urban elite. Like Harrison, Tobias Mayer was born in a small town: Marbach am Neckar in Baden-Württemberg, Germany. Despite a difficult childhood and youth, Mayer eventually managed to turn his talent for mathematics into a respectable position as a mapmaker and inventor. In a 1747 manuscript, Mayer wrote:

> It is only too well known in geography that very many, indeed most, of the numerous known and noteworthy places need to have their latitude and longitude more accurately determined. *To achieve this is one of the most important objects of astronomy* [sic]… Few [astronomers], however, have extended their labours to the problem of how their *own* [sic] observations might be properly applied to this goal."[158]

This problem led Mayer to compare his own celestial observations to the data compiled in contemporary star-catalogues, which he discovered was full of errors.[159]

Like the clock-method, the lunar-method had been languishing on the periphery of the longitude struggle for years: a promising solution frustrated by the limitations of existing technology. Mayer's innovations, methodological and mechanical, provided key elements to bridge that technical gap and revive the hope that celestial observations and accurate lunar tables could crack the longitude puzzle. His biographer wrote, "Mayer's lunar tables were the first to make the accurate determination of longitude at sea a practical possibility and – together with Harrison's chronometer – were directly responsible for transforming navigation from an art into an exact science."[160]

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[157] Howse, *Greenwich Time,* p.13.

[158] Tobias Mayer, "Untersuchungen über die geographische Länge und Breite der Stadt Nürnberg" in Eric G. Forbes, "The Birth of Navigational Science: The Solving in the 18th Century of the Problem of Finding Longitude at Sea," *Maritime Monographs and Reports* 10 second ed. (Greenwich, 1980), p.6.

[159] Forbes, "The Birth of Navigational Science," p.8.

[160] Forbes, "The Life and Work of Tobias Mayer," p.243

In this sense, the lunar-method based on Mayer's tables that was developed, tested, and supported by British astronomers like James Bradley, Charles Mason, and Nevil Maskelyne was neither archaic nor technophobic, but just as current, cutting-edge, and scientifically stimulating as Harrison's innovative clocks. Shapin and Schaffer argued, intellectual conflict occurs at the points where systems of thought overlap, often fed by socio-cultural 'givens' contemporary societies take for granted. As those 'givens' change from one generation to the next, interpretations of previous intellectual conflicts change as well, reflecting an evolving relationship with technology and shifting expectations of time.[161] Therefore, it is not contradictory to argue the astronomers and clockmakers were on the cutting-edge of contemporary science.

The difference was Mayer's tables supported methods already trusted and familiar; namely, the personal observation and charting of natural time influenced by the movements of the ship, earth, sun and moon. Harrison's method required the Board to trust the precision and reliability of his machines, and the portable bubbles of precisely measured, abstracted time they promoted. As Sobel's work indicates, this trust comes naturally to minds raised and educated within a *mechanical timescape*. The Board was not so easily convinced.

The 'lunars' trusted the lunar-method because it was linked to the natural world, and the natural flow of observable time. They distrusted the clock-method because clock-time is inherently abstracted from natural or, as they put it, "true Time."[162] The contrasting position, laid out by Harrison, his son, and their supporters in contemporary letters and pamphlets aiming to explain Harrison's situation and his treatment by the Board, mechanics trusted the precision, straightforward adjustability, and convenient portability of "apparent" clock-time

[161] See: Shapin and Schaffer, *Leviathan*, Kindle e-book; Kuhn, *The Structure of Scientific Revolutions,* (Chicago: 1996).

[162] *A Narrative of the Proceedings Relative to the Discovery of the Longitude at Sea* (London, 1765).

over the infinite variables and complex calculations involved in constantly tracking and notating the flow of natural time.[163]

This difference in *timescape* informed each camp's methodological preference, directly reflecting their educated – though disparate – worldview and sense of time and timekeeping. The pamphlets, letters, articles, and opinion pieces these groups wrote and published were for the edification of a similarly educated readership of scholars, scientists, politicians, and professionals, all struggling to make their own sense of a complex and, in part, intuitive mental revolution in the understanding of what constituted a reliable, trustworthy temporal worldview: the observational, or "true," time of the astronomers, or the abstracted, isochronous beats of a mechanical clock.[164] This is why modern authors, like Sobel, find it so easy to cast Maskelyne and the Board of Longitude as the villains to Harrison's hero: their trust in clock time, their ties to the mechanically-informed temporal worldview, are firmly established while the *seasonal timescape*, though not vanished, has since faded in prominence. But, the perceived rivalry between these men was not entirely a result of one method being inherently superior or more advanced. The lunar-method and the clock-method developed as two valid and contemporaneous approaches to the same intractable problem. It was more a question of trust, and modern Western culture has learned to trust clocks.[165] Contemporary opinions, such as those voiced in *The Gentleman's*

[163] *An Account of the Proceedings*…, p.20; William Harrison**,** MS 6026 2A, 19, (Guildhall Library).

[164] *A Narrative of the Proceedings Relative to the Discovery of the Longitude at Sea*, (London, 1765).

[165] Trust is a key element when it comes to assimilating scientific (and timekeeping) devices, theories, and methods into daily life and daily rhythms. As Kuhn argued, during scientific revolutions competing paradigms are hotly debated but rarely resolved satisfactorily because proponents of each paradigm cannot bring themselves to trust those of their rivals. Ultimately, "…adherents to different paradigms are living in different perceptual worlds. We should not expect it to be possible for them to agree on a new set of data against which both paradigms can be assessed, instead new paradigms yield new data which are simply outside the range that the previous paradigm would have considered meaningful." This applies to the type of timescape bias that can arise when minds raised in the modern temporal landscape make judgments regarding time models upheld by eighteenth century scientists, and lies at the heart of the misunderstandings and conflicts between the astronomers of the Longitude Board and Harrison. Jan Golinski, *Making Natural Knowledge: Constructivism and the History of Science* (Cambridge, 1998), p.20.

*Magazine*, were far more divided, and seemed critical of both methods – and of the methods proposed by the Parliamentary Acts and by the Board of Longitude to test the competitors' entries – detailing the positive aspects of each approach as well as sources of error.[166]

In the 1761 essay "Of the Inventions for discovering the Longitude," *Gentleman's Magazine* author "Astrophilus," responding to news that William Harrison would be traveling to Jamaica to test his father's chronometer H-4 in accordance with the terms of the Act, wrote:

> It was generally imagined, that, if a clock or watch could be so nicely constructed as neither to be affected by the motion of the ship, nor by the different state and temperature of our atmosphere, the problem would be solved in the simplest and most practicable manner; since nothing would be expected from the mariner but to determine the time of day at the ship in any part of the sea, and to compare that time with his watch, which had been first adjusted to the meridian of the place from whence he took his departure, the difference being the difference of longitude…But let us now enquire how far this method is to be depended on…We will suppose that, upon trial of Mr *Harrison'*s clock, it appears that the difference of longitude between *Portsmouth* and *Jamaica*, and *Jamaica* and *Portsmouth*, agrees within one *minute*; nay, is given to the very same *second*; yet, how shall it be made appear to the commissioners, that the ship did not lose its longitude? The clock may gain in *returning* nearly what is lost in *going*, or *vice versa*; and the difference of time, therefore, will not shew the true longitude. The commissioners, in this case, will have no certain standard by which to form a proper judgment; as the longitude of *Jamaica* has not hitherto been determined with sufficient accuracy…[167]

Ultimately, the author recommends lunar tables and chronometers be used in concert, saying, "I flatter myself that this method [tables] will go hand in hand with Mr *Harrison'*s, and that they will illustrate and confirm each other."[168]

Regarding the lunar method, *The Gentleman's Magazine* contributor "Verax" described in detail five sources of error in the June 1757 issue, from the limitations of instruments to human observation itself. He concluded "that prudence should train our

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[166] Astrophilus, "Of the Inventions for discovering the Longitude," *Gentleman's Magazine*, 31 (1761: Oct.) p.437.

[167] Ibid.

[168] Ibid.

confidence in such sorts of observations…" and that sailors on long voyages should not "reckon upon a determination of the longitude nearer than to about 30 or 40 leagues, in common circumstances."[169]

In other words, it appears educated contemporaries seemed disinclined to trust either method, but believed the flaws in each could be balanced if both methods were used together, along with a healthy dose of navigational experience and common sense. These readers and contributors just wanted a solution practical enough to ease the problem and make voyages safer, and attitude that, while voiced and debated by a literate, Enlightenment-era elite, reflected more general concerns of a trade, transport, and business-minded public standing on the cusp of rapid industrial and imperial expansion: concerns that will be discussed in more detail in Layers Three and Four. To the Commissioners of the Board of Longitude, however, the responsibility of determining and, ultimately naming, a winning method was a matter of national honor.[170]

Although the initial Longitude Act of 1714 had "the Sanction of the Legislature" and was "drawn by the Assistance of the greatest Men of that (and perhaps of any other) Age," including Isaac Newton, its phrasing inadvertently sowed the seeds for much of the conflict to come.[171] The late eighteenth century was an era of pamphlets, and the scramble for the Longitude prize was well documented and publicized. The Harrisons – namely, John Harrison and his son and assistant William – and the Board were well aware of the publicity and each camp took advantage of popular print culture to publish their side of each progressing argument.[172] That these publications were eagerly read by interested scientists,

[169] Verax, "Letter," *Gentleman's Magazine,* 27, (December 1757), p.546.

[170] Barrett, "Explaining," p.151.

[171] *An Account of the Proceedings,* p.15.

[172] These publications include (among others): John Harrison, "Remarks on a Pamphlet Lately Published by the Rev. Mr Maskelyne, Under the Authority of the Board of Longitude," (London, W. Sandby in Fleetstreet,

craftsmen, navigators, and civilians is evidenced by the fact that the popular sector made reference to them in their own writings, including the anonymously published articles printed in *The Gentleman's Magazine* in the 1750s and 60s discussing the practicality of the most promising solutions, and the usefulness of the tests required by the Board to determine their eligibility for the prize.[173] The feel of the public eye on their proceedings and decisions made the Board cautious, however. The commissioners were "very exercised by their public responsibility," and the fear of what might happen to their own reputations if they made "a public blunder" led them to put the terms of the Act under a microscope, debating the true meaning and intent behind phrases such as "practicable and useful," and "full and complete" disclosure, and considering "how assurance could be given that this had been achieved."[174]

The Harrisons unwittingly stepped into this highly principled quagmire when, in 1761, after more than twenty years of experimentation with various mechanical models, methods and techniques, they informed the Board they were ready to submit their latest timekeepers for the West Indies trial required by the Act of Queen Anne.

As stated above, the basic story of Harrison's struggles with the Board of Longitude is well-trodden ground, described in numerous articles, books, and biographies including those written by Dava Sobel and Humphrey Quill. What makes this story perhaps the most important opening skirmish of the nineteenth-century's layered temporal revolution is how

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1767); A Narrative of the Proceedings Relative to the Discovery of the Longitude at Sea, (London, Mr Sandby in Fleet-Street, 1765); Minutes of the Proceedings of the Commissioners Appointed by Act of Parliament for the Discovery of the Longitude at Sea, Their Meetings on the 25th, 28th, and 30th of May, and 13th of June, 1765; The Principles of Mr. Harrison's Time-Keeper, with Plates of the Same Published by Order of The Commissioners of Longitude, (London, W. Richardson and S. Clark, 1767); and "Autobiographical notes in Dr. Maskelyne's own hand," transcribed in Howse, *Maskelyne,* pp.214-224.

[173] Notably: Verax, "Letter," *Gentleman's Magazine,* 27 (December 1757), pp.544-546; Anonymous, "Letter," *Gentleman's Magazine* 28, (June 1758), p.254; *Astrophilus*, "Of the Inventions for discovering the Longitude," *Gentleman's Magazine* 31 (October 1761), pp.437-439.

[174] Jim Bennett, "The Travels and Trials of Mr Harrison's Timekeeper," in *Instruments, Travel and Science: Itineraries of Precision from the Seventeenth to the Twentieth Century,* ed. Marie-Nöelle Bourguet, Christian Licoppe and H. Otto Sibum (London, 2002), p.5.

clearly these two camps capture the opposing mentalities that fed a fundamental, even revolutionary, conflict between two equally valid, contemporary, yet divergent temporal worldviews: the *seasonal timescape* of the astronomers and their lunar distance method, and the *mechanical timescape* of Harrison's clocks. The interpretation will be laid out below, drawing on contemporary sources and recent historiography to trace the attitudes of both the Harrisons and the Board, after which its status as a critical case study highlighting the contrasting temporal mentalities of this layer of Britain's long temporal revolution will be further discussed and analyzed.

Apart from setting up the Board of Longitude and detailing the requirements for each prize (there were three on offer) the original Act of Queen Anne stipulated that

> One Moiety or Half-part of such Reward or Sum *shall be Due and Paid, when the said Commissioners, or the major part of them, do Agree that any such Method extends to the Security of Ships within Eighty Geographical Miles of the Shores*, which are Places of the greatest Danger, and the other Moiety or Half-part, when a Ship by the Appointment of the said Commissioners, or the major part of them, shall thereby *actually Sail over the Ocean, from Great Britain to any such Port in the West-Indies*, as those Commissioners, or the major part of them, shall Choose or Nominate for the Experiment, *without Losing their Longitude beyond the Limits before mentioned*.
>
> And be it further Enacted by the Authority aforesaid, That *as soon as such Method for the Discovery of the said Longitude shall have been Tried and found Practicable and Useful at Sea, within any of the Degrees aforesaid, That the said Commissioners or the major part of them, shall Certifie the same accordingly, under their Hands and Seals, to the Commissioners of the Navy* for the time being, together with the Person or Persons Names who are the Authors of such Proposal; and *upon such Certificate the said Commissioners are hereby Authorized and Required to make out a Bill or Bills for the respective Sum or Sums of Money, to which the Author or Authors of such Proposal…shall be Entitled by the virtue of this Act*…[175]

These were the conditions John Harrison set out to meet when he began work on his pendulum sea-clock, H-1 which, completed in 1735, has been termed "the first successful portable time-keeper ever to be made."[176] From the start, Harrison was met with

[175] *The Act of Queen Anne, Chapter 15: An Act for Providing a Publick Reward for such Person or Persons as shall Discover the Longitude at Sea*, reprinted in Quill, *Harrison*, pp.226-227. Italics inserted.

[176] Quill, *Harrison*, p.40.

encouragement from esteemed London-based clockmakers like Sir George Graham, who became the Yorkshire craftsman's chief sponsor. Graham, the Royal Clockmaker, was a Fellow of the Royal Society and – supported by Edmond Halley, the Astronomer Royal; and several other prominent Royal Society Fellows – encouraged the Society to present Harrison with a certificate for a sea trial to Lisbon in hopes the results would warrant a meeting of the Board of Longitude.

At first glance Harrison's sea trial went quite well – well enough to warrant an application for a West Indies trial, as stipulated by the Longitude Act. Harrison's application was so promising, in fact, that his "was the first proposal deemed worthy of a Board meeting in twenty-three years."[177] This meeting, which took place on June 30, 1737, marked the first known official assembly of the Board since its inception in 1714.[178]

Harrison's promising introduction to the Board was further supported by a glowing testimonial by Roger Wills, master of the *Orford* Man of War that had hosted Harrison and H-1 on their return voyage from Lisbon to England. Wills wrote that

> …when we made Land, the said Land, according to my Reckoning, (and others) ought to have been the *Start*; but before we knew what Land it was, *John Harrison* declared to me, and the Rest of the Ship's Company, that according to his Observations with his Machine, it ought to be the *Lizard*, the which indeed it was found to be, his Observation shewing the Ship to be more *West*, than my Reckoning, above one Degree, and Twenty-six Miles.[179]

Yet, rather than request the West Indies trial needed for H-1 to earn the Longitude prize, the minutes of the meeting indicate that Harrison instead "proposed to make another machine of smaller dimensions within the space of two years, whereby he will endeavor to correct some defects which he hath found in that already prepared so as to render the same

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[177] Alan Ereira, "Longitude: The Hidden Evidence," *History Today* (January 2000), p.4.

[178] Peter Johnson, "The Board of Longitude 1714-1828," *Journal of the British Astronomical Association* 99(2), p.65.

[179] Roger Wills (June 24th, 1737) in "An Account of the Proceedings …" p.19.

more perfect which Machine, when completed, he is desirous of having tried in one of His Majesty's Ships that shall be bound to the West Indies."[180] He also requested funding to help him finish the new machine.

The Board decided to grant the inventor £500 to construct a second timekeeper. They agreed that Harrison's clocks "may tend very much to the advantage of Navigation" and recommended

> the Commissioners of the Navy to cause the said John Harrison to enter into Articles with them not only to complete the said Machine with as much expedition as may be, but that he or some proper Person to be by him appointed shall actually proceed to the West Indies in the aforesaid Ship to explain the Theory and use of the Machine, in order to the making a more careful and exact Trial thereof, and that when the Ship doth return to England both the Machine which he hath already made and the other which he hath proposed to make shall remain in their possession for the Use of the Public.[181]

Humphrey Quill, found the decision not to request a West Indies trial for H-1 "both unexpected and curious," since its average rate of error of only three seconds in twenty-four hours "would have qualified H-1 for a prize, even if not the full £20,000."[182] The reason for Harrison's reticence lies in the logs of Captain Proctor, master of the ship *Centurion*, that carried Harrison and H-1 from England to Lisbon. These logs were long thought to have been lost until Charles Sturridge uncovered them in the National Maritime Museum, Greenwich.[183]

Proctor had died before Harrison's return voyage, but his logs indicate that, following a terrible storm, during which Harrison suffered from intense sea-sickness so severe he could not adequately tend to his clock, H-1 seemed have lost track of the correct time. The article explained "Proctor's log, uniquely, contains two entries each day for longitude. One is

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[180] "The Minutes of the First Meeting of the Board of Longitude," reprinted in Quill, *Harrison,* p.228.

[181] Ibid., p.229.

[182] Quill, *Harrison,* p.47.

[183] Ereira, "Hidden Evidence," p.5.

plainly his dead reckoning. The other seems to be the longitude given by Harrison's machine. Comparing the two records in Proctor's log it is clear that they diverged significantly. The positions taken from the clock are wrong."[184]

After checking and resetting the clock at Lisbon, H-1 gave a much better performance on the return voyage, as Roger Wills testified to the Longitude Board. Its performance with Proctor was not discussed, but was likely the reason Harrison worked for another nineteen years, periodically requesting and being granted additional funding from the Board, before he determined his machines to be refined and reliable enough for the West Indies trial.[185] He spent the time constructing three additional clocks, but those years wore on the Board's patience, and eroded their initial eagerness for Harrison's invention at a time when their enthusiasm for the potential of the lunar-method was growing.

It was not until 1760 that Harrison presented his breakthrough H-4 chronometer to the Board – a large, intricate watch incorporating many of his friction, temperature, and weather-mitigating innovations into a compact design that bypassed any need for a pendulum. The initial plan had been for him to sail to Jamaica in 1761 with his H-3 and H-4 chronometers for the required West Indies trial but, by that time, Harrison was sixty-eight and in no condition for such an arduous journey. It was decided Harrison's son and assistant, William, would go instead, with only H-4.[186]

The conditions for the trial were set by the Royal Society and submitted to the Board Commissioners.[187] Before leaving, the Harrisons' clock was to be set to local Portsmouth

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[184] Ibid.

[185] "Appendix I: Board of Longitude Accounts, Rewards – Alphabetical, 1737-1828" in Derek Howse, "Britain's Board of Longitude: The Finances, 1714-1828," *The Mariner's Mirror,* Vol. 84 No. 4 (November 1998).

[186] Quill, *Harrison,* p.90.

[187] The importance of witnessing science, creating scientific truth within a social context, were prominent aspects of the communities and networks of Enlightenment-era science. That the Royal Society and Board Commissioners would apply such standards to the test of Harrison's chronometer indicates they were acting

time, calculated relative to Greenwich. Upon arriving at Jamaica, the local time of Port Royal was to be calculated by an astronomer appointed to travel with William by taking on-the-spot observations: measuring equal altitudes of the sun to determine the local noon. The time at Port Royal would be compared to Portsmouth time, as denoted by the watch, thus giving the difference in longitude between Portsmouth, England and Port Royal, Jamaica. The results would then be compared to the known difference in longitude represented on maps and other trusted sources, certified by witnesses, sealed, and sent to the Admiralty.[188] The Royal Society also required witnesses to be present whenever William handled the watch during the voyage, and desired the longitude of Jamaica to be astronomically ascertained by observing Jupiter's satellites – a method introduced by Galileo in the early 1600s.[189]

John Harrison agreed to almost everything, but took enough exception to the proposal of redetermining Jamaica's longitude by observing the eclipses of Jupiter's moons to write a *Memorial* to the Board Commissioners detailing his objections, as well as confirming his intent to submit H-4 to the Jamaica trial. As a craftsman, used to mechanical precision, Harrison did not trust an observational method dependent on weather conditions and judgment-based estimations made by 'experts' with a 'trained eye,' arguing

> past experience had shown that a calculation of the longitude of Jamaica, if made by such a method, might well show an error in excess of thirty miles, and that if such a longitude were accepted as correct then the whole basis of the trial would be false...The objection becomes even more pronounced if visibility is not at its best, or if the magnification of the two observing telescopes is not identical.[190]

according to current scientific conventions. Shapin and Schaffer, *Leviathan;* David Livingstone, *Putting Science in its Place*, pp.xi, 134; William Clark, Jan Golinski, and Simon Schaffer, eds., *The Sciences in Enlightened Europe* (Chicago, 1999).

[188] Quill, *Harrison*, p.87.

[189] Ibid., p.89.

[190] Ibid., p.90; *Memorial*, Guildhall.

However, "the Board were of the opinion that it was the most accurate method, at present, by which…the differences of Longitude between Portsmouth and Jamaica may be established..."[191] The Board's final instructions regarding the conditions of the trial did drop the requirement to recalculate Jamaica's longitude using the eclipses of Jupiter's moons but, if the *Memorial* illustrated Harrison's distrust of astronomical methods, it also showcased his trust in the clock method, concluding with a paragraph stating "if the results of the forthcoming trial did not satisfy the Board 'they may either order a repetition of the same experiments, or diversify them in what manner they shall judge proper.'"[192] It was an offer the Board would soon take him up on, much to his subsequent dismay.

William Harrison sailed with H-4 aboard the H.M.S. *Deptford* on 18 November, 1761. All records indicate the Harrisons' watch "kept the Longitude both going and returning, within the nearest Limits of the Act of Queen *Anne*," as was later proved "to the Satisfaction of a Committee of the House of Commons."[193] For the Harrisons and their supporters, the success of the watch during the Jamaica trial meant Harrison had, without question, fulfilled "all that is required by the Statute of the 12th of Queen *Anne*, to entitle [Harrison] to the greatest Reward mentioned in the Act…"[194] Clearly, any further quibbling would be extraneous, and would only serve to keep from the public a potentially life and property-saving invention.[195]

But, if Harrison's achievement was so self-evident, why did the Board withhold the £20,000 prize – and why was his design never put into production for use by British

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[191] MS 3972A *National Maritime Museum Microfilm of Harrison Book and Documents Property of Mr RL Corry.* (Guildhall Library, London).

[192] *Memorial*; Quill, *Harrison,* p.90, 92.

[193] *The Case of Mr. John Harrison*, pamphlet, 1770.

[194] *An Account of the Proceedings…*, p.11.

[195] Ibid., pp.2, 11.

merchants and the navy? Was it, as so often portrayed, a class-based culture clash between the stubborn Yorkshireman and the stuffy London board? Or, was the issue more professional than personal – a question of differing scientific methods and temporal mentalities?[196]

The records indicate that the Harrisons and the Board held very different interpretations of the meaning of and intent behind the Act of Queen Anne. The Harrisons took the document as read, believing that the success of their lone prototype during the Jamaica trial was all that was required to win the prize. The Board, however, felt obligated to be as exact as possible; that it was their duty to ensure that the watch's seemingly promising performance was not a one-time fluke of mechanics, but a reliable, repeatable method that could be trusted to perform with unfailing accuracy, providing consistent results that corresponded with those obtained by observational, astronomical methods.[197] For them, "practicability" was the key term of the Act and a single trial was not enough to prove the watch had achieved that.[198] Lacking the craftsman's confidence in his own work, as well as trust in the abstracted nature of mechanical time, the Longitude Board immediately began raising objections to Harrison's claims of victory, citing dissatisfaction with William Harrison's methods for taking observations and keeping records during the trial.[199]

[196] David Livingston's *Putting Science in its Place: Geographies of Scientific Knowledge* (2003) addresses the question of the influence of the spaces where science is done – the formal environments in which a culture's ideas are generated and investigated – on the development and reception of scientific knowledge. The intransigence evidenced on both sides of the conflict between Harrison and the Board indicates space does matter – that the very different environments where the Harrisons and the Board astronomers received their education and performed their work affected their professional mentalities: how they operated and their openness to differing scientific methods and ideas.

[197] Barrett, "Explaining," p.147.

[198] Ibid.

[199] *An Account of the Proceedings….,* pp.2, 11.

While the board quibbled with the Harrisons, the lunar-distance method continued to garner attention and support. Tobias Mayer had died in February of 1762, but Maskelyne had been testing Mayer's tables on the island of St Helena with notable success. A month after William's return from Jamaica, Maskelyne presented his findings to the Royal Society.[200] For the first time, it seemed the two methods were becoming rivals in earnest, each hovering on the brink of true scientific practicability, and the scientific and instrument-making communities of London began taking sides. In February 1763, two of Harrison's Royal Society supporters submitted an anonymous pamphlet to Parliament, detailing Harrison's history with the board with an appendix of documents and letters of support the Harrisons had accrued during the trials of H-1 and H-4.[201] Harrison's own concerns were highlighted when, that March, a memorial from Harrison was read to Parliament requesting "no other longitude proposals concerned with timekeepers should be considered until judgment had been passed on H-4, following a further sea trial," indicating a mounting sense of pressure and worry that a rival method might slip in while he was tied up in debates and revision work.[202] He also requested Parliament grant him part of the reward at once, so he could disclose "the Manner and Principles for forming" the watch to an expert appointed by Parliament "so that other workmen could make such watches."[203] The result of Harrison's petition to Parliament was a new act – the Act 3 George III c. 14 'for the Encouragement of John Harrison, to publish and make known his Invention of a Machine or Watch, for the Discovery of the Longitude at Sea'– which became law before the end of the month.[204] This

[200] Howse, *Maskelyne,* p.44.

[201] Ibid., p.45. This was the document entitled: *An Account of the Proceedings, in order to the Discovery of Longitude at Sea, in a Letter to the Right Honourable ******, Member of Parliament*.

[202] Howse, *Maskelyne,* p.45.

[203] Ibid.

[204] *Act 3 George III c. 14.*

Act nominated a committee of eleven experts for the disclosure, promised Harrison five thousand pounds at its conclusion, and protected Harrison's claim to the full prize from any subsequent claims by clockmakers, though not from proponents of the lunar-distance method.[205] When the new Act reached the Board of Longitude, however, the Commissioners again found themselves stuck on one point: the exact meaning of the term "discovery." The Act required Harrison to "make or cause to be made a full and clear Discovery of the Principles of his said Instrument or Watch for Discovery of the Longitude, and of the true Manner and method in which the same is and may be constructed…" and that he then "publish and make the same known, so that other workmen may be enabled to make other such Instruments or Watches for the same purpose…"[206]

On the surface, it seemed Parliament had given Harrison what he had requested, but, as before, the Commissioners felt the need to be as exact as possible when interpreting the Act into action. Would a mere verbal description constitute a "full and clear Discovery?" A general demonstration of the working watch?

"…it must be borne in mind," wrote Rupert Gould, the man who uncovered and painstakingly restored Harrison's clocks to working order in the early twentieth century,

> that although Harrison had exhibited no. 4, complete, to the board, no clear idea of its mechanism could be obtained without taking it to pieces – for example, the thermometer curb, its most essential portion, is entirely concealed by the elaborate balance cock. And to take it to pieces is not easy: even the first step, the removal of the hands, is an operation requiring a considerable amount of time and patience.[207]

After much discussion, the Commissioners decided, in order for the terms of the Act to truly be fulfilled, Harrison would have to dismantle the watch, explain every part, and

[205] Ibid.; Howse, *Maskelyne*, p.45.

[206] *Act 3 George III c. 14.*

[207] Rupert Gould, *The Marine Chronometer: Its History and Development,* (J.D. Potter, 1923), p.57.

provide complete, detailed diagrams of its construction for publication.[208] Then, two or more copies of the watch would have to be constructed by other workmen under Harrison's supervision and tested for reliability. Only then could the true scientific repeatability of Harrison's invention be acknowledged and a final decision as to its practicability as a reliable solution to the longitude problem be made.

Harrison refused to accede to the Board's terms – a decision that puts into sharp relief the difference in mentality between the inventor and the scientists charged to judge his work. Similar intellectual and methodological dichotomies can be noted in Foucault's works – his concept of epistemic shifts, the notion that specific systems of thought dominate at specific periods – and in Shapin and Schaffer's *The Leviathan and the Air-Pump*, in which the authors portray the history of science as, not linear, but overlapping with intellectual conflict occurring at the point of overlap. Their example of Hobbes's and Boyle's divergent views of natural knowledge and the usefulness of scientific experiments illustrated how certain accepted "givens" could influence intellectual, political and social opinion. Hobbes viewed scientific experiments as unnecessary, artificial constructs devised by privileged groups while Boyle viewed experiments as a necessary procedure to determine reliable facts. Harrison's disagreement with the Board over the question of the 'repeatability' and 'practicability' of his chronometer is another example of this type of methodological dichotomy. [209] To Harrison, this manner of rigorous scientific testing was not only unnecessary, it was tantamount to a delaying tactic on the part of the astronomers, who supported the lunar-distance method.[210] His watch was not a static, unchangeable product, it was a prototype, and the innovations it held were his own, proprietary creations – innovations that could be stolen or pirated if he

[208] Harrison's diagram booklet; Guildhall Library.

[209] See: Shapin and Schaffer, *Leviathan*, Kindle e-book**.**

[210] Letters, The Clockmakers' Museum and Library Collection, (Guildhall Library).

made such a free and open disclosure of all the watch's workings.[211] To his mind, once he had the prize money he could use it to open a workshop, train craftsmen he could trust to keep his secrets, and continue to tinker with and improve upon his design. Subjecting his prototype model to the kind of repetitive tests expected of astronomical observations or chemical experiments, therefore, was an impractical waste of Harrison's time.[212] As his son, William, explained in a letter to the Secretary of the Admiralty for transmission to the Board before leaving for the second West Indies trial, "I would not be understood, that it will always require so long time to bring those machines to perfection; for it is well known to be much harder to beat out a new road, than it is to follow that road when made."[213]

In other words, from a craftsman's perspective, the technology behind the watch was meant to change, to improve, with subsequent models and adjustments, his trust in the technology and its abstract beats evidencing his adherence to the temporal understanding inherent to a *mechanical timescape* while contrasting sharply with the astronomers' *seasonal timescape*. On these grounds, Harrison declined to make the disclosure that would have earned him five thousand pounds and decided once again to stake everything on a sea trial – this time to Barbados.

The Barbados trial was to be a test not only for Harrison's chronometer, but for Maskelyne's lunar-tables. Again, William Harrison took charge of the watch. To ensure scientific objectivity and accuracy, astronomer Charles Green was appointed to oversee the observations, calculations, measurements, and comparisons of the watch's going with astronomical, or 'true' time. Maskelyne was also to oversee William's calculations while on Barbados, but William objected strongly to being judged by a self-proclaimed rival. A

[211] Sobel, *Longitude*, p.124.

[212] Letters, (Guildhall Library).

[213] William Harrison Letter to Secretary of Admiralty, reprinted in Gould, *History of the Chronometer*, p.59.

compromise was eventually reached whereby Maskelyne and Green would alternate. [214] Harrison's watch again proved itself practical, and William returned to England confident that his father would finally receive his long-awaited and well-deserved reward.[215]

William's letters to his family reveal an initial optimism that soon faded to betrayal as he realized the Board remained unsatisfied with the practicability of his father's invention. Writing to his in-laws from London shortly after his return from Barbados, William listed the Commissioners present at the latest meeting of the Board (he called them 'Parsons' – an indicator of their formal academic dress and his attitude toward them), and assured them that,

> They were all as agreable as could be…they gave us a thousand pound as by agreement, and then nominated three Gentlemen on their part to compute the Observations, & ordered me to nominate three on our part, which six Gentlemen are to give their computations on or before the last day of October; then another Board will be called. The Chair is dead [Irwin's trial had been far from successful]; as to the Moon, there was nothing said about it. I have to thank God [for] as fine a Prospect before me as can be…[216]

One of the commissioners William listed as being present at the Board meeting was Viscount Lord Barrington, a figure whose unique perspective on the longitude problem and its most prominent players has "not so far featured in the longitude story," save for a brief online article.[217] At the time of the "Harrison Affair," Barrington served as Treasurer of the Navy, leaving behind a collection of notes known as "The Barrington Papers."[218] Of the fourteen Board meetings that took place during that time, Barrington attended eight, his notes revealing the attitudes of the 'opposing side' of the Harrison Affair, as well as many of the Board's concerns regarding the clarification of the criteria necessary to win the longitude

[214] Maskelyne's autobiography, reprinted in Howse, *Maskelyne*, pp.214-224.

[215] Letters, (Guildhall Library).

[216] William Harrison, MS 6026 2A, 19, (Guildhall Library).

[217] Barrett, *Explaining,* pp.145-162.

[218] Ibid.

prize and their own survival as a body with the power to offer support to promising scientific endeavors, at a time when Harrison's vocal case against the Board was growing increasingly public in pamphlets and manuscripts detailing his alleged "maltreatment" by the commissioners.[219]

Based on his notes, which include detailed records of the Board's expenses, including payments the Board had granted Harrison to support the construction of his clocks and the two West Indies trials, Barringon's aim seemed to be untangling the long, complex history of Harrison's interactions with the Board for the Members of Parliament while also justifying the Board's continued usefulness. The emphasis he placed on details – financial and personal – and on explaining exactly why the Board continued to refuse to award Harrison the prize, indicates his audience's general attitude toward the debate: Parliament had apparently been swayed to sympathy by Harrison's much-publicized case against the Board.[220]

"The Case of Mr. John Harrison" – the unbound pamphlet included in Barringon's papers – has been printed and reprinted innumerable times since its initial publication. The wide dissemination and availability of this pamphlet and similar contemporary publications has long played a large part in determining the angle of the informed public's interpretation of the Longitude problem, garnering the Harrisons a great deal of sympathy, while the Board's position – commonly portrayed as bitter and ignorantly technophobic – has largely been extrapolated from the Harrisons' own disgruntled statements. That sympathy does not seem unfounded when reading through Harrison's published accounts of his dealings with the Board and, particularly, Maskelyne, who was appointed Astronomer Royal shortly after returning from the Barbados trial. The letters and accounts William Harrison wrote after his own return "makes clear his belief that Maskelyne accepted the commission to act in

[219] Ibid., pp.147, 149; "Harrison Journal," (Guildhall Library).

[220] Barrett, *Explaining,* p.151.

Barbados in order to ruin the prospects of the watch," while John Harrison's open disdain for the complex lunar-distance method was repeatedly made clear in his descriptions of "the improper, troublesome, erroneous, tedious Method" and Maskelyne's "infamous Nautical Almanac," which the new Astronomer Royal had proposed to the Board and succeeded in obtaining permission to publish from the Commissioners and Parliament while Harrison continued to languish in a frustrating, confrontational limbo.[221]

Barrington's speech notes grant the Board acknowledged the watch had performed well during the Barbados trial, saying: "Upon examining, the whole proceedings it was found incontrovertibly that the experiment had fully answered & greatly within the nearest Limits required by the 12. of Queen Anne."[222] But, he continued:

> If the Comss. had been certain that other timekeepers could be made which would enable other ships to find their Longitude with equal exactness they wd have given a Certificate for the great reward.
>
> —
>
> But ~~they~~ no other Watch has been made & they know not the principles of this.
>
> —
>
> They think therefore, they are not justify'd ~~at the~~ according to the Act to give the Certificate till farther discovery be made in these points.
>
> —
>
> However they think there is great presumption in H.'s favour & if his principles were discovered & other watches made deem him entitled to the whole reward.
>
> —
>
> I think they might do this without application to Parliament: But Parliament should be consulted in a point where the honour of the nation as well as Navigation is so much concerned.[223]

[221] Bennett, p.5; Harrison, "A Description Concerning such Mechanism" pp.66, 53.

[222] The Barrington Papers, (Caird Library, Greenwich), BGN-8-004.

[223] Ibid.; BGN-8-001; BGN-8-002

So, ultimately, why did the Watch fail to pass the Board? Why, even after submitting to the Board's demands, demonstrating the workings of H-4 and building the improved maritime watch H-5, were Harrison and his son forced to apply for the King's support and, finally, directly to Parliament to claim the money they and so many others were certain their invention deserved?

It comes down to a question of *timescape*. The Board and the Harrisons held different concepts of time and, therefore, had different expectations regarding time and time measurements. While the Harrisons and their supporters could accept the abstract approximations of a *mechanical timescape*, in which carefully calibrated machines carried their own distinctive bubbles of portable time from one location to another, the astronomers and scientists of the Board, who adhered to a complex and deeply layered *seasonal timescape*, recognized the artificiality for what it was, and could not bring themselves to accept the approximation or trust the technology behind it. For them, time was "true" time, astronomical time, a natural universal force, which could be more reliably charted via the painstaking process of calculating and re-calculating the tables of Maskelyne's Nautical Almanac than by making allowances for variables like a handmade clock's individual rate of going. Unable to compromise, communications broke down, tempers flared, the debate reached an impasse, and Harrison's promising invention was never passed on to the sailors who so desperately needed its aid.

Yet, the temporal revolution was far from over. Since multilayered mental revolutions, including scientific and temporal revolutions, occur at various scales concurrently, they are not always strictly linear, and different aspects find prominence among different groups.[224] Even while the conflict between the seasonal and *mechanical timescapes*

[224] See: Bernhard Struck, Kate Ferris, and Jacques Revel, "Introduction: Space and Scale in Transnational History," in *The International History Review*, Volume 33, Issue 4, 2011.

was being battled out in arenas such as the one described above, early skirmishes between the retrospective and burgeoning *progressive timescapes,* as well as the public and *private timescapes,* were beginning to take shape – skirmishes discussed in Layers Two and Three respectively, while Layer Four: From Sequential to Simultaneous, will take up the threads of the perceptual clashes between the seasonal and *mechanical timescapes* in the social and technological contexts of the late nineteenth and early twentieth centuries, returning to the conflict between neatly organized calendar grids and the isochronous beats of mechanical clocks, and the less uniform but, perhaps, more accurate 'true time' of the natural world – and, by extension, our own subjective perceptions.

*SIGNPOST 3*

The temporal revolution of the long nineteenth century was a series of cultural and intellectual transitions centered on the prevalent popular understanding and use of time. This first layer investigated the transition from the *seasonal timescape* that had characterized the temporal understanding and worldview of pre-industrial Britain to a *mechanical timescape* that characterizes the modern understanding of time as a regulated, isochronous beat abstracted from the rhythms and cycles of nature. What was behind this transition? How did the *mechanical timescape* come to supplant the *seasonal timescape* in the popular consciousness? The answers lie in the jarring separation of the civil calendar from the seasonal rhythms of daily life, embodied by the Calendar Reform of 1750-52, and the increased reliability and availability of precise mechanical timekeepers that encouraged the educated, professional public to put their trust in the abstracted beats of a clock rather than rely on the complex process of finding and tracking "true" astronomical time using almanacs and specialized instruments – a revolutionary shift popularized by the clash between John Harrison and the Board of Longitude.

The question of whether the Longitude Board was biased against the Harrisons and their clocks has influenced popular and academic works on Britain's longitude competition. Were the members acting as a careful and responsible committee, or seeking to change and subvert the Act of Queen Anne to favor their own astronomical methods? If Harrison's clocks had passed their trials, why did they not immediately grant him the full £20,000 reward? Why did they continue to order more tests, more trials, and more copies of his clocks when the need for a solution to the longitude problem was so desperate? Were they stalling until they could perfect the lunar-method, or was it something else?

Approaching the issue from the angle of divergent *timescapes* allows the conflict between Harrison and the Board to be viewed and analyzed from a different perspective. The

Harrisons and proponents of the rival lunar-distance method, such as Nevil Maskelyne, were products of two different temporal landscapes. Their understanding and expectations of time and timekeeping methods were informed by conflicting scientific ideologies, or paradigms – a conflict that hinged on a willingness to accept the abstracted estimations inherent to mechanical timekeeping – and by differing attitudes regarding the purpose and meaning of scientific practicality and repeatability. Unable to agree or compromise, the Harrisons found themselves forced to turn to Parliament for a final judgment, the whole "Harrison Affair" ultimately leaving a legacy of bitterness and misunderstanding between the classically trained scientists, and the burgeoning class of hands-on inventors and engineers that would come to play such an influential role in Britain's developing industrial revolution.

Whether they were truly rivals or cast in that role by later historians, Harrison and Maskelyne were both a part of a larger professional community. Maskelyne was a member of Britain's scientific elite, trained to trust the natural, observational rhythms of "true" time, inherent to a *seasonal timescape*. Harrison was a talented and respected craftsman and inventor, trained to trust the precision and adaptability of abstract, mechanical time – a trust the astronomers of the Board could not bring themselves to give to an inventor's handcrafted prototype without assurances of accurate and precise repeatability. In the end, Harrison was unable to earn that trust from the Board. It was left to his successors to mass produce accurate chronometers. Even then, sailors believed the nautical almanac begun by Maskelyne and the maritime chronometers inspired by Harrison worked best when used together to bridge their path across the meridians. In this way, although the *seasonal timescape* was eventually supplanted by the *mechanical timescape* in the popular consciousness, it remains a complimentary cog informing our current understanding of the complex, multilayered nature of time.

## LAYER TWO: FROM RETROSPECTIVE TO PROGRESSIVE

*SIGNPOST 1*

> The mathematical view of time as a uniform line of successive instants extending from a beginning to some indefinite point in the future is embedded in the metaphysical assumptions of historians today. All of historical chronology is based upon it…It is against this mathematical time that he measures rates of change in history and applies terms such as revolution or evolution for series of events…[225]

The practice of applying a long, linear, evolutionary timescale to history, and to the concept of self-directed social change and progress, can be considered one of the most significant features of a modern temporal mentality: a mentality capable of developing and supporting a *progressive timescape* tied to the scientific discoveries of the eighteenth and nineteenth centuries and directly influenced by the Darwinian view of time and process. Although Lyell and Darwin's timescales were not inherently progressive,[226] I have termed the temporal worldview their works helped inspire the *progressive timescape* because it implies a long, indefinite, and adaptable future and a forward-looking orientation that diverges from older seasonal or *retrospective timescapes* dependent on a cyclical, past-oriented, or Design-based sense of time. And, despite his own disinclination to "explore the social implications of his theory,"[227] as well as – in fact, because of – the fierce, controversial, and ongoing, debates

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[225] Francis C. Haber, "The Darwinian Revolution in the Concept of Time," in J.T Fraser, F.C. Haber, G.H. Muller, eds., *The Study of Time: Proceedings of the First Conference of the International Society for the Study of Time* (New York, 1972), p.383.

[226] In this context, 'progress' refers to the Enlightenment concept of the human capability of rational self-improvement, endorsed by influential eighteenth-century thinkers, like the Marquis de Condorcet, and adopted by later historians, like Baron Macaulay. Neither Lyell nor Darwin endorsed the notion of a 'design' or 'plan' behind geological or biological development, and enthusiasm for 'progress' and teleological views of history among intellectuals and authors had, in part, faded by the end of the nineteenth century as criticism and notions of decadence and disillusionment rose, but the future-oriented image of humanity's education/science-propelled, upward climb had a powerful, lasting impact on the Western self-image and worldview, influencing the adoption and spread of a long, secular timescale. See: Marquis de Condorcet, *Outlines of an Historical View of the Progress of the Human Mind*, (1795), at Online Library of Liberty, http://oll.libertyfund.org/titles/1669 (last accessed 19/2/2016); Thomas Babington, Lord Macaulay, *Critical and Historical Essays Contributed to the Edinburgh Review, 3 Volumes*, at Online Library of Liberty, http://oll.libertyfund.org/titles/macaulay-critical-and-historical-essays-contributed-to-the-edinburgh-review-3-vols (last accessed 19/2/2016); Jerome Hamilton Buckley, *The Triumph of Time: A Study of the Victorian Concepts of Time, History, Progress, and Decadence*, (Cambridge, MA, 1966), p.34.

[227] Buckley, *The Triumph of Time*, p.47.

Darwin's work and theories have provoked, this chapter argues the 1859 publication and rapid popularization of Darwin's *Origin of Species* sits at the epicenter of this layer of the nineteenth-century's temporal revolution: the deep, and ongoing, conflict between the divergent retrospective and *progressive timescapes*.[228] This chapter aims to trace and explore the temporal revolution, not the multi-branched tree of Darwinian debates and controversies or his theory of natural selection itself which, since the *Origin's* publication, has admittedly been deeply polarizing and more often adapted or subverted to other social or scientific theories than accepted in and of itself. Darwin's work is a key example in this chapter, not because it is uniquely exceptional or radical but because, by bringing focus and context to a number of already extant and hotly debated evolutionary and temporal concepts, it provided a popular cultural touchstone proponents of various notions could point to, and be understood by a wide audience.

In *The Non-Darwinian Revolution: Reinterpreting a Historical Myth*, Peter Bowler wrote:

> The introduction of a new theory is a traumatic event because it requires the destruction of one paradigm and its replacement with another that rests on conceptual foundations that may be incompatible with those currently taken for granted. In the case of theories with broader implications, a scientific revolution may initiate and symbolize a fundamental change in cultural values. The two best-known examples of such dramatic changes are the Copernican and the Darwinian revolutions."[229]

Looking back on the Victorian society affected by those changes, Silvia K. Miller reflected:

> The future was at one time predictable and recognizable because all of history was seen as a cycle in which mankind would journey forth only to return to its origins,

[228] On Darwin, Darwinism, Darwin and progress, and evolution-inspired controversies and debates see: Peter J. Bowler, *The Non-Darwinian Revolution: Reinterpreting A Historical Myth* (London, 1992); Bowler, *Evolution: The History of an Idea*, Revised Edition, (London, 1989); Michael Ruse, *Monad to Man: The Concept of Progress in Evolutionary Biology*, (London, 1996); Neal C. Gillespie, *Charles Darwin and the Problem of Creation*, (London, 1979); Sahotra Sarkar, *Doubting Darwin: Creationist Designs on Evolution*, (Oxford, 2007); Edward J. Larson, *Trial and Error: The American Controversy over Creation and Evolution*, Updated Edition, (Oxford, 1989).

[229] Bowler, *The Non-Darwinian Revolution*, p.1.

> having destroyed prelapsarian innocence at the Fall only to recover it at the Apocalypse. Darwin and science in general seem to have broken this time circle and transformed it into an open-ended line.[230]

This chapter investigates the paradigm shift Bowler and Miller describe in the context of the gradual supplantation of the short, biblical timescale with the long, secular timescale popularized by the works of geologist Charles Lyell and naturalist Charles Darwin, among others. That change, that revolution in the thought process of the educated population, is the cornerstone of the shift from the *retrospective timescape* to the *progressive timescape*.

As with Layer One, this chapter is divided into two main sections. The first, "Conflicting *Timescapes*: God's Time or Man's," traces the characteristics of the *retrospective timescape*: a past-oriented temporal landscape informed by the Judeo-Christian story of Creation, the notion of a strict hierarchy of being, and a dualistic contrast between fleeting, earthly time and God's eternal time. Like the *seasonal timescape* discussed above, despite its ancient roots, the *retrospective timescape* developed contemporaneously, and turbulently, with its newer, future-oriented counterpart, the *progressive timescape*, which viewed humanity as rational and adaptable to rapidly changing circumstances. The second section, "Lyell, Darwin, and the Popularization of the Long, Secular Timescale," will use the case of the rapid, popular propagation of the concept of geological, evolutionary time to investigate the temporal upheaval that occurred as Victorian writers and thinkers shifted their gaze from past to future: a key phase of the nineteenth-century's temporal revolution that can still be felt in the ongoing political debates between science and creation science.[231]

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[230] Silvia K. Miller quoted in Paul Alkon, *Science Fiction Before 1900: Imagination Discovers Technology* (New York, 1994), p.20.

[231] See: Barbara Forrest and Paul R. Gross, *Creationism's Trojan Horse: The Wedge of Intelligent Design*, (Oxford, 2004); Peter J. Bowler, *Reconciling Science and Religion: The Debate in Early-Twentieth-Century Britain*, (London, 2001).

While the *retrospective* and *progressive timescapes* experienced many clashes throughout the long nineteenth century, the most notable must be the conflict prompted by the publication and popularization of Charles Darwin's theory of evolution through natural selection which, over time, has become so heavily burdened with "metatheoretical baggage" that, in some contexts, it can become "hard to distinguish between scientific theory and metatheoretical beliefs…"[232]

The expansion of the secular timescale was piggybacked along the bumpy road of Victorian moral debate and social reform as scientific evidence for gradual geological change and a long, evolutionary timescale brought the swimming thoughts of the past century to a head, allowing the progressive understanding of time to overtake the once dominant *retrospective timescape*.

[232] This conflict is popularly known as the "creation controversy" or "Darwin vs. God" debate - a provocative misnomer illustrating the rise to prominence of an evolutionary worldview that has since been applied to fields ranging from engineering to literary analysis. But, as the evolutionary biologist Ernst Mayr emphasized, natural selection "is a statistical issue, an issue of relative numbers of offspring, not an issue of good versus bad... Stripped to its essentials, the theory of natural selection explains the adaptation of organisms to their particular environment… The notion of progressive evolution, of perfection of design…is not inherent in the Darwinian theory of natural selection. It is added to that theory as a belief rather than as a theoretical component supported by the study of nature" – one metatheoretical burden among many; particularly those inherent to Social Darwinism and community values. Olivier Rieppel, *Evolutionary Theory and the Creation Controversy* (Chicago, 2011), pp.v-vi.

### *CONFLICTING TIMESCAPES: GOD'S TIME OR MAN'S?*

Charles Darwin has long been considered one of the most controversial figures of the modern era, largely because his observational theories on natural selection and selective breeding have come to embody a much larger, fundamentally transitional cultural shift – a conflict that is still ongoing.[233] Many generalize this conflict as an intractable stand-off between competing schools of Science and Religion – one of many oversimplifications that have led to generations of misinterpretations and misunderstandings on both sides of the debate.[234] But, there is a significant aspect to this highly charged quagmire that has not yet been thoroughly investigated from a historical perspective: a temporal aspect.[235]

The natural selection theory of evolution Darwin endorsed came onto the scene as Britain and other Western countries were undergoing a complicated temporal revolution; an experiential transition from the strictly limited framework of medieval, human-centric time to an expansive abstract, evolutionary, geological timescale. The popularization of the long timescale required by gradual geological and evolutionary change – due in large part to the controversy and debate related to the work of geologist Charles Lyell and naturalist Charles Darwin – helped reshape the Western understanding of time, moving it from a static, feudal notion highly defined by traditional Christian beliefs toward a forward-looking sense of progress and anticipation: a newly secularized temporal awareness that piggybacked the

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[233] Stephen Barr, "Chance, By Design," *First Things*, December 2012, pp. 25-30; Greta Jones, *Social Darwinism and English Thought: The Interaction Between Biological and Social Theory*, (Sussex, 1980); James R. Moore; *The Post-Darwinian Controversies: A Study of the Protestant Struggle to Come to Terms With Darwin in Great Britain and America, 1870-1900*, (Cambridge, 1979); Brendan Nyhan, "When Beliefs and Facts Collide," http://www.nytimes.com/2014/07/06/upshot/when-beliefs-and-facts-collide.html?action=click&contentCollection=Science&region=Footer&module=MoreInSection&pgtype=article (last accessed 22/2/2016).

[234] Peter J. Bowler, *Monkey Trials & Gorilla Sermons: Evolution and Christianity from Darwin to Intelligent Design*, (Cambridge, MA, 2007), p.4.

[235] The geospatial, religious, and Darwinian revolutions that rocked Europe from the Age of Discovery through the Victorian Age all had important temporal facets, yet time is rarely, if ever, traced and analyzed in its own terms as an historical topic, making this layer of the temporal revolution particularly tricky to track without getting sidetracked by the many controversial aspects of this transitional, and heavily studied, arena.

industrial and traffic revolutions of the nineteenth century and expanded along with a growing bourgeois culture of consumption and a rising interest in natural science. Yet, the Western transition from a Biblical to a geological timescale did not go smoothly.

Before the industrial revolution set the Western world marching to a mechanical beat, the concept of time held by most educated people consisted of a delicate balance between the ephemeral and the eternal – a closed, human-centric system that had a beginning "not long ago, and an ultimate end not far in the future."[236] This geocentric image of the universe, which had its origins in the ancient Greek Aristotelian model, as well as Aristotle's assertion that "Everything which has a function exists for its function," placed Earth at the center of creation with the heavenly bodies circling in close, concentric rings.[237] The focus of much of medieval science centered on better defining this model with the aim of building a cosmological understanding in tune with Christian theology and Christian notions of a great hierarchy of being, in which all creatures, from the lowly earthworm to humans and even the angels, had their own, particular, God-given niche to fill.[238] Within this model, the concept of time was specifically linked to the physical observation of the movements of the heavenly bodies through space.[239] Timekeeping, in the middle ages, was a complex science; an astronomical means of calculating the dates of key religious festivals on the Christian ecclesiastical calendar, which dictated what could and what could not be done on certain days.[240] The most important, and complicated, of these was the dating of Easter and the forty

[236] Don L. Eicher, *Geologic Time*, (Englewood Cliffs, NJ, 1968), p.3.

[237] Aristotle, *On the Heavens, Book II, Part 3,* translated by J.L. Stocks, at Daniel C. Stevenson, *The Internet Classics Archive*, http://classics.mit.edu/Aristotle/heavens.mb.txt (last accessed 12/2/2016).

[238] Ruse, *Monad to Man*, pp.21-23.

[239] Evelyn Edson, *Mapping Time And Space: How Medieval Mapmakers Viewed Their World,* (London, 1997), p.94.

[240] Whitrow, *Time in History*, p.108.

days of Lent that preceded it – a challenge that inspired in theological scholars from St. Augustine of Hippo and the Venerable Bede to Pope Gregory XIII a preoccupation with time and the desire to seek more precise and accurate methods for measuring it.[241] The model such scholars constructed "was so complete and satisfying, and the role of humanity in the cosmos so well defined, that the overthrow of the model in the seventeenth century caused profound spiritual and psychological disorientation, from which we have yet to recover."[242]

The geospatial revolution of Copernicus and Galileo that displaced the Earth and, consequentially, humanity from their favored place at the center of all things literally redrew the celestial map, but had little substantial effect on the popular understanding and use of time which, at that point was still largely informed by the highly local, *seasonal timescape* described in the previous chapter. Bounded by sunrise and sunset and broken by daily seasonal tasks and tower clock alarm bells, the *seasonal timescape* was a practical, physical realm of celestial and nature-based observations, daily secular duties, and religious responsibilities.[243] But, influential as it was, it was only one layer of a profoundly multilayered temporal experience. The *retrospective timescape* existed as another, coexistent layer, sliced from a separate and distinctive angle informed, not by the cyclical rhythms of the sun, moon, stars, and seasons or practical, punctuated alarms denoting expected duties, but by inherited attitudes and concepts of space and time, the material and the spiritual, an inescapable mortality and an anticipated eternity. Such concepts were passed down to the lay public by generations of theologians and philosophers and supplemented by superstition, often informed by lingering traditions of ancient Christian and pre-Christian beliefs. What is the shape of creation? What is its purpose? What is humanity's role in God's great plan?

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[241] Peter Hunter Blair, *The World of Bede,* (London, 1970), p.260.

[242] Edson, *Mapping,* p.53.

[243] Capp, *Astrology,* pp.63-66.

These are the kind of large-scale questions that shaped the retrospective understanding of time.

Unlike the *seasonal timescape*, the 'big picture' questions of the *retrospective timescape* did not deal directly with daily, task-oriented experiences and, so, were not as easily influenced or altered by practical, material developments like calendar reform or mechanical clocks. These questions were more conceptual, more spiritual in nature, dealing with deep, emotional issues of life, death, and purpose. Such factors meant that the traditional, heavily theologically-influenced medieval temporal outlook continued to inform scientific thought well into the eighteenth century, and beyond. The *progressive timescape*, by contrast, was forged, not through generations of overlaid, evolving theological and philosophical concepts, but in the upheavals of religious, political, social, geospatial, and temporal revolution – revolutions informed by scientific observations and political ideologies that graphically upturned the long accepted, feudal structures of society, nature, and the cosmos.

One of the earliest and most influential clashes between these two divergent *timescapes* occurred over the question of calculating the age of the Earth. Using the Christian Bible as a source and guide, coupled with astronomical methods, scholars as diverse as the Irish archbishop James Ussher and the renowned physicist, and deist, Sir Isaac Newton determined creation to have begun some four thousand years before the birth of Christ (although Newton was careful not to assign it a specific date), and that, unless God intervened, the Earth would eventually wind down only some two thousand years after that, probably ending up with an approximately six thousand year run before the Last Judgment brought an end of days.[244] With the end apparently so close, Protestant evangelists in Britain

[244] Whitrow, *Time in History*, p.131.

and America latched hard to this short, finite timescale in their sermons, preaching to their anxious flocks that, though Earthly time was fleeting, God's time was eternal. Influential Calvinist preachers, such as Jonathan Edwards, the Connecticut theologian often credited with bringing the Great Awakening to New England, believed firmly in predestination and humanity's absolute dependence on God's divine grace. He, and his like-minded contemporaries, played on his listeners' fears by emphasizing their lack of control over the fleeting, mercurial nature of existence or the potentially dreadful eternity that awaited them, writing:

> O sinner! Consider the fearful danger you are in…You hang by a slender thread, with the flames of divine wrath flashing about it, and ready every moment to singe it, and burn it asunder; and you have…nothing to lay hold of to save yourself, nothing to keep off the flames of wrath…nothing that you ever have done, nothing that you can do, to induce God to spare you one moment.[245]

The Anglican preacher George Whitefield, one of the founders of the Methodist movement, was highly influential in both Britain and Britain's North American colonies, preaching Calvinist theology similar to Edwards's at vast open air gatherings. Whitefield's sermons inspired strong emotional reactions in his listeners and attracted enormous popular attention – earning him the regard of the noted deist Benjamin Franklin who, in his autobiography, described his attendance at an open air meeting Whitefield held in Philadelphia, Pennsylvania.[246] Franklin's account indicates how far the influence of such emotionally-stimulating sermons could spread, and Franklin's decision to publish

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[245] Jonathan Edwards, "Sinners in the Hands of an Angry God," (Enfield, CT, 8 July, 1741), at *Christian Classics Ethereal Library*, http://www.ccel.org/ccel/edwards/sermons.sinners.html (last accessed 12/2/2016)

[246] Isaac Newton was born into an Anglican family, but believed strongly in God as a 'master creator' who both designed and actively intervened in the workings of the universe. Newton's views were criticized by his contemporary Gottfried Leibnitz, who wrote: "Sir Isaac Newton and his followers have…a very odd opinion concerning the work of God. According to their doctrine, God Almighty wants to wind up his watch from time to time: otherwise it would cease to move. He had not, it seems, sufficient foresight to make it a perpetual motion." This notion of God as a Great Clockmaker was a popular deistic conception of a universe governed by natural laws. Benjamin Franklin described himself as "a thorough Deist" in his autobiography (page 54). Gottfried Leibnitz, *Mr Leibnitz's First Paper, Being an Extract of a Letter Written in November, 1715,* http://www.newtonproject.sussex.ac.uk/view/texts/normalized/THEM00226 (last accessed 12/2/2016).

Whitefield's sermons ensured his words would reach an even wider and more diverse audience.[247] He wrote:

> The multitudes of all sects and denominations that attended his sermons were enormous, and it was matter of speculation to me, who was one of the number, to observe the extraordinary influence of his oratory on his hearers, and how much they admir'd and respected him, notwithstanding his common abuse of them, by assuring them that they were naturally half beasts and half devils. It was wonderful to see the change soon made in the manners of our inhabitants. From being thoughtless or indifferent about religion, it seem'd as if all the world were growing religious, so that one could not walk thro' the town in an evening without hearing psalms sung in different families of every street.[248]

The dualistic notion of the shortness of mortal time contrasted against God's eternal time is central to the *retrospective timescape*, which understands Earthly time to be brief, linear and immutable. Other characteristics of the *retrospective timescape* include an acceptance of the hierarchal notion of creation – that animals and their environment are static rather than adaptable and every *thing* and every *creature* was designed by their creator to fill a specific place in the great chain of being. In this rather pessimistic worldview, since everything was designed for a specific purpose by an all-knowing intelligence, social progress could only be an illusion and moral virtues and laws passed on directly from God were of higher value than empirical observation of a harsh and transient material world.

The understanding and use of time informed by the *retrospective timescape* was challenged by the concept of heliocentrism popularized by Copernicus, Kepler and Galileo, by the rise of Renaissance humanism that valued the individual and the material, and by Columbus's discovery of the New World, which inflated the flat earth map into a rounded, spinning globe. Inspired by this geospatial revolution, eighteenth-century naturalists like James Hutton began observing geological formations with a new eye that looked beyond

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[247] Benjamin Franklin, *The Autobiography of Benjamin Franklin* (*1791) with Introduction and Notes edited by Charles W. Eliot*, Electronic Classics Series, edited by Jim Manis, (Hazelton, 2012), p.100, http://www.arvindguptatoys.com/arvindgupta/e-ben-franklin.pdf (last accessed 12/2/2016).

[248] Ibid., p.97.

Biblical notions of a Great Flood to the active processes of volcanic activity and erosion: a debate soon sifted into the two main camps of catastrophism versus gradualism. In contrast to the catastrophic doctrines, which sought a compromise between the Biblical creation story and scientific records of natural processes, Hutton's careful observations of mountain erosion and other similarly gradual geological processes in his native Scotland made him realize "the Earth appeared to be the product of almost limitless time" – a theory that came to be known as uniformitarianism.[249]

Hutton's theory of uniformitarianism directly challenged Ussher's calculations regarding the age of the earth as well as the widespread notion that the end was near, and helped establish geology as a science in and of itself.[250] His belief in a long, geological timescale was evidenced in his groundbreaking *Theory of the Earth* – the work that made him one of the recognized founders of the modern, rationalist worldview. He wrote:

> …the shepherd thinks the mountain, on which he feeds his flock, to have been always there, or since the beginning of things; the inhabitant of the valley cultivates the soil as his father had done, and thinks that this soil is coeval with the valley or the mountain. But the man of scientific observation, who looks into the chain of physical events connected with the present state of things, sees great changes that have been made, and foresees a different state that must follow in time, from the continued operation of that which actually is in nature.[251]

The gradual, repeating processes of volcanic activity and erosion he observed – the "great geological cycle," as Hutton termed it – required a much longer timescale than the six thousand years seemingly allotted by the *retrospective timescape*.[252] He wrote:

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[249] Eicher, *Geologic*, p.5; James Hutton, *Abstract of A Dissertation…Concerning the System of the Earth, Its Duration and Stability*, (Royal Society of Edinburgh, 1785), p.27.

[250] Edmond A. Mathez, ed., *Earth: Inside and Out*, (New York, 2000), http://www.amnh.org/education/resources/rfl/web/essaybooks/earth/p_hutton.html (last accessed 12/2/2016).

[251] James Hutton, *Theory of The Earth*, Volume II, 1795 at *Internet Sacred Texts Archive*, http://www.sacred-texts.com/earth/toe/toe32.htm (last accessed 12/2/2016)

[252] Mathez, *Earth: Inside and Out*, http://www.amnh.org/education/resources/rfl/web/essaybooks/earth/p_hutton.html (last accessed 12/2/2016).

> "…we are certain, that all the coasts of the present continents are wasted by the sea, and constantly wearing away upon the whole; but this operation is so extremely slow, that we cannot find a measure of the quantity in order to form an estimate: Therefore, the present continents of the earth…would, in the natural operations of the globe, require a time indefinite for their destruction. But, in order to produce the present conditions, the destruction of a former vegetable world was necessary; consequentially, the production of our present continents must have required a time which is indefinite."[253]

But although Hutton's geological observations fit in well with the growing scientific philosophies of a rational universe governed by natural laws, the *retrospective timescape* remained prevalent. His work was overshadowed by contemporaries who embraced the catastrophic theories that sought to compromise burgeoning scientific observations with the Biblical story of creation, like Abraham Werner's Neptunist philosophy that all rocks were products of a great primeval ocean that had once covered the entire earth.[254] This popular philosophy evidenced the temporal understanding of a *retrospective timescape* and obfuscated Hutton's theories for some four decades, until Charles Lyell furthered them with his own careful observations of the natural world. [255]

Embracing the worldview embodied by a *progressive timescape* requires a fundamental acceptance of a long timescale – far longer than the mere six thousand years accepted by the *retrospective timescape*. The prevalence and comfortable familiarity of the *retrospective timescape* meant the nascent *progressive timescape* was often adopted first by those the mainstream British public viewed as radicals and revolutionaries. The American and French Revolutions of the late eighteenth century extoled the value of the individual and

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[253] James Hutton, *Theory of the Earth with Proofs and Illustrations in Four Parts* (1795), p.195.

[254] Eicher, *Geologic*, p.6.

[255] Hutton's uniformitarian notion of gradual processes requiring enormous stretches of time ["In the economy of the world, I can find no traces of a beginning, no prospect of an end."] greatly influenced Lyell's gradualist perspective. Darwin, in turn, was so influenced by Lyell's writings, he dedicated the Second Edition of his *Journal* to him, "as an acknowledgement that the chief part of whatever scientific merit this journal and the other works of the author may possess has been derived from studying the well-known and admirable *Principles of Geology*." Walter Stephen, *The Evolution of Evolution: Darwin, Enlightenment, and Scotland*, (Edinburgh, 2009), pp.75-77.

individual rights, while the burgeoning industrial revolution emphasized the human ability to control and alter their environment.[256] The notion that humans could effectively progress, breaking free of whatever niche they were born into and using their innate talents and choices to climb the social ladder to a better, more prosperous future represented a distinct break with the *retrospective timescape* and its established hierarchy.

Proponents of the progressive understanding and use of time acknowledge a long timescale, the value of rationality, meritocracy, and the material world, and the adaptability of individuals and socio-political structures to changing circumstances. With this adaptability, however, comes a fundamental sense of uncertainty, an emphasis on choice and free will over the concept of destiny or predetermination, and a firm belief that the future can be shaped by present actions.

These two opposing, deeply layered *timescapes* existed and developed together throughout the eighteenth and nineteenth centuries, informing the educated minds of Britain and influencing how they responded to new technologies and theories, including the diverse theories of natural evolution prevalent in France following the Revolution – theories such as those endorsed by Jean-Baptiste Lamarck, Georges Cuvier, and Etienne Geoffroy Saint-Hilaire.[257]

Lamarck's theorized that the reason animals seemed to change their shape over time was because animals could adapt to their environment through individual effort – like, for example, a giraffe stretching its neck to reach high branches. Traits acquired by individual animals in this way could then be passed on to their offspring. Lamarck's ideas were supported by Geoffroy, an Enlightenment deist who believed the environment acted directly

[256] Adrian Desmond, *The Politics of Evolution: Morphology, Medicine, and Reform in Radical London*, (Chicago, 1989), electronic resource: Kindle e-book.

[257] Ibid.

on individuals to produce gradual changes in a population over time. Cuvier opposed Lamarck and Geoffroy's theories and supported the notion of extinction, but he was one of the greatest proponents of geologic catastrophism, arguing that the natural world had been formed through a series of violent catastrophes that had caused the extinctions he recognized in the fossil record. These largely incomplete and jostling theories, often coopted as a means of justifying the third estate's overthrow of the aristocratic classes, were generally looked upon with suspicion by British scholars until the British naturalist Charles Darwin's painstakingly detailed and refined observations brought the value of the theory of evolution into sharp focus with the publication of his book, *On the Origin of Species*, in November 1859 – a book dependent on the long geological timescale popularized by Charles Lyell and his predecessor, James Hutton.[258]

[258] Desmond, *The Politics of Evolution,* e-book.

*SIGNPOST 2*

The following section investigates how the controversy and debate surrounding the work of British scientists Charles Lyell and Charles Darwin helped popularize an immense expansion of the secular timeline during the nineteenth century. What was the effect of that expansion on modern time-consciousness?

The twentieth-century German historian Reinhart Koselleck coined the term "sattelzeit" to exposit the transition from Early Modern to Modern Western History in the decades around 1800, spanning roughly 1770-1830. Perhaps the most significant, intricate, and deceptively subtle aspect of this transition was the shift that occurred in Western time-consciousness.[259]

The late nineteenth century was an age of imperialism, class conflict, and a cultural shift toward secular reason. Popularized by controversy and social unrest, Darwin's theory of evolution was co-opted, interpreted, and re-interpreted to serve a variety of purposes from natural selection to Social Darwinism, paleontology to flood geology. Yet, in each incarnation, the theory of evolution and the notion of a long geological time scale influenced and broadened Britain's sense of time – a paradigm shift that can readily be seen in the lingering effects of the nineteenth-century's temporal revolution.

[259] The challenging question of breaking the historical timeline down into relevant periodizations, ages, epochs, centuries, and other categories is largely a function of a sequential timescape, which will be discussed further in Layer Four. Timescapes as used in this project, being directional but nonlinear, are a function of a simultaneous timescape [see: Layer Four] in which past, present, future, scales and perspectives all exist together in a historical continuum and, therefore, allow for a measure of temporal flexibility that can aid in the discussion, dissection, and ordered analysis of the layered, subjective, yet phenomenologically real, experience of time and temporality. Vyvyan Evans, *How Words Mean: Lexical Concepts, Cognitive Models, and Meaning Construction*, (Oxford, 2009), p.308; Osterhammel, *Transformation*, pp.45-49; Koselleck, *The Practice of Conceptual History*, p.102.

### *LYELL, DARWIN, AND THE POPULARIZATION OF THE LONG, SECULAR TIMESCALE*

Stephen Jay Gould wrote: "Darwin has now become, and properly, the quintessentially socially embedded scientist."[260] But, Darwin's embedded position in the modern, Western socio-cultural landscape is far from stable. It straddles an active fault line that runs between two coexisting, yet conflicting, worldviews – a fault line that marks the split between the *retrospective* and *progressive timescapes*.

Darwin credited Lyell's *Principles of Geology* in the introduction to the first edition of his *Origin of Species*: "He who can read Sir Charles Lyell's grand work on the Principles of Geology, which the future historian will recognise as having produced a revolution in natural science, yet does not admit how incomprehensibly vast have been the past periods of time, may at once close this volume."[261] Lyell's observations effectively displaced catastrophism with uniformitarianism "as the accepted philosophy for interpreting the history of the Earth. In so doing, he founded modern historical geology and he reintroduced, with profound impact, the concept of unlimited time."[262] After all, if geology provided evidence of gradual changes, it followed the Earth had to be much older than previously thought.

Lyell argued the present holds the key to understanding the past. He believed the natural forces shaping the Earth's crust in the present had always existed and had always

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[260] Stephen Jay Gould quoted in Adrian Desmond & James Moore, *Darwin: The Life of a Tormented Evolutionist*, (New York, 1994), front cover. Gould also noted Darwin did not use the term "evolution" in *Origin* and only used "evolve" once, saying Darwin did not want the theory of natural selection confused with Victorian "progress." Nancy K. Frankenberry, ed. *The Faith of Scientists in Their Own Words*, (Princeton, 2008), p.125.

[261] Charles Darwin, *On The Origin of Species, or the Preservation of Favoured Races in the Struggle for Life*, (London, 1859), http://www.gutenberg.org/files/1228/1228-h/1228-h.htm (last accessed 12/2/2016). In 1832, while traveling with the *Beagle*, Darwin wrote to J.S. Henslow: "I had brought with me the first volume of Lyell's "Principles of Geology"…which I studied attentively; and this book was of the highest service to me in many ways. The very first place which I examined, namely St. Jago in the Cape Verde Islands, showed me clearly the wonderful superiority of Lyell's manner of treating geology, compared with that of any other author, whose works I had with me or ever afterwards read." Frederick Burkhardt, et al, ed. *The Correspondence of Charles Darwin Anniversary Set Volume 1 1821-1836*, (Cambridge, 2009), p.239.

[262] Eicher, *Geologic*, p.8.

been uniform in the geologic past. This view encouraged a largely cyclical understanding of time; that these geologic processes could eventually return the Earth to previous states that could house creatures similar to those that had died off in the distant past, such as the ichthyosaurus.[263] His geologic theories, therefore, were not necessarily progressive in themselves. But, because Lyell did not superimpose any sense of established destiny or purpose on the geologic cycle or the natural forces he observed, his theories did represent the values of a *progressive timescape*. Lyell's book, and the uniformitarian doctrine it endorsed, was widely influential among the upcoming generation of British natural scientists, including the young Charles Darwin, "whose ideas on the gradual development of living things could not have flourished without the intellectual framework of vast time. Hence, the uniformitarian doctrine was eminently successful in nourishing scientific progress," even if the strict nature of his uniformitarian theories did not allow for variation in the rates of geologic change or the relative importance of geological agents.[264]

Darwin did not come up with the concept of evolution, but he did find the missing piece to the evolutionary puzzle that had prevented it from gaining widespread popular currency for generations: namely, the uniformitarian notion of a long timescale. Building on this theory, Darwin constructed "a singularly rational and overwhelmingly convincing argument for the origin of diverse species of organisms that populate the world."[265] His groundbreaking work brought into focus, for the first time, the process of organic evolution, for scientists and laymen alike, making it clear that "the tremendous length of geologic time…was available for biological processes as well as physical ones."[266] Yet, like Lyell's

[263] Stephen Jay Gould, *Time's Arrow, Time's Cycle: Myth and Metaphor in the Discovery of Geological Time*, (Cambridge, MA, 1987), p.103.

[264] Eicher, *Geologic*, p.8.

[265] Ibid., p.10.

[266] Ibid.

observations regarding geologic processes, while Darwin's observations of how organic lifeforms adapt to pressures of predation and changing environments over time were not inherently progressive, they did represent the values of a *progressive timescape*. Natural selection indicated the varied pressures of a changeable and uncertain material world, while the selective breeding of domesticated animals depended on the preferences humans held for certain physical traits. Neither relied on the concept of intelligent design.[267] Darwin wrote:

> All that we can do is to keep steadily in mind that each organic being is striving to increase at a geometrical ratio… Man can act only on external and visible characters: nature cares nothing for appearances, except in so far as they may be useful to any being. She can act on every internal organ, on every shade of constitutional difference, on the whole machinery of life. Man selects only for his own good; Nature only for that of the being which she tends.[268]

Some adaptations, or mutations, Darwin witnessed in individual animals were even harmful, resulting in deformities that could lead to premature death; traits Darwin – unaware of genetic heredity – described as being an "unfavorable deviation of structure."[269] The uncertainty inherent in Darwin's theory of evolution, the notion that species were modifiable rather than static, supported by his rigorously detailed observations of natural selection and selective breeding and coupled with a reliance on an acceptance of a long geological timescale, therefore evidences Darwin's, largely unconscious, assimilation of the rational, materialist worldview characteristic of a *progressive timescape*.

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[267] In correspondence with Asa Gray, Darwin called Gray's argument that natural selection was compatible with Christian belief in a Creator God ("A God who left details to chance was somehow nobler") improbable, saying his studies of domestic variations indicated variation had to be spontaneous rather than designed. Initially inspired by his Anglican faith, Darwin's "disbelief crept over me at a very slow rate…causing no distress." His agnosticism (a term coined in 1869 by his supporter T.H. Huxley) was fed more by personal tragedies and lifelong illness than his scientific studies. Frankenberry, pp.123-125.

[268] Charles Darwin, *The Origin of Species by Means of Natural Selection*; *The Descent of Man and Selection in Relation to Sex,* (Chicago, 1980), p.39.

[269] Darwin, *Origin of Species*, http://www.gutenberg.org/files/1228/1228-h/1228-h.htm#link2H_4_0003 (last accessed 12/2/2016).

When Darwin published his theory in 1859, he unleashed it on a population reeling from a transportation revolution that altered the modern relationship with time and space: the rise of railway travel. The unprecedented speeds of mechanical locomotion led to a phenomenon Wolfgang Schivelbusch termed "the annihilation of space and time" as locations that had once been days or even weeks apart were suddenly only hours away.[270] This sense of dislocation carried over to a society still adapting to the rigorous, regimented schedules of industrialized, urbanized life.[271] Factories attracted streams of uneducated, unskilled laborers from surrounding rural areas, creating a class of urban poor upon which the growing bourgeoisie middle class sought to impose their values of respectability, temperance, frugality, and literacy. A large aspect of Victorian social reform was a strong sense of righteous moral purpose, and the firm belief that choices made in the present could affect the future – that social and moral reform was not only possible, but necessary if human civilization was to improve and progress.

Victorian social reformers like Herbert Spencer adapted Darwin's evolutionary theories to human society, effectively combining the long evolutionary timescale with Victorian bourgeois morality and highly subjective need for purpose.[272] The theory of Social Darwinism Spencer developed evidenced the rapid spread and popularization of the *progressive timescape* by endorsing the concept of rational adaptability over the earlier acceptance of the static immutability of social structures, but it quickly became a justification and rationale for the expansion of British imperialism, the concept of population control, and the suppression of the poor. Such rather elitist interpretations of the Darwinian ideas of

[270] Wolfgang Schivelbusch, *The Railway Journey: The Industrialization of Time and Space in the 19th Century*, (Berkeley, 1977), p.33.

[271] See: Layer Three.

[272] Jones, *Social Darwinism*, p.10.

evolutionary adaptation to shifting environments led to assertions that the wealthy classes of society were inherently more "fit" for survival than the poor, or weaker, classes…or, carried further, even races. Victorian economist Alfred Marshall expounded the notion of "a special British racial destiny" – a belief in the "superiority of the white race;" in particular, the middle and upper classes.[273] Marshall wrote:

> …if the lower classes of Englishmen multiply more rapidly than those which are morally and physically superior, not only will the population of England deteriorate, but also that part of the population of America and Australia which descends from Englishmen will be less intelligent than it otherwise would be. Again, if Englishmen multiply less rapidly than the Chinese, this…race will overrun portions of the earth that otherwise would have been peopled by English vigour.[274]

In addition, the concept of selective breeding, applied to human society, prompted the development of eugenics – a theory its founder, Francis Galton, described as "practical Darwinism" – as well as the notion of ethnic nationalistic competition and the superiority of the white or Aryan race that would play a large role in the devastating world wars of the twentieth century.[275] Yet, despite carrying the seeds of such destruction, the fear of the "contamination" or "dilution" of the classes or peoples proponents of these theories determined to be "more fit" than others evidences the popular, social and economic assimilation of the long evolutionary timescale and the adaptive, materialist uncertainty of the *progressive timescape*.

The rapid popularization of the *progressive timescape* was also evidenced in the popular literature of the late Victorian period.[276] In the latter decades of the nineteenth

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[273] Ibid.,145.

[274] Alfred Marshall, *The Economics of Industry*, (1881), in Jones, *Social Darwinism,* p.145.

[275] Jones, *Social Darwinism,* p.99.

[276] The value of fictional works to the study of a mental revolution, such as the temporal revolution, will be discussed further in Layer Three. For more on the boundaries between history and fiction, see: Beverley Southgate, *History Meets Fiction*, (London, 2009). The fact that many of these popular works were printed in periodicals evidences a general recognition among publishers, and the reading and commuting public, "of subjective temporality as opposed to abstract, linear time" in "an increasingly mobile world of things which forced the juxtaposition of spaces and times:" a significant aspect of the nineteenth-century's temporal

century, time travel became a popular literary device – a genre that could not have developed without the acceptance and assimilation of the concept of the long, secular timescale and adaptive social structure inherent to Darwinian theories. Perhaps the most prominent example, H.G. Wells's classic novel *The Time Machine* was a modern fable of warning that sent its unnamed protagonist to a distant future, 802,701 AD, in which humans had gradually evolved into two very different species: the fragile, childlike Eloi, representative of Victorian Britain's privileged leisure class, and the savage Morlocks that represented the downtrodden proletariat – a direct result of a prolonged process of segregation.[277] Instead of a highly advanced, progressive society – the imagined pinnacle of human biological and social development – Wells's Time Traveler encountered "a tangled waste;" a world where "the aristocracy had obtained one triumph after another over nature until all diseases had been stamped out, and all the hard, invigorating conditions of life removed" and the "artisans, reduced at last to mechanical tenders of intricate machinery, the principle of which they were not required, or allowed, to understand" became "noisome beasts of prey with nocturnal habits."[278]

Samuel Clemens's *A Connecticut Yankee in King Arthur's Court* was similarly suspicious of the Victorian bourgeoisie notions of "progress," using his opportunistic American protagonist, Hank Morgan, to highlight the flaws of "modern" society against a historic backdrop of knights and chivalry.[279] All Morgan's attempts to use his supposedly superior historical and technological knowledge to improve and industrialize sixth-century

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revolution [see: Layers Three and Four]. James Mussell, *Science, Time and Space in the Late Nineteenth-Century Periodical Press*, (Aldershot, 2007), p.93.

[277] Anonymous, "The Ideas of H.G. Wells," in *The Critical Response to H.G. Wells*, edited by William J. Scheick, (London, 1995,) p.54.

[278] Ibid., p.56.

[279] Samuel Clemens, *A Connecticut Yankee in King Arthur's Court: An Authoritative Text, Backgrounds and Sources, Composition and Publication, Criticism*, edited by Allison R. Ensor, (New York, 1982), p.331.

England meet with disappointment and disaster as his anachronistic assumptions turn against him. Clemens's book looks backwards rather than forwards, highlighting how far Western civilization had already developed…even if it had not necessarily improved. But the very use of time travel in the novel, as in other examples of the genre, such as Wells's short story "The Chronic Argonauts," which predated *The Time Machine* by nearly a decade, and Edward Bellamy's influential 1888 bestseller *Looking Backward,* acknowledges the long, evolutionary sense of time, and the role of uncertainty, choice, and chance evidences the popular assimilation of the *progressive timescape*, not just in scientific circles but in popular, widely read literature as well.

The acceptance and assimilation of the *progressive timescape* did not mean the *retrospective timescape* faded away. The introduction of Darwin's theories dealt a powerful psychological blow to proponents of the older *timescape,* indicating the rise of a temporal revolution that had long lagged behind the geospatial revolution that had, generations before, assaulted and displaced the Christianized model of a geocentric, human-centered, intelligently designed cosmos.[280] A sense of moral conflict quickly developed between Christian teachings and the question of accepting the long evolutionary timescale endorsed by Darwin and those who embraced the progressive, industrial worldview. This moral conflict led some to interpret the temporal revolution as a spiritual crisis: the Darwin vs. God debate.[281] Darwin experienced this crisis in his personal life, while his supporters, like Thomas Henry Huxley, encouraged the conflict by engaging in much publicized debates with prominent religious figures – debates that increased hostility on both sides. Huxley's own much publicized debate with Bishop Samuel Wilberforce became "a bout of verbal sparring,"

[280] Bowler, *Reconciling Science and Religion*, p.1; Gillespie, *Problem of Creation*, p.21.

[281] John van Wyhe, "Darwin vs. God?: Exploding the Myth of the Clash between Church and Science," *BBC History Magazine*, 10, no.1 (January 2009): p.27.

a clash that was seemingly "as much about personalities as science versus religion."[282] At the heart of the hostility, though, lurked – and still lurks – a fundamental misunderstanding of the mentality, outlook, and worldview of two very different *timescapes*, as can be seen in current discourses regarding teaching evolution and intelligent design in American schools, and elsewhere.[283]

Perhaps, through further study of these divergent *timescapes* and the rationales and values that inform them, an understanding may one day be reached; possibly even a recognition that "it is possible to believe in God and evolution."[284] Until then, tensions remain high; evidence of an elemental paradigm shift – a fundamental shift in *timescape* from the retrospective to the progressive that took place during the nineteenth-century's temporal revolution.

[282] Ibid., p.30.

[283] According to Kahan, "The 'beliefs' individuals form about a societal risk such as climate change [or evolution] are not of a piece; rather they reflect the distinct clusters of inferences that individuals draw as they engage information for two distinct ends: to gain access to the collective knowledge furnished by science, and to enjoy the sense of identity enabled by membership in a community defined by particular cultural commitments." This implies, when it comes to asserting identity or affiliation, individuals with access to scientific findings "aren't willing to endorse the consensus when it contradicts their political or religious views. This finding helps us understand why…factual and scientific evidence is often ineffective at reducing misperceptions and can even backfire on issues like weapons of mass destruction, health care reform and vaccines. With science as with politics, identity often trumps the facts." This also applies to a community or individual's timescape and whether they accept or eschew the long evolutionary timescale. Dan M. Kahan, "Climate Science Communication and *The Measurement Problem* (preliminary draft), pdf, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2459057 (last accessed 12/2/2016); Brendan Nyhan, "When Beliefs and Facts Collide," http://www.nytimes.com/2014/07/06/upshot/when-beliefs-and-facts-collide.html?action=click&contentCollection=Science&region=Footer&module=MoreInSection&pgtype=article (last accessed 12/2/2016).

[284] van Wyhe, "Darwin vs. God?" p.31.

*SIGNPOST 3*

It is widely acknowledged that Western civilization experienced a geospatial revolution beginning in the Renaissance, but there is another revolution that is less widely known, and rarely directly acknowledged: a temporal revolution. This mental revolution in time-consciousness lagged behind the spatial revolution of the Renaissance, yet it was every bit as groundbreaking and paradigm shifting. In many ways, the traces left by that controversial break still affect the political, social, educational, and religious realities of today – perhaps most notably in the ongoing controversy that continues to surround the works of Charles Darwin and the other nineteenth-century natural scientists whose publications helped to popularize the long secular timescale, encouraging its supplantation of the short retrospective timescale in Western popular culture.

The acceptance and assimilation of Darwin's theories into popular culture evidences a fundamental change in outlook, in which Darwin was as much a focal point as Copernicus, Galileo, and Columbus were for the geospatial revolution.[285] By proving the Earth orbits the sun, Copernicus and those he inspired effectively displaced humanity from its favored position as the center of God's creation. Darwin's theories evoked the same sense of displacement, but in time rather than space, indicating a significant cultural shift in temporal worldview from a retrospective to a progressive understanding of time. This shift could be seen in the way contemporaries understood their society and their world. Unlike previous generations, who had adhered to a *retrospective timescape* understanding Earthly time to be fleeting and society to be part of God's static hierarchy of being, proponents of the *progressive timescape* understood time to be vast, society – and society's future – to be malleable, and individuals to be adaptable to changes in circumstance. This shift in worldview became evident in the late Victorian approach to social reform and in the

[285] Robert Andrews Millikan, *Evolution in Science and Religion*, (New Haven, 1927), pp.76-81.

development and popularity of a new genre of time travel literature that seemed to accept the long, evolutionary timescale as a given, indicating that, although the *retrospective timescape* remains a relevant factor in today's world, it has long been supplanted by the *progressive timescape* in Western popular consciousness.

## LAYER THREE: FROM PRIVATE TO PUBLIC

*SIGNPOST 1*

The accelerated experience of time is a familiar motif when it comes to discussing the impact of the nineteenth-century's industrial revolution.[286] Yet, while the spread of mechanized timekeeping (via factories, train schedules, public clocks, and personal watches) and the anxiety-inducing effects of the fast pace of 'modern life' is commonly referenced in history texts, the changing use, expectation, and experience of time is more often a subject of sociology than history.[287] History texts tend to allude to the layered temporal revolution this project seeks to identify and track as a piggyback issue or side-note to the social/economic/political upheaval of the period, only rarely analyzing the nineteenth-century temporal experience as a historical topic in and of itself. [288]

This chapter focuses on one of the most visible and fundamental transitions of Britain's nineteenth-century temporal revolution: the shift from an insular, locally-minded

[286] The industrial revolution, like the temporal revolution, was an intricate complexity of generations of individual revolutionary experiences under the umbrella of multi-segmented socio/political/economic/technological change. In both cases, the term "revolution" can be debated, but this project conceptualizes the temporal revolution as a collision of mind-altering personal experiences: brief, yet irreversibly transformative micro-level upheavals and skirmishes that, when viewed as interconnected temporal landscapes, shape the nineteenth century's layered temporal experience. To do this, "we must reconceptualize industrial [and temporal] revolutions as lived experiences, rich in exchanges and conflicts among masters and men as well as countries and cultures." See: Introduction, pp.4-7; Jeff Horn, et al., ed., *Reconceptualizing the Industrial Revolution*, (Boston, 2010), p.18.

[287] Such as sociologists Helga Nowotny, Hartmut Rosa, Barbara Adam, and Zygmunt Bauman, among others. See: Nowotny, *Time*, (Cambridge, 1996); Rosa, *Alienation and Acceleration*, (Malmö: 2010); *Social Acceleration*, translated by Jonathan Trejo-Mathys, (New York, 2013); Bauman, *Liquid Times*, (Cambridge: 2007); Adam, *Timescapes of Modernity*, (London: 1998); *Time and Social Theory*, (Cambridge, 1994); *Timewatch*, (Cambridge: 1995); John Hassard, ed., *The Sociology of Time*, (New York, 1990).

[288] See Introduction, pp.2, 6-8. Examples of history texts alluding to changing industrial and private temporal rhythms include: Osterhammel, *Transformation*, (Princeton, 2014); Tamara K. Hareven, *Family Time & Industrial Time: The Relationship between the family and work in a New England industrial community*, (Cambridge, 1982); Robert C. Allen, *The British Industrial Revolution in Global Perspective*, (Cambridge, 2009); Horn, ed., *Reconceptualizing the Industrial Revolution*, (Boston, 2010); Berg, *Age of Manufactures*, (London, 1994); Lown, *Women and Industrialization*, (Cambridge, 1990); McKenna, *Workers*, (London: 1980); Sanderson, *Herring Lassies*, (Banffshire Maritime Heritage Association, 2008), e-book; Clark and Carnegie, *She Was Aye Workin'*, (Oxford, 2003); Ellen Jordan, *The Women's Movement and Women's Employment in Nineteenth Century Britain*, (London, 1999); Weisman Deitch, ed., *The Lowell Mill Girls*, (Carlisle: 1998).

'off the clock' *timescape* centered on community and family life (what I have termed the *private timescape*) to the impersonal, fast-paced, highly scheduled rush of modernizing urban centers and industrialized transportation (the *public timescape*). Divided into two main sections, the first, "Is Time Money: Factory Girls and Railway Men," examines experiences of railway and factory workers while the second, "Consuming Time: Charles Dickens as Social Chronicler," considers the mind-and-perception-altering impact of railway speed and travel.

The effect of the intrusion of public time into the privacy of home life, structure, and traditional family roles and divisions of labor is recorded in journals, factory publications, and interviews.[289] The personal experiences of nineteenth-century factory workers (men, women, and children), the men who worked the odd hours required by railroad companies, and their families, highlight the disorientation that characterized the gradual psychological adjustment to an increasingly mechanized world, where the balance between work and family life was complicated by the demands of schedules based, not on the hours of daylight, but on the demands of business: of production, shipping, and transportation.[290] That adjustment affected minds on both sides of the Atlantic, marking a revolution in the thought processes, temporal experience, and temporal expectations of individuals impacted by the spread of mechanized time, transportation, and industrialized schedules – the foundation of the shift from the *private* to *public timescape* that characterized this phase of the temporal revolution.

[289] Although this project focuses primarily on Britain, the industrial and temporal revolutions were not isolated there. The inclusion of American sources, such as the writings published by the Lowell Mill Girls, highlights experiential constants that characterize the catalysts and effects of this industrially-influenced phase of the primarily mental temporal revolution.

[290] Women were particularly affected by this timescape shift and its effect on home/work balance. "The popular impression seems to be that women today are taking a larger share of the world's work than they have ever done before – that this is a new departure, the outcome of the factory system. As a matter of fact, the share taken by women in the work of the world has not altered in amount, nor even in intensity, only in character." This chapter argues that character can be defined, in part, in terms of the conflict between the public and private timescapes. Ada Heather-Bigg (1894) in Louise Tilly and Joan Scott, *Women, Work, and Family*, (New York, 1978), frontispiece.

Western societies typically considered the home, or private sphere, a female-dominated province even before the nineteenth century, while the man served as the public face of the family outside the home.[291] This chapter asks: as available work moved further from the home community, how did workers' experience of time change? How did the *public timescape* of impersonal, urbanized, industrialized experience come to supplant the ties of the *private timescape* as society's expectations shifted from the pedestrian pace of horses, canal boats, and sailing ships to the unprecedented acceleration of trains and steamships; from farm labor and the apprentice system, through cottage industry and a piece-work pay system, to early mills and a time-based pay system, in which workers were paid by the hour rather than by the individual job and time spent at work came to be equated with the amount of money earned?[292]

Tracking the development of the "higher temporal complexity" that accompanied the "rise of bourgeois society," Layer Three uses the nonlinear framework of *timescapes* to examine the same time period as Layer Two while following a different thread – a different angle of the nineteenth-century's temporal revolution: namely, the development of a public-oriented, industrialized time-consciousness among factory and railway employees (*public timescape*) and the clash of that new temporal worldview with the private temporal landscape

[291] For more on work, gender, and social conventions and expectations in the eighteenth-twentieth centuries, see: Isabelle Baudino, Jacques Carré, Cécile Révauger, eds., *The Invisible Woman: Aspects of Women's Work in Eighteenth-Century Britain*, (Hampshire, 2005); Elizabeth Roberts, *Women's Work: 1840-1940*, (Cambridge, 1988); Hareven, *Family Time & Industrial Time,* (Cambridge, 1982); Lown, *Women and Industrialization,* (Cambridge, 1990); Thomas Dublin, *Women at Work: The Transformation of Work and Community in Lowell, Massachusetts, 1826-1860,* (New York, 1979); Sanderson, *Herring Lassies,* (Banffshire Maritime Heritage Association, 2008), e-book; Clark and Carnegie, *She Was Aye Workin'*, (Oxford, 2003); Jordan, *Women's Movement,* (London, 1999); Weisman Deitch, ed., *The Lowell Mill Girls,* (Carlisle, 1998); Tilly and Scott, eds., *Women, Work, and Family*, (New York, 1978); G.E. Mingay, *Rural Life in Victorian England,* (London, 1979); Freidrich Engels, *Conditions of the Working Class in England*, (1845), e-book; Michael Hiley, *Victorian Working Women: Portraits from Life*, (London, 1979); Gertjan de Groot and Marlou Schrover, eds., *Women Workers and Technological Change in Europe in the Nineteenth and Twentieth Centuries*, (London, 1995).

[292] For more on the role of horses, see: Daniel Roche, "Equestrian Culture in France from the Sixteenth to the Nineteenth Century," *Past & Present*, no.99, (May, 2008), pp.113-145. For the transition from canals to trains and canal boats as models for railroad cars: Schivelbusch, *Railway Journey*, pp.103-107. For the transition from farm life to factories and the notion of a "woman's place" being in the home: Dublin, *Women at Work*, p.1.

that exists when one is 'off the clock' (*private timescape*)[293] This clash involves not only the question of who owns a worker's time, but also the undermining of 'traditional' gender roles as women found employment in factories.[294]

Much as the *seasonal timescape* preceded the *mechanical timescape* and the *retrospective timescape* preceded the *progressive timescape*, the *private timescape* preceded the industrialized temporal landscape of the urbanizing public sphere. Also like the other divergent *timescapes* discussed above, this *private timescape* gradually came to be supplanted in the public consciousness by its industrialized counterpart. Yet, rather than fade into obscurity, these two divergent *timescapes* continued to develop contiguously.

Though separated here into different chapters, the development of the mechanical, progressive, public, and *sequential timescape* layers (and their counterparts) overlapped – more conspicuously by the end of the long nineteenth century. Coupled with the rise of the standardized *sequential timescape* discussed in Layer Four, this 'third' phase of the temporal revolution can be seen in terms of broader industrializing, urbanizing, globalizing, homogenizing forces: "the general imposition of a high culture on society, where previously low cultures had taken up the lives of the majority, and in some cases the totality, of the population…the establishment of an anonymous, impersonal society, with mutually substitutable atomized individuals, held together…by a shared culture of this kind, in place of a previous complex structure of local groups, sustained by folk cultures reproduced locally and idiosyncratically by the micro-groups themselves." [295]

Applied to the temporal revolution, "high culture" relates to the public, mechanized (eventually standardized) time of business and industry implemented at the expense of a

[293] Ibid.

[294] Dublin, *Women at Work*, (New York, 1979); Lown, *Women and Industrialization*, (Cambridge, 1990).

[295] Ernest Gellner, *Nations and Nationalism*, Second Edition, (New York, 2008), p.56.

complex patchwork of highly local, individual, private times (the "low…micro-groups" of the majority).[296] The relative, individualized sense of time returns to the forefront in Layer Four, which tracks the concurrent rise of the contrasting *simultaneous timescape*. The structure of these 'layers,' and the ability to compare and contrast these contemporaneous, overlapping shifts in time awareness, experience, and expectation at various levels demonstrate the usefulness of the flexible, nonlinear framework afforded by *historical timescapes*.

[296] Ibid.

***CONFLICTING TIMESCAPES: IS TIME MONEY – RAILWAY MEN AND FACTORY GIRLS***

Niklas Luhmann observed, "time is an aspect of the social construction of reality."[297] He wrote:

> …we still do not have a satisfactory concept of time. The prevailing "solution" to this problem is the distinction of several different notions of time. Still, we lack a satisfactory theory that would be able to correlate variations in social structure and variations in temporal structure. …only the economic and political breakthrough of the bourgeois society provided the background for solving time problems by temporal means: by extending the time horizons of past and future and by orienting the present toward their difference. [In other words,] with the rise of bourgeois society the structure of time has changed drastically in the direction of higher temporal complexity [and] we must expect that this change will have its impact on every social structure and on every concept. Nothing will retain its old meaning.[298]

This lack of an adequate system – even an adequate vocabulary – to discuss and analyze the complex, layered nature of time has similarly hindered historians. The very use of tensed languages presupposes a socio-cultural perspective that accepts a linear understanding of past, present, and future, influencing the minds and worldviews of every culture that speaks them, and the question of the individual perception of time often crosses over from history to the disparate realms of psychology, philosophy, sociology, anthropology, physics, and even neuroscience. [299]

This section investigates two disparate groups who experienced the shift to an industrialized time-consciousness first hand: the men who worked the railways in Britain, and the women factory workers of Lowell, Massachusetts and Halstead Mill in Britain. Lowell's factory system became an internationally recognized prototype and model, as Lowell's

[297] Niklas Luhmann, "The Future Cannot Begin: Temporal Structures in Modern Society," *Social Research*, (43:1, Spring 1976), p.134.

[298] Ibid., p.133-134. These "different notions of time" include, but are not limited to, chronology (dates), experience, and the plurality of social times (*Temporalgestalten*) that disconnect 'chronology' from 'time.'

[299] Ibid.

literate female workers knew.[300] They, and their British observers, noted the contrast between, not only working conditions in Britain and America, but the women's reasons for working, life aims, education levels, opportunities for further education and/or enrichment, and socio-economic class.[301] These many differences of place, occupation, and gender, highlight the similarities these workers shared: notably, their experience with industrial time and the regimented schedules that structured their work lives and, consequentially, their time 'off' the clock.

The transition from a preindustrial, predominantly *private timescape* to the postindustrial *public timescape* had a particularly profound effect on women.[302] Throughout the nineteenth-century, women workers in Britain and America had to transcend the expectations of a patriarchal and paternalistic society, finding ways to strike a balance between their paying job and their home duties.[303] This gave them a unique awareness of the structure and pressures of industrial time.[304] Railway workers and their families faced a similar situation, since their lives were patterned on uniquely precise and demanding schedules that often kept husbands and fathers away from home for long periods.[305] The

[300] Lown, *Women and Industrialization,* p.4; Weisman Deitch, ed., *The Lowell Mill Girls,* (Carlisle: 1998). These cases – Lowell in particular – were primarily chosen because of the number and variety of available primary documents.

[301] Ibid., Dublin, *Women at Work,* (New York, 1979); Jordan, *Women's Movement*, p.70.

[302] Lown, *Women and Industrialization,* (Cambridge, 1990); Tilly and Scott, eds., *Women, Work, and Family*, pp.63-88.

[303] The "thread of patriarchy" and "paternalism" in the workplace, and the influence of female "dominion" over household duties are discussed in Lown, *Women and Industrialization*, pp.8-38, 95-131.

[304] Textile factory workers (about twenty-two percent of England's female workers in 1851) would have been most directly influenced by the pressures of industrialized time and schedules, but shop workers and servants expected to keep to the clock also had to adapt to and assimilate the strict rhythms of the public timescape into their daily lives, informing the balance of work/free/family time. Tilly and Scott, eds., *Women, Work, and Family*, pp.69; Lown, *Women and Industrialization*, (Cambridge, 1990).

[305] McKenna, *Workers*, (London, 1980). Navvies, the men who built Britain's railways, moved so often and kept such odd schedules "it was not, in the early years at any rate, the navvy custom to marry." Often, "marriages on the works were no more than shams…respectable women…whose lives were otherwise a credit to them, were not married to the men with whom they were living, and indeed their children might have different fathers…"

pressure of keeping these precise schedules was then transferred to the passengers, who had to be conversant with railway time to catch their trains.[306] Eventually, the *public timescape* entered the private lives of all classes, genders, and age groups, gradually mainstreaming the new, fast paced, forward-looking structure of bourgeois time that still informs how modern Western societies structure their days and conceptualize their past, present, and future.[307] Together, the observations left by these varied groups paint a picture of the effects of the increasingly regimented mechanical time of the industrial revolution on individuals who experienced it first hand – an experience painted in wry terms by the anonymous author Ruptured Coupling:

> In the days of old, when knights were bold
> Before watches were invented
> From dusk to dawn, with brain and brawn,
> The serf toiled, unlamented.
> The railway system changed this game
> The clock be the master
> The lifeless hands within their frame
> Insisted more, and faster![308]

Terry Coleman, *The Railway Navvies: A history of the men who made the railways*, (Suffolk, 1965), pp.187, 192.

[306] W.F. Allen, "Standard Railway Time," in "Open Letters"; Charles Dickens, "A Narrative of Extraordinary Suffering," *Selected Journalism 1850-1870*, (London, 1997), p.123.

[307] Luhman, pp.133-134. According to Mah, the "public sphere" is an "empirical reality of conflicting social identities and interests" – a complex reality of individuals and groups that also makes up the public timescape. "Public" time is "shared" time, an aspect of a "public sphere" that, Jacob noted, coalesced during the Enlightenment, elucidated by the German sociologist Jürgen Habermas as a "new consciousness of the individual self defined in relation to a universe beyond the family, separate from the state, and discovered through reading, polite conversation, and especially by the social interaction required by commercial life." Harold Mah, "Phantasies of the Public Sphere: Rethinking the Habermas of Historians," *The Journal of Modern History*, Vol.72, No.1, New Work on the Old Regime and the French Revolution: A Special Issue in Honor of François Furet (March 2000), pp.153-182, p.155; Margaret Jacob, "The Mental Landscape of the Pubic Sphere: A European Perspective," *Eighteenth Century Studies*, Vol.28, (Autumn, 1994), pp.95-113, p.95. See also: Craig Calhoun, ed., *Habermas and the Public Sphere*, (Cambridge, MA, 1992); Robert Holub, *Jürgen Habermas: Critic in the Public Sphere*, (London, 1991); Nick Crossley and John Michael Roberts, eds., *After Habermas: New Perspectives on the Public Sphere*, (Oxford, 2004); Gellner, *Nations and Nationalism*, (New York, 2008).

[308] Ruptured Coupling in McKenna, *Workers*, p.242. For the spread of industrial time on a global scale, see: Osterhammel, *Transformation*, pp.69-76

*RAILWAY MEN*

Lewis Mumford asserted: "The clock, not the steam engine, is the key machine of the industrial age: even today no other machine is so ubiquitous."[309] This was particularly true on the railway lines themselves. Frank McKenna described how strict train schedules and the unforgiving precision of railway clocks shaped the lives, loyalties and priorities of railway workers and, consequentially, how time was used and compartmentalized by the larger community operating around them:

> The railway worker was a career man – an industrial soldier, a man who commissioned himself to a lifetime of service in which time was of the essence and the timepiece the supreme commander.... Railway workers...found themselves in a clock-and watch-bound bondage wherein every tortured movement was accounted for and logged, and where every second was a rubbing knot within a roped existence.[310]

This almost militaristic dedication to duty and schedule was necessary on the railroad, where even a slight delay could lead to an accident on the line. This was especially true before high speed telegraph communication, and the establishment of standard time.[311]

Before 1840, when London-based railway time was applied by the Great Western Railway, Britain and its railroads operated according to a confusing patchwork of local times. Each city and small town kept its own time, usually determined by a sundial, meaning even neighboring towns could see a time difference of several minutes. These minor local differences did not matter in pre-industrial society, but fast trains could pass through several

[309] Lewis Mumford, *Technics and Civilization,* (New York, 1934), p.14.

[310] McKenna, *Workers,* p.250.

[311] See Layer Four. Technological innovations such as railways and high-speed telegraph systems contributed to a sense of temporal and social acceleration that pervaded the later nineteenth century, introducing a "qualitative change" and "new rationale" to travel, communication, and "ultimately to globalization processes of the nineteenth century." Roland Wenzlhuemer, "Editorial – Telecommunication and Globalization in the Nineteenth Century," *Global Communication: Telecommunication and Global Flows of Information in the Late 19th and Early 20th Century / Globale Kommunikation: Telekommunikation und globale Informationsflüsse im späten*, Vol. 35, No. 1 (131), 19, (2010), pp.7-18. See also: Hartmut Rosa, *Social Acceleration: A New Theory of Modernity*, translated by Jonathan Trejo-Mathys, (New York, 2013); Schivelbusch, *Railway Journey*, pp.52-69; Osterhammel, *Transformation*, pp.74-75.

local time zones in an hour.[312] Travelers using local times could miss their trains, evidenced in the many complaints seen in newspapers, such as *The London Times*. On 17 January, 1874 the *Times* published a reader's concern that the congestion on the line caused by late trains threatened to increase the risk of accidents. Another contributor complained about the fiscal burden of missed and late trains, stating that after missing his doctor's appointment four days in a row, he finally arrived only to find that his doctor had left for a holiday. The cost of missed work, missed appointments, canceled holidays, and the need for overnight accommodation due to missed trains were common Victorian era complaints in the *Times* and such grievances, including complaints regarding excess baggage, late mail, and various inconveniences caused by holiday makers to regular train commuters, were often satirized in *Punch Magazine.* A contribution published in the *Times* on 9 September, 1874 even discussed the number of lawsuits that had been filed against railway companies for train unpunctuality. This situation was made all the more confusing by the fact that different railroad companies ran their trains on different schedules determined by their own local times.[313]

This complicated logistical nightmare was not limited to Britain, but existed as a much broader, global phenomenon as railway, and accompanying telegraph, lines began to stretch across Europe, the United States, South America, Japan, China, India and Africa.[314] Throughout most of the nineteenth-century, even as global and international business, trade, and high speed communication and travel networks developed, each country remained

[312] Bartky, *One Time*, p.59; Ogle, *Global Transformation,* p.25; Schivelbusch, *Railway Journey,* pp.43-44

[313] Complaints above compiled in *Time Research by Dr. B.L. Gribling, NRM 2011.*

[314] The sense that this new high-speed interconnectedness was causing the world to shrink, "annihilating" space and time, is an aspect of a wider process of globalization. The "changing patterns of communication, interactions and transfers is a principal focus of global history," which aims to view space as "an object of study," while this project aims to present time as an object of historical study. Roland Wenzlhuemer, "Globalization, Communication and the Concept of Space in Global History," *Historical Social Research / Historische Sozialforschung*, Vol. 35, No. 1 (131), (2010), pp.19-47; Schivelbusch, *Railway Journey*, p.33.

divided by multiple local times.[315] The pressing need for standard time became increasingly apparent, even to those who did not regularly use the railway. But, for many countries, cities, and towns, local time was linked to local pride.[316] This issue, as well as conflicts between the railroad companies, made it very difficult to adopt an agreeable standard. Greenwich Mean Time was ultimately adopted as the global prime meridian, making London the starting point of a new, standardized system of what, eventually, became modern time zones.[317] This helped straighten the dangerous, confusing tangle of local times but, for the men who worked the railroads, keeping precise time remained a matter of life or death on the track, a stressful burden that dominated their lives.[318]

Many railway workers lived according to a distinctive split-shift system, neither clearly day work nor clearly night work, but a schedule unique to the requirements of the railway. The constant need to be on-call meant long shifts away from home, ranging from weeks to months. Men who lodged away from home were called Double Homers.[319] Many existed on a difficult schedule divided, not by the natural rhythms of night and day, but by the coming and going of freight and passenger trains, sustained by "loyalty to the company and job, where the needs of the service took precedence over the need for rest by track-numbed limbs."[320]

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[315] Ogle, *Global Transformation*, pp.110-117; Osterhammel, *Transformation*, pp.69-70.

[316] Notably: France and Brazil. *International Conference Held at Washington for the Purpose of Fixing a Prime Meridian and a Universal Day, October, 1884, Protocols of the Proceedings*, (Washington, D. C., 1884), http://www.gutenberg.org/files/17759/17759-h/17759-h.htm (last accessed, 20/4/2016).

[317] Ogle, *Global Transformation*, (Cambridge, Mass., 2015); Bartky, *One Time*, (Stanford, 2007).; see Layer Four.

[318] "One might…say…the more civilized the schedule and the more efficient the technology, the more catastrophic the destruction when it collapses. There is an exact ratio between the level of the technology with which nature is controlled, and the degree of severity of its accidents." Maintaining consumers' trust in railway travel required strict, careful efficiency. Schivelbusch, *Railway Journey*, p.131.

[319] McKenna, *Workers*, p.190.

[320] Ibid., p.192.

When they were home, this strange schedule also dominated their home lives, essentially invading, and displacing, the *private timescape* of the family home with the *public timescape* of railroad work – still a concern today when modern railway companies struggle to manage employee fatigue while maintaining a demanding twenty-four hour schedule.[321] Removed from customary day/night rhythms, this schedule meant nineteenth- and twentieth-century railway men often lived on railway estates: communities in which each man's priority went "engine, train, lodge, home," and fear of railway accidents loomed heavily.[322] Their wives' priority became ensuring their husbands were not disturbed by daytime noises.[323] McKenna observed, "Unlike the wives of seafaring men, who could attune to long separations broken by long shore leaves, the wife of the lodging man was tied to railway shift hours as firmly as her husband."[324] Daytime sleepers meant noisy children's games were prohibited, doors were never slammed. "Even when he was in bed the house was dominated by the father, because his rest was essential to the financial security of the family."[325] Growing up in this environment meant the "ritual which enmeshed the parents was upheld by the offspring," and many sons of railway workers, acclimated to their fathers' strange hours, became railway workers themselves.[326]

The lure of home and family, and the pressures of stringent punctuality, incited the

[321] John R. Wilson, ed., *People and Rail Systems: Human Factors at the Heart of the Railway*, (Hampshire, 2007), p.543.

[322] McKenna, *Workers,* p.217.

[323] Not all families could adapt to these schedules. Less respectable circumstances followed the constantly moving railway navvies who "found their women where they could, and behaved in this way very much like so many soldiers." Coleman, *Navvies,* p.187.

[324] McKenna, *Workers,* p.217.

[325] Ibid.

[326] Ibid., p.218.

question: who was in charge of the railway worker's time – the employer, or the worker?[327] Railway companies insisted their employees' time was bought and paid for—all their time, not just a twelve-hour shift. Workers were ordered to live within a mile of their local depot, ready to answer the call to work at any time. When workers were needed, a railway "knocker-up" went to the lodging houses or railway estates with a hand-lamp and a timepiece "to snatch men from sleep to work."[328] This created a new definition of time-consciousness in these communities, where punctuality was not merely a virtue, but an obligation, a way of life. No matter the personal crisis, the train had to get through.[329]

The importance of keeping accurate time was, and remains, a driving force for railway workers in Britain and around the world.[330] Ubiquitous clocks and pocket watches demonstrated the relationship between time and wages by measuring, what the workers termed, the unforgiving minute.[331] In the eyes of management, time was expensive, a cost to minimize. To workers, their time was a precious commodity they had to sacrifice to support themselves and their families.

The pocket watch came to be viewed as a status symbol, indicating a hierarchy among

[327] Marxist philosopher Georg Lukács argued such processes and issues reduced individuals "to abstract labor exchanged for a wage, replace qualitative aspects of people…with quantative exchange values" – in this context, turning them from private beings to public entities beholden to a shared, public temporal landscape. Such a "tendency toward dehumanization," "irrationality," and "alienation" is an aspect of a public timescape that becomes more prominent when layered with the overlapping sequential timescape of standard, industrialized time discussed in Layer Four and criticized by authors and artists like Kafka (*The Metamorphosis,* 1915) and Chaplin *(Modern Times,* 1936). Robert J. Antonio and Ronald M. Glassman, *A Weber-Marx Dialogue,* (Kansas, 1985), p.92.

[328] McKenna, *Workers,* p.251.

[329] Aside from shipping goods, many small towns came to depend on the railways for survival, relying on the access they provided to London and the seaside to attract families and retirees. Railway punctuality was, therefore, an essential factor. Eric Jones, *Locating the Industrial Revolution: Inducement and Response,* (UK, 2010), p.66.

[330] Wilson, *Rail Systems,* p.543.

[331] McKenna, *Workers,* p.248.

the railroad employees.[332] Owning a watch implied at least some measure of control over one's time, and a watch presented to a railway worker was a symbol of responsibility and confidence. In most industrial professions, including factory work, time was controlled from above and workers did not carry personal timekeepers. Ordered signals divided their days, whistles and bells, and although there were factory clocks, usually only middle-class management held their own pocket watches.[333] On the train, however, the need for individual workers to know the exact time was directly pressing. The watch "displayed by the guard" provided official Railway Time, but the train's driver usually held a watch of his own so he would not have to rely on quick glimpses of the station clocks the train passed, and his call was rarely challenged.[334]

But, if demanding time schedules consumed the public and private lives of railway men, the grueling work hours expected of factory employees made the question of time management and time ownership one of the hottest social, economic, and political buttons of the Victorian age.

*FACTORY GIRLS*

The issues of female factory employees brought time to the forefront of a pressing social issue that remains controversial to this day; an issue the nineteenth-century Victorians termed

[332] "The watch became an emblem of Western Civilization" across the world and "put punctuality within the reach of all." Osterhammel, *Transformation,* pp.71-72.

[333] This arrangement, in which management held total control over the workers' time during the hours they were dependent on the settings of the factory clock, often led to fraud and abuse of power charges. In his 1845 report *Conditions of the Working Class in England*, Friedrich Engels recorded the ways factory management would alter the time on the factory clock to cheat workers of their pay by making it appear as though they had arrived late, while tricking them into working longer hours. Discussing reports regarding the collection of fines imposed on workers due to absence or late arrival at the factory, he wrote: "the operatives often find the factory clock moved forward a quarter of an hour and the doors shut, while the clerk moves about with the fines-book inside…ninety-five employees [were] thus shut out, standing before a factory, whose clock was a quarter of an hour slower than the town clocks at night, and a quarter of an hour faster in the morning. The Factory Report relates similar facts. In one factory the clock was set back during working-hours, so that the operatives worked overtime without extra pay…" Friedrich Engels, *Conditions,* p.110.

[334] McKenna, *Workers,* p.248

"the Woman Question."[335] The active recruitment of women and children to factory work, along with the increasing, undeniable visibility of women working and seeking recreation in public, urban environments, struck a sharp contrast with the Victorian bourgeois social and artistic notion of women as "domestic angels," or "the angel in the house" – a contrast that unsettled mainstream Victorian reformers and emphasizes the intrusion of the *public timescape* of work and outside socialization into the "off the clock" *private timescape* of self, home and family fostered by the demands of the industrial revolution.[336]

A well-known adage reads: "A man may work from sun to sun, but a woman's work is never done."[337] Before the industrial revolution, women were rarely viewed as independent agents.[338] Their work and role in society was intrinsically linked to a larger family unit and family economy. For the most part, women and girls performed unpaid domestic labor which, despite their contributions to the domestic cottage industries and agricultural production crucial to their families' welfare, left them economically subordinate

[335] Lown, *Women and Industrialization*, p.1.

[336] The stereotype of "the domestic angel," – the Victorian ideal of the perfect, submissive, devoted housewife – was voiced in a narrative poem written by Coventry Patmore about his wife Emily, whom he portrayed as a model for all women. Entitled "The Angel in the House," the poem was originally published in four separate sections between 1854-1862, and the image it evoked became so powerful throughout the late nineteenth and early twentieth centuries that it was openly scorned by Virginia Woolf in 1931 when she asserted that "Killing the Angel in the House was part of the occupation of a woman writer." Virginia Woolf, *Killing the Angel in the House – Seven Essays*, (London, 1995) and http://www.poemhunter.com/i/ebooks/pdf/coventry_patmore_2012_3.pdf (last accessed, 30/4/2016), p.3, 52-145.

[337] Traditional folk rhyme.

[338] "Most single women belonged to households, either as daughters or servants...whatever their age, single women were regarded as dependents of the household in which they lived and worked….If they were to escape this state of dependency, they had to marry, for single adult women were effectively children." Tilly and Scott, *Women, Work, and Family*, p.31.

to the family patriarch, unable to support themselves independently.[339] It was often accepted as a given that "a women's place was clearly in the home."[340]

The progression from cottage industry to enclosed textile factories was a gradual, but logical step. For cottage workers, making linen, wool, and cotton cloth was a way of life, and every family member participated.[341] Men usually ran the large looms, women and children prepared raw materials and spun thread. But rural labor, though cheap, was unorganized and quality and productivity were uneven. By the 1760s, English inventors such as James Hargreaves, who patented the spinning jenny, began consolidating and automating textile production.[342] By 1771, the first factory was established, in Cromford, England.

As the industrial revolution spread across Britain, America and elsewhere, factory owners realized placing machines and workers under one roof allowed them control over, not only the means and quality of production, but their workers' time. Strict factory schedules soon replaced the uneven rhythms of pre-industrial cottage industry, dividing work into hours; chunks of working time measured by mechanical clocks and delineated by factory bells or whistles. Punctuality became an overriding virtue, and with it came a growing sense of obligation, an intense need to be on time.[343]

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[339] "…very large numbers [of women] worked full-time at home for no wages…Unfortunately, since this work has never been paid it is somehow assumed that it is not 'real' work at all and consequentially has become devalued in the eyes of many men and women." Roberts, *Women's Work*, p.2.

[340] Dublin, *Women at Work,* p.1.

[341] Lown, *Women and Industrialization,* p.78.

[342] This movement toward mechanization that characterized the First Industrial Revolution, though welcomed by many workers and factory owners as a means of saving labor and money, was viewed as a threat by others who valued the established apprentice system and feared the replacement of skilled artisans by machines. These individuals saw the slow pace of the world they knew being undercut by fast machines that required little training or skill to work, and which could produce higher outputs of cheaper goods than artisans who had spent a lifetime honing their craft as they progressed from apprentice to journeyman to master. *The Speech of Randle Jackson, Esq. Addressed to the Honorable the Committee of the House of Commons Appointed to Consider the State of the Woolen Manufacture of England on Behalf of the Cloth-Workers and Shearmen of the Counties of Yorkshire, Lancashire, Wiltshire, Somersetshire, and Gloucestershire,* (London, 1806), pp.16-18.

[343] This phenomenon – this pressing need to be ready and available to adapt quickly to new and changing schedules – has been seen taken to an extreme in the modern era, where the dominance of the public over the private timescape is evidenced, in part, by the ubiquity of cellphones and similar mobile devices that not only

This new sense of time and time-pressures led to a new sense of compartmentalization, particularly for women. Previously, the bulk of a woman's working life would have centered on her home and various domestic duties. Mill and factory work removed women from that home base for most of the day, requiring them to divide their time between structured, paid work and the persistent demands of domestic, family life: the basis for the clash between the insular *private timescape* and the rigidly scheduled *public timescape*.

Established in 1793 on the Blackstone River in Pawtucket, Rhode Island and modeled on Richard Arkwright's British textile factories, Slater Mill is recognized as the first successful factory in the US: the birthplace of America's industrial revolution. Its success spinning cotton thread inspired other American entrepreneurs and established the practice of hiring children to work the spinning machines and, later, women and families. Known as the "Rhode Island System," family housing was provided for the factory's employees and weaving work was hired out to local village artisans. Something of an early bridge between cottage industry and industrialization, it was ultimately overshadowed by the Waltham-Lowell system of Massachusetts, which consolidated the manufacturing process into textile centers, where everything would be done under one roof. In this system, employees (primarily young, unmarried women from nearby towns and farms) left their family homes to

provide accurate standard time but also keep their owners actively connected to a public network of calls, e-mails, texts, updates, and tweets every moment of every day, whether they be shopping, showering, working, attending classes, eating a meal, doing laundry, or even driving. In his 2007 book *Liquid Times: Living in an Age of Uncertainty*, the Polish sociologist Zygmunt Bauman argued that, with change occurring so quickly in the public world of global industry and rapidly evolving technologies, where very little can be trusted to have any sort of lasting permanence, people can no longer count on a solid, progressive career or life structure and must instead learn to structure their lives laterally and adapt to opportunities available in the short term – to go with the flow of, what he called, a new "liquid modernity." Used in this context, the term "liquid modernity" can certainly describe the breakneck pace of the ever-changing modern public timescape and the prevalent sense of disassociation from the solid, private timescape that characterizes the first world's cultural preoccupation with the massage and relaxation industry, as well as various types of therapy – all of which can be scheduled by the hour or half-hour into a busy worker's hectic day. At this point the question may become: Could the development of the leisure and relaxation industries have been an attempt to reconnect with the long-since supplanted private timescape?
Bauman, *Liquid Times*, pp.3, 10, 11.

reside in company boardinghouses, where they were expected to eat, sleep, and work in accordance with strict schedules and rigid codes of morality.[344] Although few were consciously aware of it at the time, this sudden and, often, jarring separation from the familiar routine of rural, preindustrial family life put these Lowell Mill Girls on the front lines of the nineteenth-century's temporal revolution, where they experienced firsthand a visceral shift in temporal worldview and temporal expectations as, those that could adapt, made the jump to the *public timescape* of factory life. The records they left – diaries, journals, and factory publications – offer remarkable glimpses into this disorienting temporal transition and provide invaluable context and contrast to similar records from British factories, such as Halstead Mill in East Anglia.[345]

Lowell's mills were constructed in the 1820s to a high standard but, if the owners hoped to realize any realistic profit from their investments in the land, machines, and buildings, they would not be able "[t]o tempt the skilled Yankee artisans and freehold farmers with wages high enough to persuade them to leave their customary work."[346] So, the "Lowell capitalists" recruited "an untapped source of labor...the New England farm girl."[347] Young women were viewed as dependents within a family unit; they could be paid much less than young men, who would have been expected to head and provide for a family. Yet, while these mill girls were paid higher wages than most other accepted female occupations, such as

[344] Susan Brown, *Caught Between Two Worlds: The Diary of a Lowell Mill Girl*, edited by Mary H. Blewett, (Lowell, 1984), p.1.

[345] Lowell served as a prototype and example of a "paternalistic" system also adapted in Britain, designed to attract "respectable" young women workers and assure them and "their parents that the boardinghouses…were observing some of the traditional values of rural society," including strict curfews and church attendance. "…industrial development would shift the focus of production from family to factory…If the factory was to be a surrogate family, its hierarchy would have to be modeled on the organization of the family." Hareven, *Family Time*, p.55.

[346] Brown, *Two Worlds*, p.1.

[347] Ibid.

domestic servant, there remained a fear that leaving home for factory work in town would lead to their moral ruin, and the creation of a "degraded proletariat."[348] Work, for these girls, was intended to be "a brief experience prior to marriage... Their parents were assured that the virtues of their Yankee daughters would be preserved by a system of careful supervision both at work and in the corporate boarding houses where they would eat and sleep.[349] The steady work habits and disciplined characters of the girlhood of New England would be adapted to the factory system."[350]

Many early mill girls were from well-off agricultural families, their lives and experiences grounded in a seasonal, *private timescape* with little knowledge of the mechanical, *public timescape* prevalent in urbanized spaces. They often had a high school education, and some, like Susan Brown of Epsom, New Hampshire, had worked as teachers.[351] These girls came to Lowell to experience life at a different pace, but it was not always an easy transition. Most mill workers kept in constant correspondence with their family and friends, but many suffered from severe homesickness, and found it difficult to adapt to the demanding, highly regimented schedule that defined factory life. Eliz. E. Turner, wrote: "I toil day after day in the noisy mill. When the bell calls, I must go: and must I always stay here, and spend my days within these pent up walls, with this ceaseless din my only music?"[352]

One of the most common complaints concerned the bells that framed their new lives,

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[348]Ibid., p.2.

[349] Hareven, *Family Time*, p.55.

[350] Brown, *Two Worlds*, p.2.

[351] Ibid., p.6.

[352] Eliz E. Turner, "Factory Girl's Reverie – Longing for Home," originally published in *The Lowell Offering*, Vol. 5, 1845, pp.140-141, in Mary S. Paige and Larry Metzger, *Voices and Masks: the Experience of 19th Century Mill Girls and Enslaved Women from Primary Sources*, (Concord, 2000), p.133.

calling the girls to and from bed, work, and meals, as this factory publication shows:

> "I will not stay in Lowell any longer; I am determined to give my notice this very day," said Ellen Collins, as the earliest bell was tolling to remind us of the hour for labor. …"I am going home, where I shall not be obliged to rise so early in the morning, nor be dragged about by the ringing of a bell, nor confined in a close, noisy room from morning till night. ...I object to the constant hurry of every thing. We cannot have the time to eat, drink or sleep; we have only thirty minutes, or at most three quarters of an hour, allowed us, to go from our work, partake of our food, and return to the noisy clatter of machinery. Up before day, at the clang of the bell—and out of the mill by the clang of the bell—into the mill, and at work, in obedience to that ding-dong of a bell—just as though we were so many living machines. I will give my notice tomorrow..."[353]

Yet, despite its critical tone, the purpose of this article was actually to highlight the benefits of life as a mill girl, compared to the "dull, lifeless silence" of farm labor.[354] Even with its annoyingly persistent bells, the fast-paced mill schedule made for a comparatively exciting and active lifestyle, and it did allot time for socializing and leisure, allowing the girls to attend lectures or dance classes in town and cultivate their minds with easy access to books. Often, the girls' complaints about adapting to the quick pace of factory life were cloaked with humor:

> You appear surprised at the hurry and bustle now going on in the room, but your attention has been so engaged that you have forgotten the hour. Just look at the clock, and you will find that it wants but five minutes to "bell time." We will go to the door, and be ready to start when the others do... I shall be obliged to hurry you, as it is some way to the boarding house, and we have but thirty minutes from the time the bell begins to ring till it is done ringing again, and then all are required to be at their work...
> ...Now, don't be bashful or wait to be helped, but comply with the oft-made request 'help yourself' to whatever you like best [to eat], for you have but a few minutes allotted you to spend at the table. The reason why is because you are a rational, intelligent, thinking being, and ought to know enough to swallow your food whole; whereas a horse or an ox, or any other dumb beast knows no better than to spend an hour in the useless process of mastication. The bell rings again and the girls are hurrying to the mills...and the feeling...comes over us (there is no use denying it) when we hear the bell calling us away from repose that tired nature loudly claims – the feeling that we are *obliged to go*. And these few hours...are far too short, three at the most at the close of day. Surely, me thinks, every heart that lays claim to humanity will feel 'tis not enough."[355]

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[353] Anonymous, "The Spirit of Discontent," in *The Lowell Offering,* Vol. 1, 1841, pp.111-114.

[354] Ibid.

[355] Benita Eisler (ed.) "A Second Peep at Factory Life" originally published in *The Lowell Offering,* Vol. 5, 1845, in Paige and Metzger, *Voices and Masks,* p.36.

In Britain, as in the US, when the means of production transferred from private homes to textile factories, women workers earned much lower wages than men and, while "[e]mployment in the mills enabled women to enjoy social and economic independence unknown to their mothers' generation," it also carried drawbacks.[356] These women worked grueling schedules—usually thirteen to fifteen hours a day, six to seven days per week—in unclean, unsafe conditions. Airborne toxins damaged their lungs and left some female workers infertile. Constant machine noise could cause hearing loss, and the work itself often resulted in disabilities and physical deformities. Assault and harassment were common. In addition, female employment outside the home fed the nineteenth-century controversy of the "Woman Question:" the question of determining "the place of women in relation to men in a society undergoing rapid economic transformation which undermined traditional expectations and definitions."[357]

Because of their different economic and family situations, the emotional and domestic experiences of factory girls in Lowell and Britain were often markedly different, but the effect of their regimented factory work on their perception and use of time was quite similar.[358] In many cases, once they acclimated to factory work and the compartmentalizing effects of factory time, few women returned to the "dull, lifeless silence" of their pre-industrial, domestic lifestyles, opting to keep their factory jobs after marriage, work in town as shopkeepers or clerks, or run boardinghouses with their husbands.[359] Job turnover at the factories was high, and many female workers who left factory work for a short time, to attend

[356] Dublin, *Women at Work*, p.1; Jordan, *Women's Movement*, (London, 1999).

[357] Lown, *Women and Industrialization*, p.1.

[358] Ibid., p.145.

[359] Brown, *Two Worlds*, p.19.; Hiley, *Victorian*, (London, 1979).

to family or try other jobs, returned to the mills.[360] In an 1837 report, a British Factory Inspector wrote:

> "The writer of this article happened to be in a counting-house of a mill-owner, at Manchester, when the clerks were complaining of the 'extreme difficulty of getting girls for household work, on account of the mills taking them all.' Within half an hour, two girls presented themselves asking for work at the mill, saying 'that they had just quitted service in Liverpool, having understood they could get work in the mills.' One of them stated that she had been brought up in a mill, as an apprentice; and after having tried service, was desirous of returning to her former occupation…"[361]

Questioning a worker about her previous employment as a servant, a Scottish commissioner, Mackintosh, was told she liked mill work better than domestic service, because she was "sorer confined in service than in the mills. At the mill, we have Sunday, and we have time after the mill sets: we hadn't that at service."[362]

The difficulties many British women faced while struggling to strike an effective balance between work and home obligations can be seen in the records of the Halstead Mill in East Anglia, run by the Courtauld family. For many British working class families, it became common in the nineteenth-century for young women to find factory employment in their early teens, then remain factory workers for the rest of their lives. At Halstead, more than a third of the mill women were over twenty and married. Aside from reasons such as illness and injury, the factory records show a marked contrast between the cause of absence of male workers and for female workers. It was not uncommon for male workers to take extended leaves of absence from the factory to work at other jobs, sometimes leaving for a period of ten years or more. Women's absences were usually much briefer, from a few weeks to a year, and most often were due to family obligations. Instead of being cause to leave

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[360] Dublin, *Women at Work*, p.70.; Hiley, *Victorian*, (London, 1979).

[361] Kenneth E. Carpenter, advisory editor, *British Labour Struggles: Contemporary Pamphlets 1727-1850: The Battle for the Ten Hour Day Continues – Four Pamphlets1837-1843*, (New York, 1972), Factory Commission Supplementary Report D, 2.226, p.47.

[362] Ibid., Second Factory Report, p.2.

work to assume a traditional domestic role, for many factory women, marriage, rearing children, and taking care of elderly family members became only brief, temporary absences from work, reflecting the difficulties they faced trying to balance their paid work obligations with the unpaid demands of home and family.[363]

This stressful situation challenged the middle-class ideals of motherhood and child welfare. At the Courtauld's factory, the task of ensuring female workers' child-rearing patterns conformed to middle class ideals fell to Mary Merryweather, an evening school mistress. To her, the working "mothers' interests were secondary to promoting ideals of motherhood symbolizing respectability in both the social and spiritual order."[364] With the mother working at the factory all day, care of young children and infants often fell to neighbors, overworked or unemployed fathers, or slightly older children, usually seven or eight years old, who were, themselves, too young to work in the factories.[365] Attempting to mitigate the "neglect" she witnessed, Merryweather tried to open a nursery and start monthly "maternal meetings," to discuss domestic and childcare arrangements, but "many millworkers expressed surprise and suspicion as to why the Courtaulds should provide such a facility."[366] Many working class women felt they had adapted quite well to compartmentalizing their work and home lives, and preferred to make their own arrangements. Merryweather's nursery ultimately failed, but the issue of women's roles and the stresses of juggling paid work and domestic duty remained emotionally and politically charged topics throughout the nineteenth-century, embodying the difficult and complex transition from the private to the *public timescape*.[367]

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[363] Lown, *Women and Industrialization,* p.145.

[364] Ibid.

[365] Ibid.

[366] Ibid., p.146.

[367] Hiley, *Victorian,* (London, 1979).

The health, physical capabilities, and parenting skills of women factory workers were hotly contested issues throughout the Victorian period, becoming prominent subjects in countless reports, inquiries, criticisms, and exposes – including those of Friedrich Engels and Karl Marx, whose respective works, *Condition of the Working Class in England* and *Das Kapital*, detailed abuses and family struggles of factory workers in some of Britain's largest and most industrialized urban centers. While some contemporary factory commissioners argued "whatever may be said about the delicacy of the female organization, and the inability of the female operative to endure fatigue, the female, as a child, an adolescent, and an adult, bears factory work better than the male, and in regard to her own peculiar constitution and health, sustains no appreciable injury from it,"[368] others contested that although factory work "does not actually destroy life, it undermines it, and proof is sought in the small number of old men to be found in the factories."[369]

The workers, however, often focused on a different aspect of the debate: the fair division of the day into working and non-working hours, and the monetary value of their working time.

*IS TIME MONEY?*

Marx wrote: "The creation of a normal working-day is…the product of a protracted civil war, more or less dissembled, between the capitalist class and the working-class."[370]

Engels, the co-father of Marxist social theory, agreed, arguing the industrial revolution acted as a catalyst jarring the working class into thinking and, ultimately, fighting for their own rights and dignity. He asserted, if not for the industrial revolution, the poorer classes of pre-

[368] Carpenter, *Contemporary Pamphlets*, Factory Commission, 2nd Report, p.4.

[369] Ibid., Factory Commission Supplementary Report D, 2.226, p.54.

[370] Karl Marx, *Capital: Critique of Political Economy*, Vol.1, Chapter 10, Section 6, "The Struggle for the Normal Working Day. Compulsory Limitation By Law of the Working-Time. The English Factory Acts, 1833 to 1864," e-publication, http://www.marxists.org/archive/marx/works/1867-c1/ch10.htm#S7

industrial Britain would never have emerged from the "silent vegetation" of highly localized, rural agrarian peasant life which:

> …romantic as it was, was nevertheless not worthy of human beings. In truth…they were merely toiling machines in the service of the few aristocrats who had guided history down to that time. The industrial revolution has simply carried this out to its logical end by making the workers machines pure and simple, taking from them the last trace of independent activity, and so forcing them to think and demand a position worthy of men. As in France politics, so in England manufacture and the movement of civil society in general drew into the whirl of history the last classes which had remained sunk in apathetic indifference to the universal interests of mankind.[371]

Once the working classes began to stand together and protest their situation, working hours became one of the central, and most persistent, issues. From the time the first British factory was established until Parliament passed the first Factory Act in 1833, there was no standard limit to the 'working day.' According to one factory commissioner's report, the worst "evils" of factory life arose "when there was no law, and when children might enter the mills at any age, and work any number of hours, and when, in fact, they did work 72 hours, in the best regulated mills."[372]

But, in the era of laissez-faire, British politicians hesitated to set strict regulations on private businesses. Early attempts at reform had no teeth, and the Factory Acts were established gradually, and piecemeal.[373] Five legislative acts passed through Parliament between 1833 and 1901, and all but the last dealt specifically with reducing working hours and raising the minimum acceptable age of employment from seven to twelve. Step by step, these Factory Acts slowly brought the working day down to ten hours for women and children under the age of eighteen and set aside at least two hours a day for the education of child workers. Yet, even with these acts in place, little was done to address the conditions

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[371] Engels, *Conditions,* p.9.; see also: Eugen Weber, *Peasants into Frenchmen: The Modernization of Rural France 1870-1914*, (London, 1977).

[372] Carpenter, *Contemporary Pamphlets,* Factory Commission Supplementary Report D, 2.226, p.63.; Norma Landau, *Law, Crime and English Society 1660-1830,* (Cambridge, 2002), pp.232-6, 244-5.

[373] Ursula Henriques, *The Early Factory Acts and Their Enforcement*, (London, 1971).

faced by adult male workers and the ten hour day remained a grueling ordeal for many women, who were still expected to perform their traditional domestic duties at home.

> "It is certainly much to be regretted that any class of persons should toil 12 hours a day, which, including the time for their meals and for going to and returning from their work, amounts, in fact, to 14 of the 24 hours...." a factory commissioner wrote.[374]
> Without entering into the question of health, no one will hesitate, I think, to admit that, *in a moral point of view*, so entire an absorption of the time of the working-classes, without intermission, from the early age of 13, and in trades not subject to restriction, much younger, must be extremely prejudicial, and is an evil greatly to be deplored.... For the sake, therefore, of public morals, of bringing up an orderly population, and of giving the great body of the people a reasonable enjoyment of life, it is much to be desired that in all trades some portion of every working-day should be reserved for rest and leisure."[375]

British factory inspectors often looked to conditions at the Lowell mills when searching for positive examples of factory conditions. They specifically noted the Lowell mill girls worked an hour longer than British regulations recommended, even while acknowledging the social and educational background of Lowell's female workers differed greatly from average British factory workers.

> The whole number employed in the [Lowell] Factories have come, seeking the employment, from a distance. We understand that many of them are the daughters of respectable parents, worth from 5,000 to 10,000 dollars, and some even 50,000 or 80,000, but partly from love of independence, partly from the lively pursuit of gain, which pervades every bosom – even, it seems, that of ladies – in America, they voluntarily quit their homes, to earn an independent and individual means of existence. They lead most steady respectable lives while at Lowell, are boarded at excellent houses provided for the purpose, lay up, in the Saving Bank of Lowell, almost all their earnings, and quit their employment when they have saved, what they think, a competence…[376]

The well-read female workers of Lowell were aware of their British counterparts' working conditions, and voiced their fears of becoming trapped in a similarly inequitable cycle of low wages and long working hours:

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[374] Leonard Horner in "Reports of Insp. of Fact. for 31st Dec., 1841." Quoted in Karl Marx, *Das Kapital*, e-book.

[375] Ibid.

[376] Carpenter, *Contemporary Pamphlets*, Factory Commission, 2nd Report, p.48.

> …we have only to cast our eye across the Atlantic to the Old World and behold the degradation, misery, and want of the laborer there and compare notes with them, and gaze in the mirror of their history and see their the reflection of our own image… Now how many years would elapse before the same state of things would arrive in this boasted land of liberty and equal rights at the rapid strides we are now advancing? Remember it is not an age of donkey and cart speed, but of the…railroad. And all things seem to advance at the same rapid rate. Even the reduction of the price of labor progresses with the same rapidity… Were our lives given us, to be squandered here for naught? … And when our fathers, and mothers, and brothers, saw us leave our own beloved cottage homes, and when we bid them a farewell, and they us, a 'God speed for good' did they expect us to become the tools of corporation interest, and barter away our lives, and our immortal minds, that a few cotton Lords might be made richer? No! ... Resolve to unite and leave rather than be crushed.[377]

Like the railway workers, whose lives were dictated by the strict schedules of the railroad, factory workers in Britain and America learned quickly that, to survive the hectic pace of the industrialized world, they had to prioritize, compartmentalize, and schedule their own time, carving their days into specifically timed slots for work life, family life, and social activities. The battle to establish a more equitable balance between time spent on and off the clock equated 'work hours' with 'billable hours,' reinforcing the adage of the business world: 'time is money' – a phrase that embodies the supplantation of the *private timescape* with the *public timescape* in the modern economy.

[377] "Justice to Labor," Address of the Factory Girls of Lowell adapted at their meeting held at the City Hall Thursday evening, November 16, published in "The Protest: Published and edited by the operatives of Lowell to meet the exigencies of the time," (Lowell: November 25, 1848).

*SIGNPOST 2*

The intrusion and expansion of the *public timescape* into the *private timescape* of home and family life was not limited to factory and train workers. This disorientating conflict between divergent temporal worldviews also seeped into the lives of consumers. The second section, "Consuming Time: Charles Dickens as Social Chronicler," focuses on one of the most vocal of these consumers, Charles Dickens, and his role as a social chronicler to investigate the politicization of time as a commodity and a source of socio-economic conflict. Although primarily fictional constructs, Dickens's social novels and articles represent his perception of the social realities he witnessed and experienced, "identifying and articulating the many relations that individuals or groups cultivate with the social world." [378]

In Dickens's vast and diverse works, the transition from the private to *public timescape* is most often voiced as a sense of invasion, a quickening, maddening pace that sends even the most settled neighborhoods out of their mind.[379] This section examines Dickens's experience as a consumer of public time and investigates the development of Panoramic Vision and its influence on travel and the popular notion of the rapidly shrinking world.[380]

[378] Roger Chartier, *On the Edge of the Cliff: History, Language, and Practices*, translated by Lydia G. Cochrane, (Baltimore, 1997), p.94; Louis Cazamian, *The Social Novel in England 1830-1850: Dickens, Disraeli, Mrs Gaskell, Kingsley*, translated by Martin Fido, (London, 1973); Amanda Claybaugh, *The Novel of Purpose: Literature and Social Reform in the Anglo-American World*, (London, 2007).

[379] Charles Dickens, "An Unsettled Neighborhood," *Selected Journalism 1850-1870*, (London, 1997), p.48.

[380] Schivelbusch, *Railway Journey*, p.33.

### *CONSUMING TIME: CHARLES DICKENS AS SOCIAL CHRONICLER*

*It was the railway which inaugurated a uniform time system upon Britain—and later the world.*[381]

For many people in rural areas, the railroad was their introduction to the industrial revolution – a chugging, grinding, smoky intrusion of a bustling, crowded, mechanizing world into the relative calm and privacy of the agricultural countryside. The sight of such powerful machines shooting across the British landscape on specially laid tracks became a symbol of human achievement and progress, and the experience of train travel did more to alter passengers' perceptions of time and space than practically any other aspect of the industrial age. The railroad became a key catalyst for the extension of the *public timescape* (and its accompanying schedules) into the home lives of the British people, where it gradually came to subordinate the *private timescape*. And Charles Dickens, one of the most famous and prolific authors of the nineteenth-century, perched alert and observant within the transitional miasma between these two extremes.

Charles Dickens was a fantasist. By his own admission, he aimed to introduce readers to "the stirring world around us, the knowledge of many social wonders, good and evil," without the constraint of having to always adhere to the straight facts.[382] But, to what extent can fictional works of literature be used by historians as a legitimate historical source?[383]

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[381] Quote attributed to H.D. Howse in McKenna, *Workers,* p.244.

[382] Dickens, *Journalism,* p.xiii.

[383] Literary texts, like Dickens's stories, contain "representational frameworks" that have the power to transform real socio-political tensions into "symbolic struggles – that is, into struggles whose weapons and rewards were representations…signals and indications…that need only be *seen, noted, shown,* then *narrated* and *reiterated* in order for the force of which they are the effects to be *believed*"…making use of "notional tool[s] that contemporaries themselves used to render their own society less opaque to their understanding" – thereby making challenging social realities, such as Britain's changing relationship with industrial time, relatable to a broad and varied audience. Chartier, *On the Edge of the Cliff,* pp.95, 100.

Fiction is a filter for reality, a means for creative authors to interpret and exaggerate situations, events, and personal traits with an eye toward entertainment, and it carries with it the danger that "a powerful fancy may falsify the world around it."[384] Yet, the distance afforded by fiction also provides perspective, which can reveal broader truths about the contemporary habits and attitudes of the authors, their society, and their times. For this reason, literary works have long been valuable resources for historians. In some cases, where primary sources are difficult to track down, contemporary literary works can offer as much illumination as personal diaries, particularly when it comes to the historical investigation of the more intangible aspects of human life and society—in this case, the perception of time during Britain's industrial revolution and the transition from the private to the *public timescape*.

Charles Dickens's personal experiences with and expectations and interpretations of industrialized time can be considered something of a gauge of the average contemporary mindset.[385] Like most of his contemporaries, Dickens's gradual adaptation to the new temporal rhythms of the industrial revolution was mostly subconscious. Unlike most of his contemporaries, Dickens was a prolific writer.[386] While, most of the time, an individual's experiences and conflicts with local and railroad time has to be gleaned from a comment or phrase in a letter or a diary—such as those of the Lowell mill girls—Dickens wrote detailed, often humorous accounts, of the contemporary confusion and sense of disassociation triggered by the clash between the traditional local time and industrialized railroad time.

In 1850, Charles Dickens became the 'conductor' of the popular journal *Household*

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[384] Dickens, *Journalism*, p.xii.

[385] Dirk den Hartog, *Dickens and Romantic Psychology: The Self in Time in Nineteenth-Century Literature*, (London, 1987); Pam Morris, *Dickens's Class Consciousness: A Marginal View*, (London, 1991).

[386] See: Matti Peltonen, "Clues, Margins, and Monads: The Micro-Macro Link in Historical Research," *History and Theory* Vol. 40, No. 3 (Oct., 2001), pp.347-359; Andrew Sanders, *Dickens and the Spirit of the Age*, (Oxford, 1999); John Drew, *Dickens the Journalist*, (New York, 2003).

*Words*, which was published every Wednesday until 1859, when a falling out with his publishers led him to replace it with a new journal, *All the Year Round.* These journals became an outlet for his "inexhaustible" imagination, and many of his articles were reflections on his own experiences and observations of the immediate world around him. His changing experience with the railroad was a recurrent theme.

At the time Dickens was writing, travel by rail was still a relatively new and intimidating experience, particularly for passengers from smaller towns or rural areas where the rapidly extending lines of track had not yet penetrated. As discussed above, before the industrial revolution each town and village kept its own local time, and trains moved at such unprecedented speeds that the slippage of a few minutes could mean the difference between meeting or missing the train. Each railway line soon recognized the need to develop its own standard time, which eventually merged into 'railway time.'[387]

Railway guides, like the Bradshaw, became popular as passengers struggled to make sense of this demanding, confusing new schedule. In "A Narrative of Extraordinary Suffering," Dickens related the tale of the unfortunate Mr. Lost, a retired businessman described as "a gentleman of credit and of average ability."[388] Against the protests of his wife and servant, who argue "that Master warn't the man as was fit for Railways, and Railways warn't...fit for Master," Mr. Lost decides to travel from his country home to London.[389] He purchases a Bradshaw and Railway Assurance in case of an accident, but becomes hopelessly confused by the Bradshaw's symbols and references and is ultimately reduced to traveling to London by the more familiar means of a horse and buggy. Determined to make his way home by rail, he is immediately swept away by the confusion of

[387] See: Layer Four.

[388] Dickens, *Journalism*, p.123.

[389] Ibid.

destinations and station announcements. Dickens wrote:

> …all hope appeared to desert him…His imprisonment was of the severest kind. Tortures were applied, to induce him to go to Bath, to Bristol, Yatton, Clevedon Junction, Weston-super-Mare Junction, Exeter, Torquay, Plymmouth, Falmouth, and the remotest fastness of West Cornwall…Remaining firm, however, and watching his opportunity, he at length escaped—more by the aid of good fortune, he considers, than through his own exertions…[390]

> And now indeed he might have thought that after combating with so many obstacles…his way at length lay clear before him, and a ray of sunshine fell upon his dismal path. The delusive hope, if any such were entertained by the forlorn man, was soon dispelled. It was his horrible fate to depart from Cirencester exactly an hour before he arrived there, and to leave Gloucester ten minutes before he got to it![391]

After his misadventures, the traumatized ruin Mr. Lost has become drifts his bewildered way to a station hotel, unable to find his way home. There, "he sits continually turning over the leaves of a small, dog's-eared quarto volume with a yellow cover, and babbling in a plaintive voice, "BRADSHAW, BRADSHAW," even after his wife arrives to take him home.[392]

This complete confusion of time and space reduces an otherwise confident, intelligent businessman to a gibbering wreck, but although the story of Mr. Lost is clearly a humorous exaggeration, the humor derives from fact. Even today, Mr. Lost's predicament strikes a familiar chord among those who have had to navigate their way from A to B on the modern railway system. The sense of disorientation Lost feels, the displacement from reality, is natural when confronted with an unfamiliar regimen everyone else seems to take in stride.[393] Mr. Lost stepped out of his straightforward horse and buggy world into the rush of modern, industrial time, and—like many first time railway travelers—he found himself hopelessly out of his depth, awash in a jumble of place-names that had lost all spatial meaning.

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[390] Ibid., p.125.

[391] Ibid., p.126.

[392] Ibid., p.128.

[393] See: Mike Crang and Nigel Thrift, eds., *Thinking Space*, (London, 2000); Phil Hubbard and Rob Kitchin, eds., *Key Thinkers on Space and Place*, Second Edition, (London, 2011).

Even more revealing is an article Dickens published in *Household Words* a month later, "A Flight," describing one of his earliest experiences with railway travel—a trip to Paris—and detailing, what he termed "that queer sensation born of quick traveling."[394]

> Bang! We have let another Station off, and fly away regardless. Everything is flying. The hop-gardens turn gracefully towards me, presenting regular avenues of hops in rapid flight, then whirl away. So do the pools and rushes, haystacks, sheep, clover in full bloom…corn-sheaves, cherry-orchards, apple-orchards, reapers, gleaners, hedges, gates, fields…cottages, gardens, now and then a church. Bang, bang! A double-barrelled Station! Now a wood, now a bridge, now a landscape, now a cutting, now a—Bang! A single barreled Station—there was a cricket-match somewhere with two white tents, and then four flying cows, then turnips… Now we slacken. With a screwing, and a grinding, and a smell of water thrown on ashes, now we stop![395]

From his perspective, the landscape outside the train window seemed to be flying past at impossible speeds, each image passing too quickly to absorb before the next took its place. His focus was firmly on the foreground, on the trees and creatures closest to his speeding window—reflecting the mentality of a man used to coach travel and walking speed, where all the details of the road, from the color of the pebbles to the lichen on the trees, could be thoroughly appreciated. What Dickens experienced on his 'flight' is precisely what Schivelbusch described as the "annihilation of space and time," caused by the experience of unprecedented speed.[396]

The construction and establishment of the railroad and the experience of railway travel were among the most transformative influences on the nineteenth-century perception of time and distance. The railroad, more than practically anything else, brought the industrial revolution home to most British citizens along with the development of a new, industrialized sense of time and movement Schivelbusch termed "Panoramic Vision."[397] This development

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[394] Dickens, *Journalism*, p.137.

[395] Ibid., p.139.

[396] Schivelbusch, *Railway Journey*, p.33.

[397] Ibid., p.61.

is aptly illustrated in the reports of nineteenth-century travelers, and particularly in Charles Dickens's writings—mostly because Dickens never stopped writing. His journal articles therefore provide a sort of unofficial internal record of Dickens's own, essentially subconscious, adaptation to the mechanized schedule of the industrial world.[398]

About a decade after his 'flight', Dickens was far more familiar with train travel, and the speed was no longer so alarming.[399] In "The Calais Night Mail," (1863) Dickens described his train journey in a much more leisurely way.

> "…about here…are the queer old stone farm-houses, approached by drawbridges, and the windmills that you get at by boats. Here, are the lands where the women hoe and dig, paddling canoe-wise from field to field…Here, are the long monotonous miles of canal, with the great Dutch-built barges garishly painted…"[400]

The contrast between this description and the previous one is quite striking. Here, Dickens's sense of time is no longer racing, and his eyes rest, not on the flying foreground, but the slowly shifting background, experiencing the changing landscape as a series of wide, panoramic views.[401]

To the modern mind, the order and flow of mechanical time is a largely unconscious part of our perceptions, tending to color our understanding not just of the present world, but our interpretation of the worlds of the past as well...and it was the same with Dickens. His fictional works highlight the transitional struggles and confusions of his age, be they temporal, spatial, social or political. And, his detailed descriptions of his own attitudes and adaptation to the regimented schedules and unprecedented speed of the railroad, as well as its physical and psychological effects on railway neighborhoods, illustrate the intrusion of public time into private life – the shift from the private to the *public timescape*.

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[398] See: Mussell, *Periodical Press*, (Aldershot, 2007).

[399] This period discussed in Ben Wilson, *Heyday: Britain and the Birth of the Modern World*, (London, 2016).

[400] Dickens, *Journalism*, p.227.

[401] Schivelbusch, *Railway Journey*, p.61.

*SIGNPOST 3*

The train schedules and factory bells of the industrial revolution had an immeasurable impact on the lives and lifestyles of those who lived and worked with them. They forever altered how individuals approached their work, structured their days, and conceptualized the time they spent with their families.

The experiences of the women who worked at the Lowell and Halstead mills prompted a distinct shift in their attitudes toward and expectations of time. Despite the pressures and anxieties of keeping to a demanding, industrial schedule, once they had adapted to the faster pace, many found they could not go back to their slower, pre-industrial lifestyles. For all its noise and hurry, they discovered they preferred scheduled factory life over the "dull, lifeless silence," of farm work, and many, having learned to compartmentalize their days into periods of work and leisure, chose to remain at work even after marrying and starting families, despite prevailing nineteenth-century attitudes concerning respectability and traditional women's roles.

Nineteenth-century railway workers shared a similar experience with regimented time; their lives enmeshed in challenging schedules demanding their full loyalty and dedication, often at the expense of home and family.[402] Their schedules also affected the community around them, even influencing how and where children could play on the railway estates. Their time was not their own, it belonged to the company, fostering an almost militaristic attitude toward punctuality and duty to the railroad. This militaristic structure carried over to civilian passengers, who found themselves at the mercy of a new, fast-paced schedule. For many, a ride on the train was their first taste of industrial time and speed, and to them, the experience was like being caught in a disorienting whirlwind, or propelled like a bullet from a gun. They felt they were witnessing the annihilation of space and time as they

[402] Coleman, *Navvies*, (Suffolk, 1965).

knew it and, in a way, they were right. The experience of railway speed and railway time conditioned passengers to the precise schedules and fast pace of industrial life, and encouraged the subconscious development of "panoramic vision," to cope with speeds impossible to achieve before the industrial revolution. The examples discussed in this section illustrate the impact of industrial time on the experiences, expectations, and mentalities of the individuals who experienced firsthand the turbulent transition from a private, preindustrial temporal worldview to the fast-paced, tightly scheduled, *public timescape* intrinsic to the modern experience of time.

## LAYER FOUR: FROM SEQUENTIAL TO SIMULTANEOUS

*SIGNPOST 1*

Layer Four brings this project, if not full circle, at least full spiral, returning to the conflict between neatly organized calendar grids and the isochronous beats of mechanical clocks, and the less uniform but, perhaps, more accurate 'true time' of the natural world and, by extension, our own subjective perceptions. Using *timescapes* as a tool, this project has so far approached this conflict, which lies at the heart of Britain's nineteenth-century temporal revolution, from several separate, yet complimentary angles. This final chapter will investigate two divergent *timescapes* that came into their own as the long nineteenth century began its dovetail into the short twentieth – *timescapes* that continue to coexist and inform our understanding and expectations of time in the twenty-first century. These competing, concurrent temporal landscapes can be described as the *sequential timescape* (the concept of time as a strictly structured absolute that could be applied on a global scale, in which every person's life events are scheduled to align with the same ticking clock) and the *simultaneous timescape* (the concept of time as applied to individual experience, in which moments are shared by all, but experienced subjectively).[403]

By the end of the long nineteenth century, the complex layers of the temporal revolution had been molding the modernizing time sense for several generations. The fundamental issues of mistrust and misinterpretation (*timescape* bias) that so often developed between proponents of the various divergent *timescapes* discussed above still remained, however – particularly the tension between the *mechanical timescape* (which was, by this time, moving steadily toward an international, standardized time system) and the more

[403] This sense of simultaneity can also be observed developing in other venues, such as in the "imagined communities" created by the spread of a shared print culture published, distributed, and read in the local vernacular. News, novels, and other printed works could be read by many people at once, encouraging a sense of a larger world community with multiple players all sharing the same time despite being in different places. Benedict Anderson, *Imagined Communities: Reflections on the Origin and Spread of Nationalism*, Revised Edition, (London, 2006), p.224.

individual, seasonal, sensual *timescapes* of private life and the natural world that had never faded, despite the rising dominance of public, scheduled, mechanical time. This last layer uses the sequential and *simultaneous timescapes* to analyze this later phase of Britain's temporal revolution, in which minds raised in a *mechanical timescape* came to acknowledge and use both absolute and relative notions of time as a vital – if largely unspoken – facet of daily life.

This chapter has two main sections. The first, "Conflicting *Timescapes*: Standard Time and the Greenwich Time Lady," follows the long road toward the standardization of time, asking: what were the motives for developing an international time standard, and how effective was the implementation? What effects did new technologies, such as the railroad and telegraph system, have on the public's understanding and use of public, mechanical time? Sources for this section will include records kept by the Astronomer Royal, George Airy; the writings of W.F. Allen, one of the leading supporters of adopting national time zones within the US and a delegate at the International Meridian Conference in 1884; and the transcript of that conference. The primary focus, however, is the history of the Greenwich Time Lady, Ruth Belville, and her struggles with the Standard Time Company – a struggle that exemplifies the tension between the sequential and *simultaneous timescapes* and returns to the issues of trust and *timescape* bias. Why, decades after the implementation of standard time, the telegraph, and even the telephone, did London's top watch and chronometer specialists continue to subscribe to Ruth Belville's door-to-door time service rather than turn to professional companies and their tech-forward, self-regulating clocks?[404] In many ways,

[404] Ruth Belville's seemingly anachronistic time service is a 'micro' case of a 'macro' trend: a prime example of how trust in an older technology and an older timescape could continue concurrently with the development of new timekeeping technologies and the synchronized timescapes they supported. For "global history on a small scale," and the importance of individual cases to broader, big-picture history see Francesca Trivellato, *The Familiarity of Strangers: The Sephardic Diaspora, Livorno, and Cross-Cultural Trade in the Early Modern Period*, (New Haven, 2009); Struck, Ferris, and Revel, "Space and Scale in Transnational History," (2011).

the question of public and expert trust in the new telegraph-based time system echoes the conflict that kept the Longitude Board from granting Harrison the Longitude Prize, discussed in Layer One.

The second section, "Temporal Flexibility: Manipulating Time in a Standardized World," investigates the concurrent reaction to the growing ubiquity of the *sequential timescape* by proponents of the *simultaneous timescape* – a *timescape* that understood time as a complex network of simultaneous actions and experiences. The *simultaneous timescape* evolved as artists, authors, filmmakers, and scientists challenged the strict structure of an absolute, standardized timeline. The sense of 'temporal rebellion' against the 'straightjacket' of standard, public time that pervaded this phase of the temporal revolution is expressed in turn of the century art, literature, and science – a period of transition and expectation often termed "The Gilded Age," or "*La Belle Époque.*" This is because the effects of a mental revolution provoke reflection, not only on external factors, but internal introspection as well. Sources include the works of Conrad, Kafka, Joyce, Einstein, and Harpo Marx, whose unconventional understanding and use of time echoed not only the artists and authors of the time, but the poorer classes who, separated from the *sequential timescape* of the bourgeoisie, personified the temporal landscape inherent to the *simultaneous timescape*.[405]

[405] In the context of a temporal revolution, works of fiction were a means for creative authors, such as Conrad, Joyce, and Kafka, to digest and analyze temporal changes they observed and felt taking place within and without themselves and their communities at the turn of the nineteenth century – changes that most people would note and discuss without necessarily writing down. Vovelle argued: because literature, "is much more than a simple reflection of a lived social practice, [it] offers an elaborate and complex type of evidence. It can produce vivid contrasts with the system of conventions of the age" – including temporal conventions that are most often taken for granted and, therefore, all but invisible elsewhere. Autobiographical works are, by nature, retrospective, and works like Harpo's, that describe an unconventional time sense from the inside, and in practice, are particularly rare. Michael Vovelle, *Ideologies and Mentalities*, translated by Eamon O'Flaherty, (Britain, 1990), pp.31-32.

***CONFLICTING TIMESCAPES: STANDARD TIME AND THE GREENWICH TIME LADY***

"No man is an island, entire upon itself," the seventeenth-century poet John Donne wrote in his *Devotions*, "every man is a piece of the continent, a part of the main…"[406]

In this passage, Donne was referring to a shared humanity, arguing that the loss of any member affects, and diminishes, the whole.[407] Since the adoption of an international system of standard time and a universal day in 1884, individuals around the globe have come to share, not only the kinship of a common humanity, but also a collective sense of ubiquitous, sequential time, precisely measured and accurately distributed across the world. The modern system of standard time presumes collectivity; connecting everyone with access to a working timepiece in what J.T. Fraser described as a vast, "carefully kept sequence of social presents…a system of synchronization and scheduling that helps keep the collective integrity of the industrial state…"[408] The system is so synchronized that, within the *sequential timescape*, an individual who loses track of time feels disoriented and out of step, while someone who loses track of the date – who drifts away from the continent – is regarded as out of touch, possibly out of their mind. Yet, like the 'imaginary' lines of latitude and longitude that crisscross the globe, this modern, *sequential timescape* derives from a mathematical convention; a painstakingly measured overlay that "does not originate with but only allows for organic cycles."[409]

Looking back from a twenty-first century reality of atomic clocks, global positioning systems, and time signals transmitted by satellite, presumptions inherent to *timescape* bias can become a significant issue. It can be difficult for a mind raised within a worldwide web

[406] John Donne, *Devotions*, (1624), quoted in J.T. Fraser, *Time: The Familiar Stranger*, (Amherst, 1987), p.188.

[407] Ibid.

[408] Ibid., p.190.

[409] Ibid.

of near-instant electronic communication and standard temporal frameworks to imagine an era where homes, schools and businesses were not smoothly networked into a time system so universal as to be taken for granted as an unquestioned facet of daily life.[410] That was the case, however, during the transitional period at the end of the nineteenth century. Yet, even then, *timescape* bias remained a factor, influencing how far individuals and businesses familiar with the values inherent to the older *mechanical timescape* of individual clocks were willing to trust the burgeoning *sequential timescape* of synchronized systems.[411]

In the decades between the establishment of standard time and the outbreak of World War I, private homes and businesses often subscribed to commercial time-providing companies in order to feel confident that their shop, office, and household clocks were set to the correct time. In London, clients could turn to the Post Office, whose public clock was electronically regulated by the Royal Observatory in Greenwich; to businesses like the Standard Time Company, a tech-forward venture started by inventor and chronometer maker John Lund; or to Ruth Belville, a single, self-employed woman who visited her clients personally, once a week, carrying a palm-sized chronometer she affectionately called Arnold. To the dismay of the Standard Time Company, many of the most prominent London clock

[410] For a recent popular example of the educated, modern mind's adherence to the sequential timescape, in the song "Naughty" the character Matilda sings with the conviction of a child stating the obvious that "Every day starts with the tick of a clock." Tim Minchin, *Matilda the Musical Original Broadway Cast Recording*, (Yellow Sound Label/Broadway Records, 2013).

[411] The Standard Time Company's smear campaign against Ruth Belville's individualized time service (discussed later this section) indicates customers needed convincing before shifting their trust from Belville's antique, handcrafted clock to the seemingly more tech-forward telegraph-based regulator service the STC provided – evidence the transition from a mechanical to a sequential timescape was not as straightforward or homogenous as is often presumed. Just as minds raised in a mechanical timescape tend to trust the abstracted bubbles of mechanical clock time as a natural advance over the seasonal timescape, as seen in Layer One, proponents of a sequential timescape tend to presume standardized systems and to be a natural advance over individual, unsynchronized machines, an aspect of timescape bias that tends to leave out the ongoing, overlapping conflicts between the concurrent, conflicting timescape layers that describe the temporal revolution. This is evidenced in many current works that discuss time during the late nineteenth century, as they tend to do so using the frameworks of "empire," and "communication," emphasizing the "drive for uniformity" and the development of "interconnectedness" and "globalization." Ian R. Bartky, *One Time Fits All: The Campaigns for Global Uniformity*, (, 2007), p.1; Vanessa Ogle, *The Global Transformation of Time 1870-1950*, (Cambridge, Mass., 2015), p.3; Osterhammel**,** *Transformation*, pp.45-76; Rooney, *Belville*, p.173.

and chronometer makers, high-end shops, and dockyards trusted their clocks to Ruth Belville's seemingly quaint – even anachronistic – time service rather than switch to the newest state-of-the-art technology. The question is: why? What can Ruth Belville's struggles with the Standard Time Company reveal about the temporal expectations and biases of a period still transitioning toward a mentality informed by the *sequential timescape*?

Before a clock reading four o'clock in Washington D.C. meant it was nine o'clock in London and ten o'clock in Berlin, the *sequential timescape* that informs the modern mind could be little more than an imagined extrapolation of the *mechanical timescape* of clocks and clockmakers. The development of a mentality inherent to a *sequential timescape* depends on there being a global support structure already in place with the technological capacity to ensure every clock, watch, and timekeeper within its scope ticks to the same measured beat. The assembly of this structure was gradual and generally uncoordinated, laid down piecemeal as railroad, steamship, and telegraph lines extended across borders to link up towns, cities and, eventually, countries in a complex transport and communication network that fed the growth of international trade and business throughout the nineteenth century.[412] Until that technological structure was established – particularly the telegraph system, which could transmit information across vast distances in a matter of seconds – an international standard time system would remain an alluring aspiration, hovering just out of reach. In the meantime, there was the *mechanical timescape* of individual clocks still coexisting, somewhat uneasily, with the *seasonal timescape* of 'true' astronomical time. And, the Royal Observatory in Greenwich was the point where the two met.

Ruth Belville was thirty-eight years old when she took over the time distribution service started by her father, John Henry Belville, a long-time Observatory employee, in

[412] Standage, *Victorian Internet*, (London, 2000); G.L. Lawford and L.R. Nicholson, eds., *The Telcon Story: 1850-1950*, (London, 1950).

1835. Before that, London watch and chronometer makers had often made the climb up Observatory Hill to have their chronometers checked by the Greenwich astronomers or, at least, their assistants, and to get the correct time. The Admiralty as well – particularly the Hydrographic Office, which oversaw marine navigation and charts – sent hundreds of chronometers to be tested at Greenwich each year. The Astronomer Royal, George Airy, took exception to the irritating "burden" these tests put on his staff, complaining the Observatory was being used as merely "a place for managing Government chronometers" rather than serving as the vital scientific institution it should have been. He soon established a rule stating "Chronometer-makers are admitted to the Royal Observatory, for the purpose of inspecting and removing the chronometers, and for other business, on Mondays only," and started looking for a means of distributing Greenwich Time to the public that would not require the public to congregate at the observatory.[413] This prompted John Belville to start his time-distribution service. As the man who supervised the transit telescope, the time ball, and the chronometer department, he had long been the main link between the clockmakers and the observatory. Belville purchased a precision pocket chronometer, made by legendary chronometer maker John Arnold in 1794, established a list of clients (many of the leading chronometer makers of the day), and either he or an assistant began making regular treks from the observatory by steamboat to central London, a journey of several hours round-trip, carrying a little mechanical bubble of local Greenwich Time to the businesses that most relied on it for their livelihood, and the safety of their customers.[414]

This seemed to be a fine stop-gap measure but, by 1849, Airy had developed a grander, much more far-reaching scheme: the concept of a vast local-time network based in Greenwich and distributed to London and – perhaps, eventually – across the country by

[413] Airy, quoted in Rooney, *Belville*, pp.16-17.

[414] Rooney, *Belville*, p.22.

means of galvanic communication: the new electric telegraph system.[415] In 1851, Airy found the technological means to make his idea a reality when he was introduced to the clockmaker Charles Shepherd's system of 'sympathetic clocks,' on display as part of London's Great Exhibition, held in the Crystal Palace at Hyde Park.[416] Airy commissioned Shepherd to build a system of electrically linked 'sympathetic clocks' to connect Greenwich Observatory with London Bridge Station, just over five miles away. The system, set in motion a year later, began with a master regulator clock electrically linked to numerous smaller dials within the observatory, a large sympathetic dial outside the observatory's gates that could provide Greenwich Time to the interested public, and to the time ball on the observatory's roof. The signal then continued via wire to the Lewisham railway station near Greenwich Park, then to London Bridge station, where a final sympathetic clock ticked beside a switching unit that sent regular time signals around the existing London network, "to the railway companies, the Post Office, and even to the Electric Telegraph Company's headquarters on the Strand, opposite Charing Cross station, where they operated a time ball on the roof."[417] This neatly connected electrical system was exactly the sort of project that Airy believed would ensure Greenwich Observatory could continue to bill itself as a relevant, modern scientific institution in a rapidly industrializing world.[418] It might be supposed such an efficient,

[415] Airy referenced an 1849 report stating: "Another change…will depend on the use of galvanism; and as a probable instance of the application of this agent…I fully expect in no long time to make the going of all the clocks in the Observatory depend on one original regulator. The same means will probably be employed to increase the general utility of the Observatory, by extensive dissemination throughout the kingdom of accurate time-signals, moved by an original clock at the Royal Observatory…" George Airy, *Autobiography of Sir George Biddell Airy, Honorary Fellow of Trinity College, Cambridge, Astronomer Royal from 1836-1881*, edited by Wilfred Airy, (Cambridge, 1896), p.201.

[416] Ibid., p.206; C.H. Gibbs-Smith, *The Great Exhibition of 1851: A Commemorative Album*, (London, 1964), p.7.

[417] Rooney, *Belville*, p.29.

[418] By 1853, "Great progress had been made with the distribution of time. The same Normal Clock maintains in sympathetic movement the large clock at the entrance gate, two other clocks in the Observatory, and a clock at the London Bridge Terminus of the South-Eastern Railway…..It sends galvanic signals every day along all the principal railways diverging from London. It drops the Greenwich Ball, and the Ball on the Offices of the Electric Telegraph Company in the Strand;…All these various effects are produced without sensible error of

interlocked, mechanical system would also eliminate the need for time-distributing middlemen, like Belville, by allowing Greenwich Time to travel at the speed of electricity as far as the telegraph lines could reach. But, if this tech-forward plan was as effective as it seemed, why did Belville's foot-paced time service survive him to be passed on to his wife Maria, then his daughter Ruth, and how did Ruth manage to continue her time-distribution business despite changing technology, two world wars, and the introduction of the speaking clock – an automatic telephone service – in 1936?[419]

Rooney pointed out, "the crucial point…does not relate to the technology so much as its users. All systems involve people, and people are complicated and make decisions about technology for complicated reasons. To understand the history of technology, we need to consider human psychology and the complex process of how and why people change their behavior."[420] And, at the heart of that process is trust – a trust that the technology in question will perform its required function reliably and repeatedly. This is the trust the Longitude Board, steeped in the temporal expectations of the *seasonal timescape*, could not summon up for Harrison's handcrafted chronometers.[421] Belville's Arnold chronometer held an almost inverse position, however. Unlike the board members of several generations earlier, Ruth Belville and her customers were products of an already entrenched *mechanical timescape*, in which mechanical chronometers represented a tried and tested technology. Although the

time; and I cannot but feel a satisfaction in thinking that the Royal Observatory is thus quietly contributing to the punctuality of business through a large portion of this busy country." Airy, *Autobiography*, pp.215-216.

[419] "Speaking Clock: Why are People Still Dialing for the Time?" *BBC News Magazine*, (22 July, 2011), http://www.bbc.co.uk/news/magazine-14198506 (last accessed 3/3/2016).

[420] Rooney, *Belville*, pp.172-173. Rooney was curator of timekeeping at the Royal Observatory, Greenwich and co-curator of the Observatory's Time Galleries. His book – so far, the best if not only biography specifically focused on Ruth Belville, her family, career, and struggles with the STC – brings together a wealth of what would otherwise be sparse, scattered, obscure, difficult to locate information on a little known, rather eccentric London figure, making it a highly useful resource for this chapter.

[421] See: Layer One.

production process for precision chronometers had been streamlined over the years, accurate mechanical timekeeping still relied on the tested performance of individual machines. This was particularly true of Belville's Arnold timepiece, which had a cataloged performance record and a history of reliable service that made it a trusted, mechanical link to the local, seasonal time so carefully calculated by the Greenwich astronomers. It was this level of reliability and trust chronometer makers depended on when setting and testing their own clocks, and which informed their understanding and expectation of mechanical time.

The telegraph system, by contrast, represented a new layer of temporal understanding and a different expectation of mechanical time – one in which all clocks could be synchronized by standard mechanical pulses, and local Greenwich Time could be transmitted instantaneously across vast distances.[422] This was the nascent budding of the *sequential timescape*: a temporal understanding that takes for granted the universal availability, continuity and unwavering reliability of standardized, mechanical time. When Airy began putting his scheme into practice, the telegraph was still relatively new, and full of technical bugs. If technology relies on public and professional trust to be assimilated into popular culture, Airy's system, and the emerging *sequential timescape* it implied, had a long way to go. The impending clash between these differing *timescapes*, personified in part by the clash between Ruth Belville and the rival Standard Time Company, would help instigate the next phase of the long nineteenth-century's temporal revolution: namely, the mind and framework-changing acknowledgement that time is far more than a streamlined, mechanical beat.

[422] Like the assimilation of the mechanical clock [Layer One], the implementation of standardized mechanical communication, like the telegraph, is often taken for granted as a smooth, homogeneous transition toward a naturally superior system. On time/distance compression and cultural homogenization due to the mechanization and standardization of communications systems like the telegraph, see: Standage, *Victorian Internet*, (London, 2000); Winseck and Pike, *Communication and Empire*, (London, 2007); Carolyn Marvin, *When Old Technologies Were New: Thinking About Electric Communication in the Late Nineteenth Century*, (Oxford, 1988); Iwan Rhys Morus, "'The Nervous System of Britain': Space, Time and the Electric Telegraph in the Victorian Age," *The British Journal for the History of Science*, Vol. 33, Issue 4, December, 2000, pp. 455-475.

Airy's plan for distributing Greenwich Time by telegraph was relatively simple on its face. It was based on a single regulator clock with a pendulum that, with each swing, worked an electric switch. The switch opened or closed an electric circuit that linked the regulator clock to a series of electric clocks, all connected to that circuit. When the switch closed the circuit, a pulse of electricity surged through the whole system, simultaneously advancing the hands of each electric clock forward by one second. When the switch opened the circuit, the flow of electricity was cut off until the pendulum swung again, the circuit closed, and the electric pulse moved all the synchronized clock hands forward another second.

Because these clocks ran on electricity, rather than tension, gears and springs, they never had to be wound. Because they were all connected through an electric circuit to a single pendulum clock, they worked in synch and would not have to be individually corrected.[423] And, because the measured electrical pulses triggered by the regulator clock's swinging pendulum could travel as far and wide as an electrical wire could extend, these electric time signals could be sent out from Greenwich Observatory at specific hourly or daily intervals via cables hooked into Britain's expanding telegraph system.

The system worked well within the Observatory's internal network. Clocks in different rooms all read the same time, with no variance or confusion as to which was more accurate. Problems emerged when distance, friction, and weather became factors in Airy's time-distribution plan – variables that were not insurmountable, but which would undermine the public's trust in the system and cause Airy and the technicians who maintained the wires, batteries, clocks, and connections, no end of headaches.

The "punctuality of business" was a reigning preoccupation for Britain in the latter half of the nineteenth century: a busy "nation of shopkeepers" setting the pace of a vast,

[423] This system can still be seen as part of the display at Greenwich Observatory today.

trading empire.[424] Punctuality became a hallmark virtue of the Victorian age, touted by the middle classes along with values like frugality, patience, and temperance and contributing to the development of a British "obsession" with precise time.[425] There was great public interest in having access to reliably accurate public clocks and time signals, such as the Greenwich time ball, and the time ball that perched on the roof of the Electric Telegraph Company in London. In a letter to Airy from the Electric Telegraph Company on August 28, 1852, engineer Edwin Clark described how "the public assemble in crowds" to see their new time ball drop, "and the chronometer makers think it a great boon."[426] Yet, despite the usefulness of having a public time ball electronically linked to Greenwich Time right in central London, and despite the public and professional interest it engendered, the electrical system that operated it, carrying the time signals from Greenwich to the Strand by wire, was not always reliable. In the same letter praising the ball's potential, Clark complained "there was however some error in the time yesterday. It was 28 seconds too late before we received the current…we were rather bothered by receiving a current unexpectedly about a ¼ to 1 and again about 10 min to 1 which nearly let the ball down on our heads."[427]

While technical difficulties may be expected to plague any new technological endeavor, Observatory records are full of similar complaints that continue into the 1860s. Responding to repeated notifications from the Electric Telegraph Company regarding missed

[424] Airy quoted in Rooney, *Belville,* p.29. For more on communications, trade and empire, see Ian Bartky, "The Adoption of Standard Time," *Technology and Culture*, Vol. 30, No.1, Jan. 1989, pp.25-56.; Bartky, *One Time Fits All*, (Stanford, 2007); Carlene Stephens, "The Most Reliable Time: William Bond, the New England Railroads, and Time Awareness in 19th Century America," *Technology and Culture*, Vol. 30, No.1, Jan. 1989, pp.1-24; Allen W. Palmer, "Negotiating and Resistance in Global Networks: The 1884 International Meridian Conference," *Mass Communication and Society*, 5, 2002, pp.7-24.

[425] "Speaking Clock: Why are People Still Dialing for the Time?" *BBC News Magazine*, (22 July, 2011), http://www.bbc.co.uk/news/magazine-14198506

[426] File 3, RGO 6 661, Leaves 101-178, Section 2 cont., 168.

[427] Observatory Records archived at Cambridge University Library. File 3, RGO 6 661, Leaves 101-178, Section 2 cont., 168.

time signals, late time signals, false signals, electric currents that were too strong or too weak (if the current lasted too long it could prevent "us from raising the ball by holding the armature of our magnet hard over"[428]), Airy wrote on September 1, 1852, "All machines go wrong at some time, and the more heartily it goes wrong at first, the better. So that we are rather fortunate in the ball-failures." He went on to note he attempted to fix the problem by "[touching] the contact-lever with a file (I hope not too much)…be not surprised if I have done some other mischief."[429] A response from the Electric Telegraph Company that same day read, "Dear Sir, we have received no currents from Greenwich today neither at 1 nor any other hour. The ball did not fall in consequence…P.S. I have received your note of this morning. The [premise] that you did mischief with the file may perhaps prove true."[430] The next day, the Electric Telegraph Company "got current…at 6 min before one, but not at one – the crowd were therefore disappointed."[431] The London crowd was again disappointed on October 18 when "Yesterday (Sunday) a current came from Greenwich and discharged our ball at 1 ½ minutes before one…it happened unfortunately at a time when great crowds were assembled on purpose to set their watches. I only mention it to caution your assistants how [easily] an unseen hand can derange our operations."[432]

Accidents, faulty current, and faulty connections affected the timing of the ball drops and the setting of the 'sympathetic clocks,' frustrating the London businessmen, workers and craftsmen who assembled every day to set their watches by Greenwich Time, but wind and lightening also affected the current. A lightning storm caused an "alarming drop of the ball"

[428] File 3, RGO 6 661, Leaves 101-178, Section 2 cont., 174.

[429] Ibid., 176.

[430] Ibid., 178.

[431] Ibid., 180.

[432] Ibid., 192.

at the Electric Telegraph Company on April 8, 1853, provoking enough public interest that Airy wrote a letter to the Daily News explaining why the ball had dropped "three minutes before its correct time."[433] Even minor adjustments and repairs made to the master, or 'normal,' clock at Greenwich could have an adverse effect on time signal transmissions to the public. On August 8, 1853, a repair to the clock left it running one minute fast, which caused the Strand time ball to drop, unexpectedly, one minute before one o'clock, to the irritation of the Electric Telegraph Company and the public.[434]

A difference of one minute, or even three minutes, might not seem like much to a casual observer even today, and the multiple errors, faults, and accidents that occurred over the years Airy ran his time service likely did not have a significant effect on the daily routines and decisions of most people who came to set their watches by the Electric Telegraph Company's time ball at the Strand or the synchronized public clocks at the post offices or railway stations of London – but it did mean a great deal to precision clockmakers. Repeated complaints regarding the system's unreliability ultimately led Airy to write a special notice to chronometer makers in an attempt to reassure them that his time signal system was trustworthy and dependable:

> NOTICE TO CHRONOMETER MAKERS AND TO THE PUBLIC: THE system of dropping the Time-Signal-Ball on the buildings of the Electric Telegraph Company, 448, Strand, by a galvanic current from the Royal Observatory, Greenwich, having, after the experience of several months, been found perfectly efficient (interrupted only by occasional repairs of the apparatus); Chronometer Makers and others are informed that, when no extraordinary signal is exhibited, implicit reliance may be placed on the accuracy of the time given by the Drop of the Ball.[435]

[433] Ibid., 205-209.

[434] File 5, RGO 6 661, Leaves 251-300, Section 2 Cont., 256-258.

[435] George B. Airy, *Notice to Chronometer Makers and to the Public*, (August 20, 1853), File 5, RGO 6 611, Leaves 251-300, Section 2 Cont., 263.

This notice went through several drafts and was finally sent out on August 24, 1853. In the observatory's record files, however, it is, ironically, stacked together with over a dozen notices from the Electric Telegraph Company complaining of technical difficulties and failures regarding spent batteries, dis-or-misconnected wires, fluctuating current, and faulty connections ranging from August 27 to July 4 the following year, averaging at least one unpredicted failure per month. Airy continued to stand by the system and its potential, however, and encouraged expansion, offering his advice and support when the Liverpool Observatory erected a time ball late in 1853. In December, he received a complaint reading:

> The time ball recently erected by the Electric Telegraph Company in this town has now been in operation some weeks, and in consequence of supposed inaccuracies in the time shown by it…I therefore beg to make you acquainted with the results of my observations which extend over three days only. The ball fell too late on each day…No one knows better than you do *the extent to which life and property may be endangered by such an inaccurate exhibition of time in this large sea port*, proposing as it does to be stamped with the authority of the Royal Observatory. I have communicated with the chairman of the Observatory…on the subject and he has forwarded the substance of my letter to the editors of the Liverpool Mercury, and also requested me to publish as extensively as possible the error of the time ball in Castle St. with the view of [dispensing] as far as we are able the [clamour] that may arise therefrom.[436]

The bustling Port of Liverpool was rapidly developing into a trading center and key transportation hub for cross-Atlantic travel. Like shipping traffic on the Thames in London, ships at the Mersey docks of Liverpool depended on having accurate local time available to them at port so they could check and set their chronometers and confidently calculate their longitude at sea.[437] As in Harrison's day, any small deviation could mean the difference between safe arrival at port or the tragic loss of sailors, passengers, ships, and cargo. The visual signal provided by the time ball was meant to be a reliable gauge for the busy port but,

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[436] File 1, RGO 6 612, Galvanic Time Balls, Time Signal Sympathetic Clocks Regulated By The Royal Observatory, Index and Leaves 1-73, Sections 1-5, 51/52. Italics inserted.

[437] For more on transatlantic trade, see: Winseck and Pike, *Communication and Empire*, 2007; John Darwin, *The Empire Project: The Rise and Fall of the British World System, 1830-1970*, (Cambridge, 2009); Osterhammel, *Transformation*, pp.710-743.

like its cousins at Greenwich and the Strand, it was useful only if its performance could repeatedly be proven accurate and, therefore, trustworthy.

The Liverpool time ball received current from the Electric Telegraph Company, whose London office received current from Greenwich by way of several railway stations. To Airy, this meant his responsibility for the system's performance ended once the signals left Greenwich.[438] Any problems with distribution beyond that were issues to be taken up by engineers, technicians, and clockmakers. Yet, floods of complaints continued to be delivered to his office year after year – complaints that offer interesting insight into contemporary attitudes regarding time balls, the telegraphic time service, and their general usefulness. Many expressed anxiety that faulty signals would undermine the public's trust in the system, indicating the informed public did make a point of checking the time balls to get the time and were genuinely frustrated when the drop went wrong. An 1858 letter from the Liverpool Observatory reads:

> For some time past the Merchants and Captains on 'change have [overused] themselves daily by comparing the striking of the Town Hall clock at 1 p.m. with the dropping of the Ball as they understand the latter to be done by you at Greenwich, and they inform me that for weeks together they have seen the ball leave the top of the mast the instant that the sound of the clock is heard; but that occasionally the ball is late (never too soon) from a quarter to half a minute, and that lately this has occurred more frequently, and sometimes for two or three days in succession. I shall be very glad to do anything in my power to render the dropping of this ball more certain, as regards correctness, if you can point out how I can assist in so doing. The authorities here are getting very fastidious about accurate time, now that they have seen the practicality and certainty with which clocks can be controlled and I expect soon to have arrangements made for connecting several of the public clocks of importance with our normal clock.[439]

Despite errors and concerns about accuracy, it is clear from this and similar letters that the British public were becoming increasingly preoccupied with time. And, as the

[438] File 1, RGO 6 612, Galvanic Time Balls, Time Signal Sympathetic Clocks Regulated By The Royal Observatory, Index and Leaves 1-73, Section 53.

[439] File 2, RGO 6 613, Leaves 77-160, Sections 8-15, 209/210.

telegraph extended alongside the railways, so did the time signals from Greenwich. The Electric Telegraph Company became a central hub from which time signals from Greenwich were transmitted across Britain in every direction, from London to Exeter to Norwich to Liverpool and beyond. For a fee, private citizens could subscribe to have their houses or businesses wired up to the telegraph system to receive time signals, but those who did not want to pay or who could not afford subscriptions generally depended on the visual signals of the time balls or public clocks at the railroad stations and post offices for the correct time – clocks electrically synchronized to tick in accordance with Greenwich Time. A letter to Airy from the Electric Telegraph Company dated June 28, 1858 explained the system:

> The Railway Companies throughout Great Britain generally depend upon us for time, and through them of course most of the town clocks in the country get regulated. We make no charge for giving them time although it necessitates a total suspension of commercial business at 10 o'clock daily. Although however we get nothing for the service the Railway Comp's are such good customers to us in other ways that we could not think of relinquishing the custom which is of such importance to them and the country generally that I have no doubt my Directors would if required put special wires to Greenwich rather than have it interrupted.[440]

For all its faults and flaws, the system for distributing Greenwich Time via telegraph was having a definite effect on Britain's awareness and use of time. As the network grew with the railways, Airy began receiving notices that places outside London were adopting Greenwich Time as an unofficial standard. On October 30, 1852, Airy noted the people of Exeter had decided to set their clocks to Greenwich Time, rather than local Exeter time (about two hundred seven miles southwest of Greenwich), and he supported the idea of having the Electric Telegraph Company send them "one of the hourly signals which I send to the Lothbury station."[441] Britain's competing railway companies saw the advantage of adopting Greenwich Time along their lines rather than conforming to local time wherever the

[440] File 6, RGO 6 613, Leaves 426-579, Section 28 (continued), 36.

[441] File 2, RGO 6 612, Leaves 74-140, Sections 6-14, 75.

service began – most made the switch by 1848. By 1852, daily electric time signals sent from Greenwich were remotely setting station clocks as well as post and telegraph office clocks for most of Britain's cities – time that could be passed on to an increasingly time-conscious public. It seemed that Britain was moving toward standardization, and that Greenwich Time would come out on top of a vast, interconnected temporal network: the cohesive temporal environment of a *sequential timescape*.

Yet, the question of trust in the new time-by-telegraph system remained, and was rapidly becoming a pressing international issue. The speed of telegraph communications, trains, and other industrial shipping and transportation methods, like steamships (which began effectively crossing the Atlantic in the 1830s), was rapidly making local times obsolete, inconvenient, and potentially dangerous. The use of conflicting local times on the same line, or on intersecting lines, could – and too often did – lead to fatal crashes or, at the very least, missed connections.[442] Missed connections often meant missed deadlines, affecting trade and business profits.[443] Differing city times did not just affect travel, though. Different local times affected birthdays (and, therefore, questions of inheritance), stock exchanges, and other time-sensitive issues.

Before railway time was standardized, trains generally used the local time of their place of departure to schedule their journey and their stops, so – to give a general example – a train traveling direct from Paris to Calais would run on local Paris time until it reached Calais. On the return trip, the train would run on local Calais time until it reached Paris. Any potential passenger hoping to catch the train at any stop at any town or city between the two had to be aware of the local time in Paris (going) or Calais (returning) to determine when to head for the station (assuming the train was running on time). This system made even simple

[442] Schivelbusch, *Railway Journey*, p.129.

[443] As seen in numerous newspaper complaints. *Time Research by Dr. B.L. Gribling, NRM 2011.*

connections a logistical nightmare. Journeys requiring passengers to change trains – for example, if a traveler from Paris had to change trains in Munich to reach Vienna – invited a whole new level of temporal confusion, particularly if the train the traveler wished to catch at Munich originated in Frankfurt, and was running on local Frankfurt time all the way to Vienna. Passengers connecting from the Paris train would have to know the time at Frankfurt to catch their ride in Munich. If a traveler had to change trains more than once, or break the journey with a ferry or coach, the confusion of local times could become utterly baffling...especially if the Parisian traveler had only a tourist's familiarity with German. Faced with a mechanical muddle of this magnitude, Charles Dickens could not have been the only one who felt like his character, Mr. Lost, when he stood staring up at the destination boards and array of clocks on the station wall, each set to display the hours and minutes of a different hub city.[444]

This maddening temporal/logistical kerfuffle of a time system was not limited to Britain, Europe, or their expanding empires. It also affected the US and Canada. The move toward the global standardization of time is an integral aspect of the emerging transnational sphere during this period, and the US was instrumental in developing that standard, hosting the 1884 Meridian Conference in Washington D.C. The Prime Meridian would ultimately be set in Greenwich, England, but much of the impetus for a universal time standard came from America, making American cases increasingly relevant to this study as the globalizing nineteenth century transitioned into the twentieth.[445] The US gained independence from Britain during the early stages of the temporal revolution and shares the temporal structure

[444] Dickens, *Journalism*, p.128.

[445] See: W.F. Allen, *The Adoption of Standard Time in North America in 1883*, Pamphlet printed November 1903; Clark Blaise, *Time Lord: Sir Sandford Fleming and the Creation of Standard Time*, (Vintage, 2002), e-book; Ogle, *Global Transformation*, 2015; Bartky, *One Time Fits All*, 2007.

and presumptions inherent to the English language as well as a proactively innovative nineteenth-century industrial experience.

Like Europe, the US and Canada operated on a bewildering multitude of uncoordinated local times, generally based on local noon at the nearest observatory, city center, town square, post or telegraph office, or jeweler's shop, some of which sold the time to customers or operated time balls. In the Midwest, the *Chicago Tribune* newspaper listed twenty-seven separate local times in use in Illinois, twenty-seven in Michigan, thirty-eight in Wisconsin, and twenty-three in Indiana.[446] On the East Coast, the observatory at Boston's Harvard University operated a time-by-telegraph service, selling subscriptions to the telegraphic transmission of their local time signals. The US Navy also operated a time service – for the government – funded by a bill passed by Congress in 1882. The bill granted $25,000 to "provide for the expense of transmitting daily by telegraph the meridian time of the Naval Observatory at Washington D.C. to all principal maritime ports of the US having a custom house, US navy yards, and state capitals and cities of not less than 15,850 people when averaged by authorities."[447] It also provided for a system of synchronized clocks and time balls to be erected on the custom house of each port. But, as forward thinking and 'locally' useful such measures may have been, none of these regional standards were in agreement with each other, none aligned with a recognized national standard, and none could be readily coordinated with the practical needs of international travel and shipping – a problem made even more awkward once the transcontinental railroad was in place. Steamships ran regular routes across the Atlantic, trains operated coast to coast, but any

[446] Randy Alfred, "Nov. 18, 1883: Railroad Time Goes Coast to Coast," http://www.wired.com/2010/11/1118railroad-time-zones/ (last accessed, 25/3/2016).

[447] "A Bill to Provide for Transmitting the Meridian Time of the Naval Observatory at Washington to Ports of Entry and Other Cities, and for Placing Time-Balls on Custom-Houses, for the Protection of Commerce, and for Other Purposes," 47th Congress, 1st Session, Report No. 681, US House of Representatives, March 9, 1882, W.F. Allen Papers, New York Public Library Collection, Folder 14.

international traveler attempting to transfer from ship to rail, or from one train line to another, on their way from Europe to the Pacific coast would inevitably be caught up in a discombobulated tangle of competing local times.

The various industrialized countries knew something had to replace the confusing local time system, preferably something as reliable as local, seasonal time, but which could be applied to a vastly interconnected, industrialized world.[448] The question was: how? How could the competing nations of the world come to agree on a single, universal time standard? What might such a system even look like? If there was to be a global time system, where would it start? Which country would claim the honor of hosting the prime meridian? These were difficult problems – layered practical, political, and logistical puzzles of disjointed hours, uncollated minutes, and local pride writ on a global scale; puzzles many believed to be insoluble – but, as the nineteenth century pressed on and the interlocking pressures of international travel, trade, and business developed in complexity, the need for an international time standard grew increasingly glaring.[449]

The solution initially sprouted from the exasperating temporal difficulties inherent to North America's east-west transcontinental railroad system, and its roots can be traced to a pamphlet written by Charles F. Dowd in 1869 – a pamphlet espousing the idea of dividing the country into a standard system of measured time zones. Dowd, a school principal, was intrigued and troubled by the difficulties caused by the "present confusion of railway time," which he described as "a matter of very general experience."[450] Railway time, he argued,

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[448] For some examples of the gradual move toward globalization that took place during the long nineteenth century, see: Bayly, *Birth of the Modern World*, (Malden, MA, 2004); Standage, *Victorian Internet*, (London, 1998); Winseck and Pike, *Communication and Empire*, (London, 2007); Ogle, *Global Transformation* and "Whose Time Is It?", pp.1376-1402.

[449] W.F. Allen, *The Adoption of Standard Time in North America in 1883*, Pamphlet printed November 1903, 11.

[450] Charles F. Dowd, "System of National Time for Rail Roads; A Specimen Time Table and a Time Gazetteer for All Stations in the US and Canada," (Albany, NY: Weed, Parson, and Co., 1870), William F. Allen Papers, New York Public Library, Box 2, Folder 1.

was "governed by no general principle to enable a person familiar with [the time] in one location to judge [it] in another."[451] This allowed "absurd paradoxes" to occur in the daily operation of trains and telegraphs – paradoxes like "messages from East to West being received before they were sent."[452] The most straightforward solution, as he saw it, would be to apply the lines of longitude that had long guided navigators at sea to the problem of coordinating railroad time on land. "Longitude and Time are convertible," he argued.[453] "In navigation, this interchange is constant – longitude found from time and time from longitude, but although the same can be done on land for intercommunication, locality is so easily determined by cities and countries that abstract lines of longitude so important at sea are little regarded."[454]

Dowd put much earnest effort into developing and attempting to disseminate his idea, moving his prime meridian – the arbitrary starting point for his system – from Washington D.C. to New York City before finally deciding on Greenwich, London, which had long served as a staple meridian for navigators, as the most practical source for world time. Between 1869 and 1873, Dowd met with railroad managers and explained his system. In his vision, standard railroad time would exist as something of a mathematical cover slip set over the existing system of local times. The difference between standard railway time and the local time of each town or city would be indicated at all railway stations, marked by + and – signs.[455] The system looked promising as a theory but, as a practical solution, it did not go

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[451] Ibid.

[452] Ibid.

[453] Ibid.

[454] Ibid.

[455] W.F. Allen, *The Adoption of Standard Time in North America in 1883*, Pamphlet printed November 1903, 10.

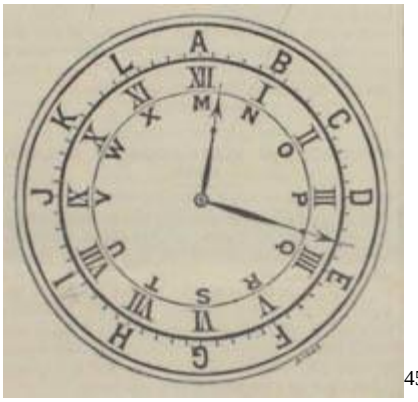
far enough. Even if every railway in the country was set to run on the same standard, the problem of uncoordinated local times would still exist, presenting so many difficulties that the railway officials "politely but decidedly declined to attempt to adopt [Dowd's plan], and many of them regarded the whole problem as incapable of practical solution...After 1873 Mr. Dowd's suggestions were not presented at any meeting of the associations and ceased to be considered seriously if at all by railway managers."[456]

A similar, if more complex, system was later developed and championed by Sir Sandford Fleming, a prominent Canadian engineer and inventor born in Kirkcaldy, Fife, Scotland, who helped develop much of Canada's railway network, including the Intercolonial Railway and the Canadian-Pacific Railway. Fleming's desire to develop a world time standard was stimulated when, in 1876, a misprinted train schedule caused him to miss a train in Ireland, forcing him to spend an uncomfortable night at the station.[457] Following this experience, Fleming developed a time zone system for North America based around a unique twenty-four hour clock. Fleming's standard time system, rather than relying only on imagined lines of longitude, attempted to align the dividing meridians with existing state boundaries wherever possible while his twenty-four hour clocks would display standard time using a system of letters (reading in an alphabetical spiral from A to X), combined with numbers – the larger, outer ring of letters standing for a.m. while the smaller, inner ring of letters stood for p.m. [458]

[456] Allen, *Adoption of Standard Time*, 11.

[457] Clark Blaise, *Time Lord: Sir Sandford Fleming and the Creation of Standard Time*, (Vintage, 2002), p.10.

[458] Ibid.

 [459]

Using this system, A:00 would denote standard midnight while standard noon would read as M:00. Fleming presented his ideas to the American Society of Civil Engineers, but after limited circulation his plan did not progress much further.[460] It would have required a radical change in timekeeping notation, and the expense and complexity of updating all printed schedules, public clocks and private watches to conform to his twenty-four hour system seemed overwhelming and impractical. Though Fleming's plan for standard time was not officially adopted, he is popularly known as the "Father of Standard Time" due to his dedicated advocacy of a global timekeeping system employing meridian-based time zones, and for his active participation in the 1884 International Meridian Conference held in Washington D.C.[461]

So, if Dowd's plan was rejected as too impractical and Fleming's as too complicated, who was responsible for developing the meridian-based time system that was ultimately adopted as the model for standard time – and a solid grounding for the burgeoning *sequential timescape*? According to numerous testimonials from railroad officials across the United States, much of the credit belongs to William Frederick Allen, a railway engineer from New Jersey who later served as the editor, manager and, eventually, president of the National

[459] http://railroad.lindahall.org/siteart/essays/Clock_rj4501125_200.jpg

[460] Allen, *Adoption of Standard Time*, 11.

[461] Blaise, *Time Lord*, e-book.

Railway Publication Company.[462] In this capacity, Allen was responsible for compiling the *Official Railway Guide*, then the largest publication in the world, which, by the time of his death in 1915, weighed in at over 1,600 pages and covered the United States, Canada, and Mexico.[463] It was Allen and his staff's task to coordinate North America's railroad timetables into something readers could follow – an immense undertaking that immersed Allen in the problem of railway times on a daily basis. When the regional railway associations consolidated to form the American Railway Association in April, 1876, W.F. Allen was appointed Secretary and, in 1881, the association's General Time Convention turned to Allen for a solution to the ongoing problem of working out a practical standard time system for North America.[464] Allen took this charge very seriously, understanding "the needs of these great engines of modern civilization [the railroad and telegraph] created a general demand for exactness in time reckoning which had never existed before," yet was now required "both for the use of their employees and the public…"[465] Between 1881 and 1883, Allen traveled around the country, talking with railway men and passengers and building a general picture of the experience of railway travel within the United States. "It is a lamentable fact that our railways are run today by no less than fifty meridian times, varying

[462] Allen became the assistant editor of the *Official Railway Guide* in 1872, when the publication was only 192 pages long. Six months later, he was promoted to editor and manager of the company. He was elected vice president in 1910 and president in 1914, a year before his death. During that time, he oversaw the publication's expansion and transition to the standard time system he helped to implement in 1883. He also served as the Secretary of the General Time Convention in 1875 and Secretary of the Southern Time Convention in 1877. "Memoir of William Frederick Allen, Died Nov. 9, 1915," *Transactions of the American Society of Civil Engineers*, V.LXXX, 2244, W.F.Allen Papers, New York Public Library.

[463] "Memoir of William Frederick Allen, Died Nov. 9, 1915," *Transactions of the American Society of Civil Engineers*, V.LXXX, 2244, W.F.Allen Papers, New York Public Library.

[464] Ibid.

[465] W.F. Allen, "The Reformation in Timekeeping," *Popular Science Monthly*, Vol. 26, December 1884, http://en.wikisource.org/wiki/Popular_Science_Monthly/Volume_26/December_1884/The_Reformation_in_Time-Keeping

from each other by all sorts of odd combinations of minutes," he wrote.[466] "The roads using the various standards cross and interlace each other in such a puzzling manner as to render any ready acquisition of knowledge of the standard by which each is governed a sheer impossibility. Studying a map of the system is like tracing the intricacies of a labyrinth."[467]

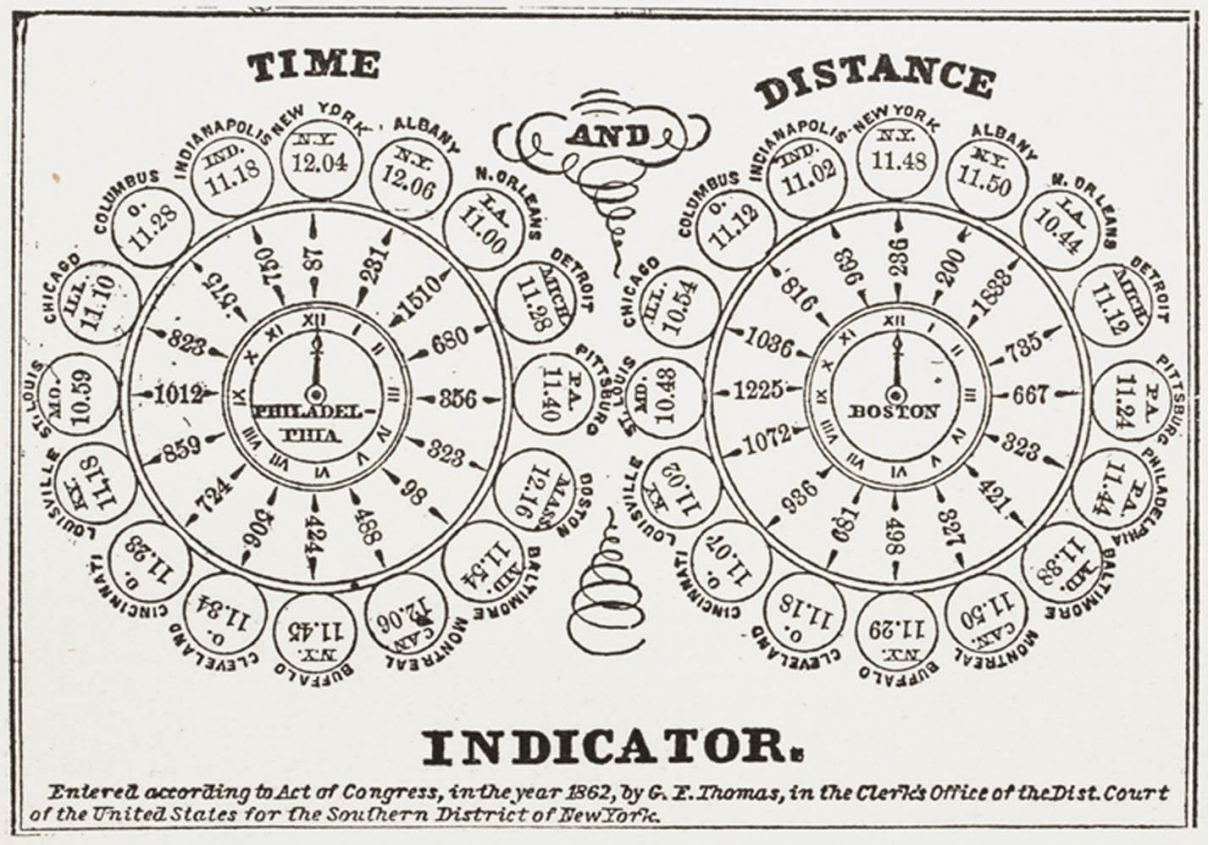
The problem was so universal, efforts by station managers to simplify the system and explain the train schedules to the public – like posting time and distance tables and arrays of clocks displaying the specific local times used on each railroad line – only added to the confusion. Allen wrote:

> …there is to-day scarcely a railroad center of any importance in the United States at which the standards used by the railroads entering it do not number from two to five. The inconvenience this causes was aptly expressed, not long since, by a bright and intelligent Virginia lady, one of a party of tourists. Finding herself utterly unable to reconcile the time shown by her usually reliable watch to the varying times shown by the railway clocks at different points, she turned to the writer, and using a provincial expression asked appealingly: "Please tell me what is *sure enough* time?"[468]

[466] That was down from more than seventy-five just a decade before. Beyond the railway lines, there were over one hundred different local time standards in use in the US throughout the nineteenth century. W.F. Allen, "Standard Railway Time," in "Open Letters," *The Century Illustrated Monthly Magazine, Volume 4; Volume 26*, 796. http://books.google.com/books?id=wT8-AQAAMAAJ&pg=PA643&lpg=PA643&dq=century+illustrated+monthly+magazine+september+1883&source=bl&ots=qVO9a3t7Ym&sig=D3lMmqKUH-vmvQIlF5me9Ahm1Hw&hl=en&sa=X&ei=UAs2U8e-B8mX0AGR6IC4Ag&ved=0CC4Q6AEwAQ#v=onepage&q=open%20letter%20september%201883&f=false

[467] Ibid.

[468] W.F. Allen, "Standard Railway Time," in "Open Letters," 796. For similar complaints from the British public regarding the British railway system, see: "The Mail Train," "Excess Baggage," "Poems and Ballads," "Railway Nursery Rhymer" in *Punch*, 9 October, 1852; *The Times*, 17 January, 1874; *The Times*, 9 September, 1874 in *Time Research by Dr. B.L. Gribling, NRM 2011.* Also, Alun C. Davies, "Greenwich and Standard Time," *History Today*, Vol. 28, 194-199, p.197.




469

Allen found train stations, instead of acting as connecting hubs in a comprehensive space-time network capable of sustaining a *sequential timescape*, had become places where time splintered and trust in the *mechanical timescape* broke down. A handwritten document in Allen's records described the situation:

> How often has a traveler with a fine watch, loathe to set it to another time, yet constantly feeling it inconvenient not to, finally set it wrong, and the moment he has moved these old fashioned hands, he is all at sea, the fellow passenger he asks may not have the correct time, the Regulator in the Railway station may be out of order, he no longer feels the same confidence in his watch until he gets home again… How much is done nowadays in five minutes, how many trains have been missed by less than five minutes?[470]

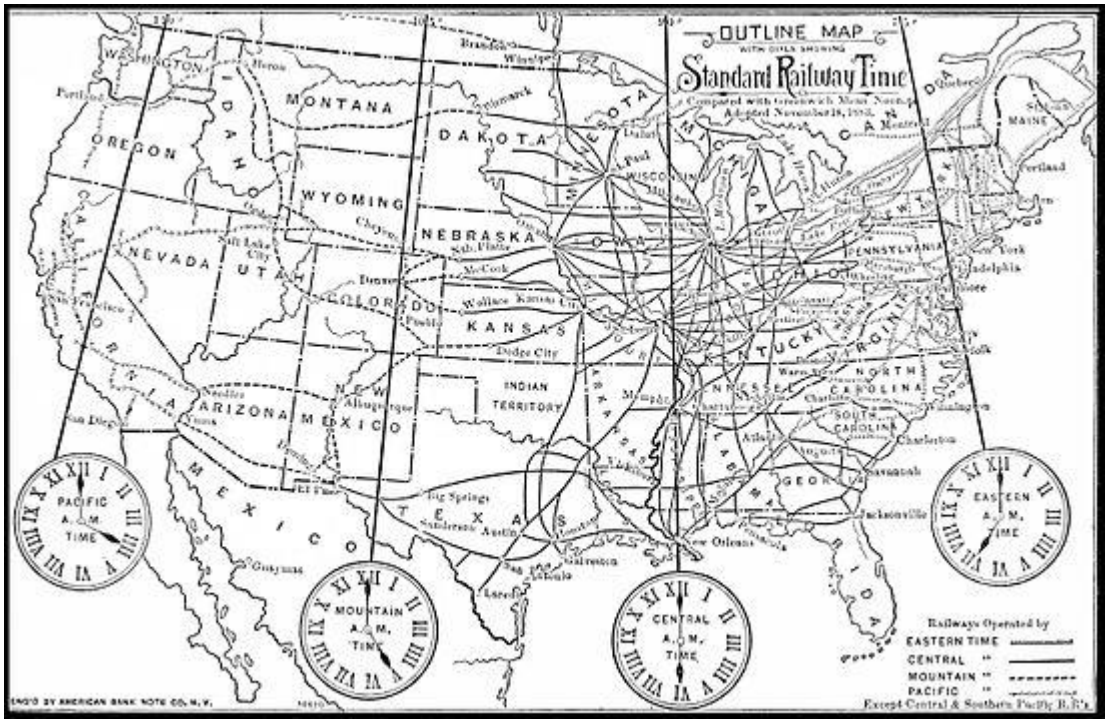
[469] http://railroad.lindahall.org/siteart/essays/time_indicator.jpg

[470] John N. Bell, "Standard Time" document, W.F. Allen Papers, New York Public Library, Folder 11.

Railroad officials were resolved that what they referred to as "the 'Hard Scrabble' system now in use with its 50 different standards intersecting and interlacing with each other," was "an abomination and a nuisance which cannot too soon be remedied."[471]

The system Allen developed adopted the idea of flexible, meridian-based time zones spaced one hour apart, or fifteen degrees of longitude – similar to the plans previously endorsed by Dowd and Fleming. He also adopted the idea of using the Greenwich meridian as a starting point. Taking Greenwich as the 0 degree longitude mark, he divided the globe into quarters. Local time at the 90 degree meridian, which cut through the Midwestern United States, became Valley Time (later Central Time). Once that was established, it was a relatively straightforward matter to divide North America into five time zones: Atlantic Time, sixty degrees west of Greenwich Observatory, would become the standard for Eastern Canada; Eastern Time, seventy-five degrees west of Greenwich would become the standard for the East Coast. Fifteen degrees west of that, Central Time would be the standard, then Mountain Time on the 105th meridian, and finally Pacific Time on the 120th meridian. In this new system, no local clock that had been adjusted to conform to the standard meridian time of its allotted time zone would deviate from its own local noon by more than half an hour. If adopted, these new time zones would make the old "Hard Scrabble" system of conflicting minutes obsolete in a set up that could easily be extended to encompass the globe, dividing the busy, industrializing world into neat, tangerine-like segments of fifteen degrees each with all clocks everywhere ticking away the same measured seconds and minutes. Only the hours would differ – a temporal indication of a person's spatial position on a spinning planet.

[471] "Standard Time for Railways of the United States and Dominion of Canada Report on the Subject of National Standard Time made to the General and Southern Railway Time Conventions Held in St Louis April 11, 1883," NYPL P89034, 1901.




472

To test the viability of his new system, Allen drew up a survey sheet and sent copies, along with maps diagraming his proposed time zones, to railway managers and superintendents across the US and Canada. The forms asked three basic questions: if the railway official was "in favor of the hour system of Time Standards as illustrated by the accompanying map [see above] and as recommended for adoption by the General and Southern Railway Time Conventions," if the company would agree to "run its trains by the _____ [Eastern, Central, Mountain, Pacific] Standard…provided the majority of roads in your section favor that standard," and to list any objections to the proposed system on the back of the form.[473] Allen received a slew of positive responses "from the managers of 78,000 miles of roads" agreeing that, if the other companies assented to make the change,

[472] W.F. Allen, "The Reformation in Timekeeping," *Popular Science Monthly*, Vol. 26, December 1884, http://en.wikisource.org/wiki/Popular_Science_Monthly/Volume_26/December_1884/The_Reformation_in_Time-Keeping

[473] "Slip Forms from Railroad Workers/Managers to W.F. Allen, Secretary General and Southern Railway Time Conventions, 46 Bond St, NY," William F. Allen Papers, New York Public Library, Box 1.

they would be all in favor.[474] Only a few of the dozens of returned slips indicated a negative response, the most significant from the Chicago and North-Western Rail Road, which read:

> Dear Sir: The reason why I say no to the questions on the other side of this sheet is because it would be an entire revolution in our time, and I am unable to see any advantage to be derived from the change. Our trains now run by Chicago and St Paul time, and the people along our wide-spread system have become thoroughly conversant with the fact, and I cannot see what advantage to them or to the Railway Company would accrue from making the change proposed. With our immense communication system in and out of Chicago, the adoption of any other than Chicago time for our Standard would result in endless embarrassment to the immense number of people we handle here every day.[475]

The fear that changing the time standard would only exacerbate the confusion that already plagued the railroads was valid, and many large hub cities, like Chicago, had built their schedules around their own local noon. Nevertheless, despite Chicago's disinclination to change their clocks to comply with any standard but their own, Allen presented his time zone map and survey responses to the General Time Convention in April, 1883, where it was agreed his suggestions would be adopted as the new standard time system governing the railroads of North America. Allen reported:

> The marked distinction between this system and those that had been suggested before…were largely of a technical character…but were quickly understood by railway managers, by many of whom the intricacies of the situation had previously been considered as presenting insuperable obstacles. Among these distinctive features may be noted:
>
> 1. It provided for an elastic instead of a rigid boundary line between the hour sections.
>
> 2. It designated every point upon the boundary lines where the change from one hour section to the other was to be made.
>
> 3. It arranged a method of passing from the use of one hour standard to another without danger of interference or mistake.
>
> 4. It included definite information respecting the changes required in the schedule of every train on each railroad, in passing from the use of the old to the new standard, so as to preserve unbroken the…time and connections with trains on other railroads.

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[474] W.F. Allen, *The Adoption of Standard Time in North America in 1883*, Pamphlet printed November 1903, 13.

[475] W.F. Allen Papers, Box 1.

> 5. It suggested a common-sense adjustment between local and standard time by the statement "In fact, local time would be practically abolished."
>
> 6. It proposed nothing that could not be adopted in practice.[476]

Accordingly, on November 18, 1883, "the change was put in effect…without any appreciable jar. The roads North and West of Chicago as well as the city of Chicago deferred making the change until Dec 2nd, but at present all roads in the district governed by the 75th and nearly all in that governed by the 90th meridian are running on Standard Time…"[477]

Standard time was in effect along the railroads of the United States and Canada, and with it came a new confidence in the railroad, the telegraph, and in the synchronized beats of the clocks that presented the time to the public. Reflecting back on the change just one year later, Allen wrote:

> Comparatively few among the millions of people…took the trouble to investigate the actual meaning of the change or the arguments in its favor. It appeared to be the work of practical railway managers, and to be favored by leading scientists… So the people quietly acquiesced, reset their watches a few minutes faster or slower, and for the most part soon forgot that any but "standard time" had ever been in use.[478]

The nascent *sequential timescape* was putting up shoots, bolstered by the apparent support and trust experts – those practical railway managers and leading scientists – had shown for the newly implemented system. Recent studies indicate the public is more likely to trust experts whose position is "in line" with their "previously held beliefs."[479] When an expert's position stands contrary to those beliefs, it is much more difficult to influence public

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[476] Adoption of Standard Time Pamphlet, 12-13.

[477] W.F. Allen, "Response to Survey Sheets," W.F. Allen Papers, Box 1.

[478] W.F. Allen, "The Reformation in Timekeeping," *Popular Science Monthly*, Vol. 26, December 1884, http://en.wikisource.org/wiki/Popular_Science_Monthly/Volume_26/December_1884/The_Reformation_in_Time-Keeping (last accessed, 24/3/2016)

[479] Christie Nicholson, "We Only Trust Experts If They Agree With Us," *Scientific American*, September 18, 2010, http://www.scientificamerican.com/podcast/episode/we-only-trust-experts-if-they-agree-10-09-18/ (last accessed, 27/3/2016).

opinion.[480] If standard time was accepted with so little question, it indicates most railway travelers, commuters, and watch-owners, already proponents of the *mechanical timescape*, were mentally predisposed toward accepting the standard mechanical time of the *sequential timescape* as long as they felt they could trust the networks and frameworks that shaped it. According to Allen, the backing of railway managers and scientists provided the support necessary to foster that trust, but another step was needed before the budding *sequential timescape* could flower.[481] The confusion of local times that plagued the industrialized world had to be abolished, not just in America, but in every nation.

In September, 1881, a geographical conference held in Venice had inspired the US to pass an Act of Congress giving the President authority to call an international conference specifically to discuss the world's time problem. While the potential and possible setting of such a conference was being discussed, the pressing need to effect the "unification of longitude and time" continued to be debated by leading scholars.[482] Establishing a universal prime meridian had been one of the points emphasized at an International Geodesic Conference – the Seventh General Conference of the European Arc Measurement – held in Rome in October 1883, but the results of their discussions had been inconclusive.[483]

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[480] As seen in Layer Two, the 'Darwin vs. God' debate.

[481] W.F. Allen, "The Reformation in Timekeeping," *Popular Science Monthly*, Vol. 26, December 1884, http://en.wikisource.org/wiki/Popular_Science_Monthly/Volume_26/December_1884/The_Reformation_in_Time-Keeping (last accessed, 24/3/2016).

[482] Howse, *Greenwich Time*, p.138. The International Meridian Conference, and similar scientific and educational conferences, can be considered an example of a broader pattern of transnational cooperation to address problems many nations found themselves sharing during this period of globalization, with Allen and Fleming becoming important contributors to this emerging transnational sphere. See: Ogle, *Global Transformation*, 2015; Davide Rodogno, Bernhard Struck, and Jakob Vogel, eds., *Shaping the Transnational Sphere: Experts, Networks and Issues from the 1840s to the 1930s*, Studies in Contemporary History, (New York, 2015).

[483] Multiple references were made to the conference in Rome during the 1884 conference in Washington D.C., and it was suggested that the proceedings in Rome had, at least in part, informed the President's decision to host the International Meridian Conference. Howse, *Greenwich Time*, 138; *International Conference Held at Washington for the Purpose of Fixing A Prime Meridian and A Universal Day, October 1884*, (Washington D.C., 1884), 3. http://www.gutenberg.org/files/17759/17759-h/17759-h.htm (last accessed 4/21/2016).

Following this, an International Meridian Conference, to be presided over by US President Chester A. Arthur, was finally organized for October 1884, with the stated aim of "fixing upon a meridian proper to be employed as a common zero of longitude and standard of time-reckoning throughout the globe."[484] W.F. Allen and Sir Sandford Fleming joined delegates from around the world to represent their ideas and their countries at the conference, which was held in Washington D.C. and lasted through eight meetings.

It was agreed from the start a prime meridian had to be established in order to inaugurate a standard, universal day. The main problem was determining where that zero meridian line should be set. Most of the delegates acknowledged Greenwich would be the most practical location. According to a statistical table Fleming cited during his address, "Greenwich, is used by 72 per cent of the whole floating commerce of the world, while the remaining 28 per cent is divided among ten different initial meridians."[485] France, Brazil, and San Domingo objected to the idea of the standard prime meridian for world time running through such a specifically British site as the Royal Observatory. Even Fleming went on to argue the prime meridian should be territorially neutral, referring to a proposal he had put forward in 1879 advocating the adoption of a longitude line set 180 degrees from Greenwich for the purpose – a line that mostly passed through ocean and sparsely settled lands on the other side of the world. Professor J.C. Adams, a delegate from Great Britain, quickly countered Fleming's proposal, noting:

> The proposition to count longitude from a point 180 degrees from the meridian of Greenwich appears…not to be accompanied by any advantage whatever. On the contrary, it must lead to inconvenience. You do not, by adopting the meridian opposite Greenwich, get rid of the nationality of the meridian…The one half is just as national as the other half.[486]

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[484] *International Conference Held at Washington for the Purpose of Fixing A Prime Meridian and A Universal Day, October 1884,* (Washington D.C.: Gibson Bros., Printers and Bookbinders, 1884), p.3. http://www.gutenberg.org/files/17759/17759-h/17759-h.htm (last accessed, 21/4/2016).

[485] Ibid.

[486] Ibid.

Despite nationalistic objections, the fact that the majority of the world's shipping already looked to Greenwich Time to find their longitude at sea was a substantial swaying point and it was finally resolved on October 13, 1884 that the prime meridian of the world should be set at Greenwich. The vote carried with twenty-two ayes. France and Brazil abstained, and San Domingo voted no in the belief that the world time standard should be politically neutral.[487] The transit telescope of the Royal Greenwich Observatory became the site of the Prime Meridian and, therefore, the starting point of the new Universal Day. The settlement was not perfect, and its impact was not immediate, but it did represent a significant starting point from which the gradual expansion of the modern system of universal standard time and global time zones could develop – and with it the temporal landscape of the *sequential timescape*. The Gordian knot of hopelessly tangled local times had been cut and, as the nineteenth century transitioned into the twentieth, the time standard hammered out in Washington would eventually be adopted as law by nearly every nation on earth.[488]

As interest in conforming to a general time standard grew, commercial businesses began forming with the aim of electronically distributing Greenwich Time to a paying public – products of the new, and rapidly growing, *sequential timescape*. In London, which had long been running on Greenwich Time, two electric time suppliers were in active service. The first, and most prominent, was the Royal Greenwich Observatory which, as the home of world standard time, supplied electric time signals to the British government. This meant, it sent direct signals to the Post Office (which passed it on to its branch offices, the railway system and a limited number of private customers), to Big Ben at Westminster, and to coastal

[487] Ibid.; Howse, *Greenwich Time*, p.141.

[488] For issues related to globalization and trends toward homogeneity, see: Jürgen Osterhammel and Niels Petersson, *Globalization: A Short History*, translated by Dona Geyer, (Princeton, 2005), http://press.princeton.edu/chapters/s7952.html (last accessed 25/3/2016).

signal stations run by the Admiralty. The second was the Standard Time Company, which had been established to provide hourly time signals to private subscribers – a service it continued to operate into 1964.[489] The Standard Time Company's operations relied on hourly time signals received via direct private wire from Greenwich, which they then sent out to subscribers throughout the London area via their own network of overhead wires. The system implemented numerous inventive, tech-forward fail-safes designed to cut down on the types of signal failures that continued to plague the Post Office system, but it was still, essentially, distributing second-hand time and, therefore, never managed to attain official certification from Greenwich Observatory.[490]

There was a time service in operation that could boast official certification, however: Ruth Belville and her trusty Arnold chronometer, representatives of the older *mechanical timescape* that – although it predated the intricate electronic network that supported the new *sequential timescape* of standard time – had never lost its validity, or the trust of scientists, navigators, and chronometer makers. To Ruth Belville and the STC, selling precisely calibrated mechanical time was their business, a means of earning their livelihood. Both had started their ventures before the advent of international standard time: the STC in 1876; the Belvilles in 1835. But, while Ruth Belville had inherited her business, the Standard Time Company was out to corner the market.[491] This set the stage for a clash between two *timescapes* – the individualistic *mechanical timescape* of Ruth Belville's Arnold chronometer and the London clockmakers, and its more modern iteration: the new, expanding *sequential timescape* supported by the STC's network of electronically synchronized clocks.

[489] Howse, *Greenwich Time,* p.105.

[490] Ibid., p.104.

[491] The STC's rates were lower than the Post Office, but "still out of financial reach for the majority of people." As it grew, the company attracted primarily corporate customers, like the London Stock Exchange, Lloyd's insurance, and banks, which makes the fact that they perceived Belville as a threat all the more curious, and significant. Ogle, *Global Transformation,* p.66.

The clash came to a head in March of 1908, following some three months of planning and politicking on the part of a new, ambitious STC stockholder: Mr. St Andrew St John Winne, a Fellow of the Royal Geographical Society and an experienced promoter. Winne saw the STC as a company with good potential for growth trapped in a stagnant market.[492] At this point, the Standard Time Company had more than three hundred subscribers, mainly shops, pubs, banks, newspapers, and some factories and railroads, all of which needed to know the correct time in order to comply with various time-related laws that had recently been passed setting the length of the working day…and the drinking evening.[493] But, by 1908, the STC's profits were low and they were still on the lookout for new subscribers – particularly among the most prominent holdouts: the precision chronometer makers, important dockyards, and prestigious high-end shops of London that still relied on Ruth Belville for accurate Greenwich Time.

According to Winne, the STC had the latest technology and a solid infrastructure already in place; London should, therefore, be a world leader in time synchronization and an example for the rest of Europe. Yet, out of some sixty-four public clocks operating in central London, only Big Ben (which received current from Greenwich) and two newly erected clocks were synchronized.[494] The rest relied on weekly windings and settings carried out by

[492] "Technically, the [STC's] system was ingenious. Each subscriber's clock was first fitted with an instrument activated by a electric impulse, transmitted once an hour to all clocks simultaneously 'by one of 3 master clocks whose pendulums are maintained constantly beat for beat with the Mean Solar Clock at Greenwich…from which a signal is received every hour…Clocks of even inferior quality will maintain true time if corrected sufficiently frequently, and once an hour is found to be ample…'" Alun Davies, "Greenwich and Standard Time," p.198.

[493] During the 1870s, British legislators had set strict curfews on London pubs and other businesses licensed to sell alcohol: any business caught selling alcohol after hours could be stripped of its license. Because of this restriction, by 1886 about a quarter of the STC's subscribers were London pubs and other drinking establishments. Rooney, *Belville,* p.64.

[494] Regarding Big Ben's accuracy, "By 1874, the Astronomer Royal could report that on 83 per cent of the days of the year the clock was accurate to within less than one second a day. In 1875 neither sun nor clock-stars were visible during a prolonged spell of cloudy weather, and for ten days no one in Britain knew the right time. When star readings were eventually possible, Big Ben proved to be more accurate than the chronometers at Greenwich. Maps of central London were published, with circles drawn concentric to Big Ben's clock tower. These indicated the number of seconds to be subtracted, according to distance, from the time of hearing the first

clockmakers, an old-fashioned and highly inefficient system when compared to the hourly nudges of electric current received by synchronized clocks.[495] What London (and the STC) needed, in Winne's view, was legislation to compel anyone who operated a public clock to keep it precisely aligned with standard, Greenwich Time – a state of affairs that would, hopefully, create a fresh demand for their time service.[496] To this end, a series of newspaper opinion pieces and editorials began to appear in *The Times,* with the aim of publicizing the issue, provoking public interest, and evoking public opinion.[497] The debate, which has since come to be known as the "lying clocks saga" began on January 8 with a letter by Sir John Cockburn, a founding member of the British Science Guild, who argued, "It is not unusual within a hundred yards to find clocks three or four minutes at variance with each other…A lying timekeeper is an abomination, and should not be tolerated…A by-law might well be

blow at any hour when the temperature was 50˚ F, and there were tables for corrections to be made at other temperatures." Alun Davies, "Greenwich and Standard Time," p.196.

[495] Rooney, *Belville,* pp.82, 75. Complaints about the inaccuracy of London's public clocks had been published for decades, some going back as far as 1828. A writer to the *Horological Journal* in 1901 complained things had changed little since that time, saying: "'…the times indicated on public clocks in London showed large differences;…Post Office and railway clocks were no better than others, whilst some church clocks, from which above all others the truth is expected, were the worst of all. It is a fact that London, with its millions of private clocks and watches, is absolutely without a single standard time indicator as a basis for regulating them, with the exception of those provided by private enterprise and exhibited to the public gratuitously or as a means of advertisement.'" Alun Davies, "Greenwich and Standard Time," p.197. Also, Hannah Gay, "Clock Synchrony, Time Distribution, and Electrical Timekeeping in Britain 1880-1925," *Past & Present,* no. 181, (November 2003), 107-140, pp.112-118.

[496] The STC served as a "nexus" between the Royal Observatory's "master timekeeper" and London's businesses and, as such, embodied a control issue that preoccupied Victorians: "the moral drive to regulate and standardize aspects of daily life," with standardized clocks transmitting "Victorian moral concerns of 'power' and 'intelligence' between imperial state and individual.'" An inaccurate clock, out of step with the synchronized standard, could, therefore, be decried on moral as well as scientific grounds. See: David Rooney and James Nye, "'Greenwich Observatory Time for the Public Benefit': Standard Time and Victorian Networks of Regulation," *The British Journal for the History of Science*, Vol.42, No.1, (March 2009), pp.5-30.

[497] See: E. J. D. Newitt, et al, "Lying Clocks," *Times* [London, England] 10 Jan. 1908: 12, *The Times Digital Archive*. http://find.galegroup.com/ttda/infomark.do?&source=gale&prodId=TTDA&userGroupName=stand&tabID=T003&docPage=article&searchType=AdvancedSearchForm&docId=CS202700330&type=multipage&contentSet=LTO&version=1.0 (last accessed 28/3/2016). Newitt was the Secretary of the Standard Time Company.

framed requiring clocks in public places to be synchronized with standard time; the penalty for repeated disregard to be the removal of the offending dial."[498]

The reader response was immediate, and revealed a clear dichotomy of opinion between advocates for electronic synchronization (proponents of the *sequential timescape*) and the clockmakers of the "old guard" who felt the very suggestion that their clocks were incapable of keeping accurate time on their own without electronic encouragement was an insult to their profession.[499] Many of these clockmakers also operated weekly clock-maintenance services for their clients – services that would be directly threatened by the continued expansion of the system of synchronized public clocks.[500]

The newspaper debates continued until March, when the whole carefully orchestrated propaganda campaign culminated in a public lecture delivered by Winne on Wednesday, March 4 to a gathering of more than sixty listeners, including scientists and clockmakers.[501] There, the benefits and weaknesses of both the clock-winding services and electronic synchronization were aired.[502] The clock-winding services were condemned for their slowness, allowing individual clocks to gradually fall out of step with standard time until the technician returned to re-set them. Electronic time distribution systems were condemned for their vulnerability to faults, delays, and breakdowns, which only served to undermine the

[498] Rooney, *Belville*, p.78; John Cockburn, "Lying Clocks," *Times* [London, England] 9 Jan. 1908: 7. *The Times Digital Archive*, http://find.galegroup.com/ttda/infomark.do?&source=gale&prodId=TTDA&userGroupName=stand&tabID=T003&docPage=article&searchType=AdvancedSearchForm&docId=CS118027817&type=multipage&contentSet=LTO&version=1.0 (last accessed 28/3/2016).

[499] Ogle, *Global Transformation*, pp.69-71.

[500] Rooney, *Belville*, p.78.

[501] Ibid., p.85.

[502] Gay, "Clock Synchrony," pp.112-118.

public's trust in the system (despite the fact that the STC and most of the smaller London clockmakers received Greenwich Time by wire).[503]

Given the piles of complaints filed in boxes among the Royal Greenwich Observatory's records housed in the manuscripts department of Cambridge University Library, and similar stacks of complaints located in the archives of the Post Office telegraph department, it is clear this did represent a general public attitude regarding the telegraph signals that provided the city with standard time.[504] It is just as clear that this attitude provoked a defensive response from the scientists and businesses that purveyed those signals to the public. The gathering did achieve its aim, however. It successfully advertised the services provided by the STC, cast doubt on the reliability of mechanical clocks that had not yet been networked into the STC's synchronized electric time system, and stimulated interest in the ongoing problem of providing the public with accurate standard time. But, it also brought up the fact that there was a rival time service in business.

Ruth Belville had not been involved in the "lying clocks" debate. She had not known about Winne, Winne's speech, or even been aware that a propaganda campaign had been building up against her time service until a flock of reporters alighted on her doorstep the day after Winne gave his talk.[505] But, the fact that her chronometer had long been certified by the Royal Observatory as an accurate purveyor of Greenwich Time had made the unwitting Ruth a major obstacle on Winne's road to expansion. After all, Ruth's service did not wire second or third-hand approximations of Greenwich Time to subscribers. Her clock was regularly set and certified by Observatory astronomers. Beyond that, the service she provided was built on

[503] Howse, *Greenwich Time,* p.104.

[504] See: Observatory Records archived at Cambridge University Library Manuscripts Room, RGO 6 George Biddell Airy: Papers, from FILE 1, RGO 6 611 GALVANIC COMMUNICATION WITH SOUTH EASTERN RAILWAY AND ELECTRIC TELEGRAPH INDEX & LEAVES 1-48 SECTION 1+2 through FILE 5, RGO 6 614, LEAVES 155 – 221, SECTIONS 14 CONT.

[505] Rooney, *Belville,* p.73.

a solid foundation of life-long relationships that extended from Ruth back to her parents.[506] This was a prime "example of how trust is built," her biographer explained, "a classic case of working out how customers *think*; what they value and are prepared to pay for. Good pedigree and a long lineage, continuity of service, the personal touch and a friendly face."[507]

During the talk, Winne had tried to play all that down, dismissing Ruth's time service as insignificant, an "interesting and amusing" side-note to the serious business of time distribution and, according to one report, going so far as to suggest her feminine charms were the only reason she had managed to maintain permission from the Astronomer Royal to have her chronometer checked at the observatory every Monday.[508] The gathered officials may have chuckled at that, but Ruth Belville's time service was more direct and reliable than any provided via telegraph wire – and that made her a genuine threat to the STC that could potentially undermine public trust in their network. The pervading public doubt in the consistent reliability of electric time signals allowed Ruth's familiar, if old fashioned, time service and its *mechanical timescape* to endure.[509]

Both Ruth Belville and the STC managed to maintain their respective businesses well into the twentieth century, each purveying accurate, standard time while representing two separate, yet completely valid, temporal worldviews: the *mechanical timescape* of individual mechanical clocks and the *sequential timescape* of networked, synchronized mechanical clocks. As Ruth Belville's biographer explained:

> From the users' perspectives, Airy's telegraph time service, and that of St John Winne's Standard Time Company, was good but not always good; available but not always readily so; accurate enough for most people most of the time but no more so than Ruth's service, which was always reliably correct to a tenth of a second and

[506] Alun Davies, "Greenwich and Standard Time," p.196.

[507] Rooney, *Belville,* p.58.

[508] Ibid., p.87; Howse, *Greenwich Time*, p.86.

[509] Ogle, *Global Transformation*, p.67.

> thereby continued to retain a loyal specialized following for as long as she had the endurance to continue. New isn't necessarily better, it's just different, and the solution people go for depends on what they need.[510]

The same can be said for people's expectation and use of time, as will be seen in the next section.

[510] Ibid., p.173.

*SIGNPOST 2*

The previous section investigated the construction and development of a temporal landscape informed by the *sequential timescape*: a *timescape* shaped by the in-step beats of standard, linear time that gradually came to supplant the older *mechanical timescape* of individually calibrated timekeepers as support for and trust in the late nineteenth-century's coordinating time, travel and communications networks attracted businesses and individuals to electronically synchronize their clocks with new universal time and time zone standards. In this section, "Temporal Flexibility: Manipulating Time in a Standardized World," the expanding *sequential timescape* will be contrasted with an opposing temporal worldview: the *simultaneous timescape*. This highly individualized temporal paradigm developed in direct response to the new stresses and demands of an industrialized reality of synchronized clocks, pervasive schedules, and diminished private time, coupled with a sense of detachment from the rhythms of the natural world and subjective individual perceptions that deeply disquieted many of the most prominent artists, authors, and intellectuals of "*La Belle Époque*."[511]

The *sequential timescape* is the interconnected, international, globe-spanning version of the abstract, *mechanical timescape*. Only, instead of being composed of many separate bubbles of isochronous mechanical time, each attached to an individual mechanical clock or watch, all set to a variety of local times and none quite exactly in synch with its closest neighbor, in the *sequential timescape* the individual clock-bubbles have synchronized and joined together to form a single standard temporal environment. Like the *mechanical timescape*, its reliability depends on technology with the ability to support it. Proponents of a *sequential timescape* must trust in its accuracy, just as the Harrisons trusted the *mechanical*

[511] Late-Victorian preoccupation with the "causes and symptoms of contemporary decline" and visions of decadence and degeneration illustrated this sense of anxiety and uncertainty about the future, as seen in H.G. Wells's *The Time Machine* and Max Nordau's 1895 work *Degeneration*. Jenny Bourne Taylor, "Psychology at the fin de siècle," in *The Cambridge Companion to The Fin de Siècle*, edited by Gail Marshall, (Cambridge, 2007), pp.13-14. Also, Buckley, *Triumph of Time*, pp.66-93.

*timescapes* of their clocks.[512] But, if the *sequential timescape* is the globalized counterpart of the *mechanical timescape*, the *simultaneous timescape* represents a comparable globe-spanning counterpart to the highly localized *seasonal timescape* discussed in Layer One, standing in flexible opposition to the rigidity of an absolute, abstract timeline and the regular, accompanying beats of synchronized mechanical clocks. The clash between these two divergent *timescapes* is the clash between the punctual, future-oriented bourgeoisie and the extended present of the poorer classes; between structured daily schedules and stream-of-consciousness meanderings; between the stiff Newtonian timeline and Einsteinian flexibility.[513] What was the effect of this conflict on modern time-consciousness? This section investigates how this revolutionary paradigm shift changed modern expectations of time, and how this change was reflected in the literature, art, film, and science of the gloaming years of the long nineteenth century.[514]

[512] Attempting to undermine customers' trust in Ruth Belville's individualized time service and bolster public trust in their telegraph-based electronic service was at the heart of the STC's "Lying Clocks" campaign. If trust was not such a significant factor informing both the vendors' and customers' timescapes and timescape biases, such tactics would not have been necessary, and Belville's time service likely would have faded much sooner than it did. Rooney, *Belville*, p.173; Nicholson, "We Only Trust Experts If They Agree With Us," http://www.scientificamerican.com/podcast/episode/we-only-trust-experts-if-they-agree-10-09-18/ (last accessed, 27/3/2016).

[513] For more on the late nineteenth-century bourgeois value of punctuality and their future-orientation, as well as contrasts with the more now-oriented poorer classes, see: Linda Young, *Middle Class Culture in the Nineteenth Century: America, Australia, and Britain*, (December, 2002), e-book, http://www.palgraveconnect.com/pc/doifinder/10.1057/9780230598812, (last accessed 31/3/2016); Jerrold Seigel, *Modernity and Bourgeois Life: Society, Politics, and Culture in England, France and Germany Since 1750*, (Cambridge, 2012), e-book, pp.267-304, (last accessed 31/3/2016); David Morse, *High Victorian Culture*, (London, 1993); Gail Marshal, ed., *The Fin de Siècle*, (Cambridge, 2007); Buckley, *The Triumph of Time*, (Oxford, 1966); Harpo Marx, *Harpo Speaks!*, (New York, 1961).

[514] For example: the works of Joseph Conrad, Franz Kafka, James Joyce, and Edvard Munch, among others. Contemporary critics viewed such works as representing insight into the late nineteenth-century *zeitgeist*, or spirit of the age, including new pressures, anxieties, and rebellious feelings regarding standard, industrialized time and its regulating, mechanizing, even dehumanizing effects on the human mind and spirit. See: Owen Knowles, ed., *The Cambridge Edition of the Works of Joseph Conrad: Youth, Heart of Darkness, The End of the Tether*, (Cambridge, 2010); Reiner Stach, *Kafka: The Years of Insight*, translated by Shelley Frisch, (Princeton, 2008); Julian Preece, ed., *The Cambridge Companion to Kafka*, (Cambridge, 2002); James Joyce, *Ulysses: The 1934 Text, as Corrected and Reset in 1961*, (New York, 1992); J. Jill Holland, ed., trans., *The Private Journals of Edvard Munch: We are Flames Which Pour out of the Earth*, (Wisconsin, 2005); Reinhold Heller, *Munch: The Scream*, (London, 1973); Mara-Helen Wood, ed., *Edvard Munch: The Frieze of Life*, (London, 1992).

### *TEMPORAL FLEXIBILITY: MANIPULATING TIME IN A STANDARDIZED WORLD*

On February 16, 1894 – one decade after the International Meridian Conference had set Greenwich, London as the global prime meridian, the starting point for international standard time – newspapers on both sides of the Atlantic carried the alarming story of Martial Bourdin: a young French anarchist who, it seemed, had accidentally blown himself to pieces the evening before while carrying a brick-sized bomb up the path toward the Royal Observatory in Greenwich. The *New York Times* reported: "A loud explosion was heard just after nightfall by the keepers of Greenwich Park, about six miles from London Bridge. A hasty search led to the discovery of a man mutilated and groaning with pain on the hilltop near the observatory. His legs were shattered. One arm had been blown from his body, and he had been almost completely disemboweled."[515]

Speculation began at once as to the anarchist's motives. Why had this man brought a bomb to Greenwich Park? Could he have been targeting the Royal Observatory? Had Bourdin planned to stop the clock that had so recently come to represent, and regulate, the pace of international business?

Symbolic as such an act may, potentially, have been, the notion was quashed just two days after the event, when the same papers that had broken the story reported "the theory that Bourdin intended to blow up the Greenwich Observatory is hardly tenable. An anarchist outrage in London or elsewhere in England would probably result in such regulations regarding foreign anarchists being taken that they would lose the only refuge they have in Europe. It is, therefore, considered that they would not commit an act in this country that would probably result in their expulsion."[516]

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[515] *The New York Times*, February 16, 1894.

[516] *The New York Times*, February 18, 1894.

*The Times* in London echoed this sentiment with: "It seems reasonable to suppose that [Bourdin] stumbled and came into unexpected contact with the earth, with the result of being in the most literal sense "hoist with his own 'petard.'" What he was doing with his petard in Greenwich Park must probably remain to some extent a matter of conjecture," but added the cynical caveat:

> …it can hardly be supposed that he took the police seriously…Upon the whole we must incline to the theory that Bourdin really was about to throw his bomb at the Observatory windows. This theory is not complimentary to the Home Office nor does it square with the comfortable belief that England is so very convenient as headquarters that Anarchists will do nothing to imperil their asylum…Anarchists do not care to exist in inglorious idleness.[517]

The eventual determination that Bourdin had, most likely, been seeking a quiet, open space where he could test a homemade explosive (officials had found a formula for a bomb when they searched his body, copied from a book in the British Museum – and more research on explosives in his lodgings[518]) served to soothe, but certainly not to settle the matter which remained, as far as most conjecturers were concerned, a popular unsolved mystery.[519] The notion of militant anarchist plotters determined to blow apart the modern straightjacket of standard time, coupled with a young man's accidental martyrdom for the cause, was far too romantic to abandon so easily. It set fire to the public imagination – the most enduring spark

[517] "Further and Calmer Inquiry into the Explosion," *The Times*, February 17, 1894. During the inquest into the incident, Colonel Majendie, Chief Inspector of Explosives to Queen Victoria, testified it was unlikely that Bourdin had stumbled. Physical evidence indicated Bourdin was more likely standing about forty-six yards from the Observatory wall, holding the bomb in his left hand. A glass bottle of sulphuric acid had been in his pocket, leading Majendie to believe Bourdin had poured out enough acid to prepare the bomb but mischance, miscalculation, or bumbling made the bomb go off prematurely. Majendie was sure Bourdin had targeted the Observatory, but others speculated he had been preparing to hand the bomb off at the Thames for use in France, seen the Observatory – a notable British "prestige building" – and possibly decided to arm and throw the bomb then, though Bourdin's true intent and ultimate destination may never be certain. See: Hermia Oliver, *The International Anarchist Movement in Late-Victorian London*, (London, 1983), pp.103-104; 99-109.

[518] Paul Gibbard, *Oxford Dictionary of National Biography*, "Bourdin, Martial (1867/8–1894), anarchist," (Oxford: Oxford University Press, 2004-2014), http://www.oxforddnb.com/view/printable/73217

[519] For an example of popular contemporary conspiracy theories regarding what Conrad called "The Greenwich Bomb Outrage," see: David Nicoll, *The Greenwich Mystery: Letters from the Dead*, (David Nicoll, April 19, 1898). Nicoll was an editor and active anarchist in Britain.

igniting the mind of the Polish-born British novelist Joseph Conrad, whose 1907 novel *The Secret Agent* was directly based on Bourdin's controversial end and the anarchist group he had belonged to.[520]

But, why Greenwich? Why should anarchists target an astronomical observatory rather than some politically significant site, such as the Houses of Parliament or international embassy buildings; an economically relevant target, like the London banks; or a socially pertinent mark like a trendy theater or restaurant – and why would the public be so eager to latch on to such a theory? As Conrad had his conspiring characters point out: "'The whole civilised world has heard of Greenwich. The very boot-blacks in the basement of Charing Cross Station know something of it…'Yes,' he continued, with a contemptuous smile, 'the blowing up of the first meridian is bound to raise a howl of execration.'"[521]

As home of the Prime Meridian, Greenwich Observatory had become a symbol of a new sense of world unity; a shared temporal experience made tangible in the form of synchronized clocks, regulated train schedules, the telephone, and wireless radio telegraphy systems – all of which had the almost magical ability to "annihilate" space and time and make distant events seem local and pressingly relevant.[522] An attack on Greenwich, therefore, would represent an attack on that sense of unity, as well as an attack on the middle-class sensibilities of order, progress, and punctuality that had become a foundation of modern urban life and the international business world: in other words, the whole bourgeois temporal

[520] Conrad dedicated the book to fellow writer and social critic H.G.Wells, author of *The Time Machine* (1895).

[521] Joseph Conrad, *The Secret Agent: A Simple Tale*, (1907), http://www.gutenberg.org/files/974/974-h/974-h.htm (last accessed 25/2/2016).

[522] Wireless telegraphy was first theorized by James Clerk Maxwell in 1884, and by 1904 the first wireless news service had been established by the Marconi Company. By 1912, wireless signals had become "an essential part of international communication, linking land stations and ships at sea in an instantaneous, worldwide network." Kern, *Culture*, p.69.

construct of the late nineteenth century.[523] To many, in Europe and across the Atlantic, the conquest of time via technology was viewed as a highly positive development, one of the greatest human achievements of the modern age. To stop the clock at Greenwich would be to reveal the busy bustle of the *sequential timescape* for the manmade, technological overlay it was, openly disputing the industrialized nations' supposed control over their time. [524]

Yet, even without an anarchist attack, as the network grew tighter, as the scheduled demands of each day became increasingly structured and organized, and as the mentality fostered by the *sequential timescape* grew more culturally integrated and, therefore, progressively more invisible, the more noticeable the stresses, anxieties, and dissatisfactions with the fast-pace of the industrialized world were becoming. A pervading sentiment that the modern worker was shackled by the soul-crushing demands of inflexible, public, mechanical time began to creep into the attitude, and literature, of the *fin de siècle*. This oppressive feeling was creatively, and effectively, depicted in Franz Kafka's *The Metamorphosis*. In this story, after leading a dreary existence consisting almost solely of work and sleep to support his younger sister and pay off the debt his exploitative parents owe to his exploitative boss, Kafka's character Gregor Samsa wakes up one morning to find himself inexplicably transformed into a giant bug. No longer able to work, his family view him as an

[523] For more on the pervasive influence of bourgeois culture, order, and (temporal) values, see: Sven Beckert, *The Monied Metropolis: New York City and the Consolidation of the American Bourgeoisie, 1850-1896*, (Cambridge, 2001); Young, *Middle Class Culture*, http://www.palgraveconnect.com/pc/doifinder/10.1057/9780230598812, (last accessed 31/3/2016); Seigel, *Modernity and Bourgeois Life*, e-book, (last accessed 31/3/2016); Marshal, ed., *The Fin de Siècle*, (Cambridge, 2007); Frederick Cooper and Ann Laura Stoler, eds., *Tensions of Empire: Colonial Cultures in a Bourgeois World*, (Berkley, 1997), e-book, http://quod.lib.umich.edu/cgi/t/text/text-idx?c=acls;idno=heb02494 (last accessed 31/3/2016); Buckley, *The Triumph of Time*, (Oxford, 1966); Ogle, *Global Transformation*; Kern, *Culture*, (Cambridge, Mass., 1983).

[524] Anarchism, as a formal political philosophy, began with Pierre-Joseph Proudhon circa 1840 and espouses a rather flexible rhetoric of anti-statism and the opposition of hierarchal authority in human political and social relationships. It was not unreasonable, therefore that Greenwich Observatory, as a symbol of the imposition of industrialized, mechanical bourgeois time on human society, could be viewed as a likely anarchist target. See: Hermia Oliver, *The International Anarchist Movement in Late-Victorian London*, (London, 1983); George Woodcock, *The Anarchist Reader*, (Hassocks, 1977); Sam Dolgoff, ed., trans., *Bakunin on Anarchy: Selected Works by the Activist-Founder of World Anarchism*, (London, 1973).

embarrassment and financial burden. They hide him away, abuse him, injure him, and eventually cause his death before turning on his younger sister.[525]

Gregor begins the story as a fully integrated product of the *sequential timescape*. Already transformed, his first thoughts are not of his weirdly altered physical condition, but of the fact he has to get out of bed in time to catch the five o'clock train to work, and all the stress involved in making that connection.

> "Oh, God," he thought, "what a strenuous career it is that I've chosen! Travelling day in and day out. Doing business like this takes much more effort than doing your own business at home, and on top of that there's the curse of travelling, worries about making train connections, bad and irregular food, contact with different people all the time so that you can never get to know anyone or become friendly with them. It can all go to Hell!"[526]

Despite his aggravated, dismissive attitude, his next reaction is a rush of anxiety as he looks at his alarm clock and realizes he has overslept by nearly three hours. Realizing he was out of synch with his usual schedule before he even opened his eyes is enough to send his mind spinning into a panic:

> "God in Heaven!" he thought. It was half past six and the hands were quietly moving forwards, it was even later than half past, more like quarter to seven. Had the alarm clock not rung? He could see from the bed that it had been set for four o'clock as it should have been; it certainly must have rung…What should he do now? The next train went at seven; if he were to catch that he would have to rush like mad... And even if he did catch the train he would not avoid his boss's anger as the office assistant would have been there to see the five o'clock train go, he would have put in his report about Gregor's not being there a long time ago...[527]

These frenzied thoughts would seem familiar to anyone who has missed their morning alarm, but given Gregor's transformation, and his apparent obliviousness to the change, his

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[525] Franz Kafka, *The Metamorphosis*, 1915, http://www.gutenberg.org/files/5200/5200-h/5200-h.htm; Mark Spilka, *Dickens and Kafka: A Mutual Interpretation*, (California, 1963), which presents a Freudian critique of the societal, familial, and personal dysfunctions of the characters and their settings and relates them back to those of their author, himself confronted with the psychologically crippling, or 'infantilizing,' constricts, pace, and pressures of modern, bureaucratic time and urbanism.

[526] Kafka, *Metamorphisis*, http://www.gutenberg.org/files/5200/5200-h/5200-h.htm

[527] Ibid.

preoccupation with clock time in this scene lifts his situation from the routine to the absurd. While struggling to force his insect-like body out of bed, Gregor remains fixated on his alarm clock relentlessly ticking minute after minute – seven o'clock…ten minutes past seven…half past seven… – and the consequences he would have to face at work for being late to a business so absorbed by a "time is money" mentality that it takes as little notice of its employees' physical and mental condition as Gregor takes of his own.[528] Gregor only gradually realizes his condition is real, and that he is no longer capable of keeping his habitual routine – that he has become permanently divorced from the *sequential timescape* of the clocks and trains of the business world…and, by extension, the human world of his sister and parents, who are forced to find jobs and keep to the clock in order to make up for his lost wages. Yet, in the months that follow, although his family treat him like an unwanted parasite, incapable of understanding their speech or their world, Gregor retains his mind and his compassion until he finally dies of neglect.[529]

While this story may, in part, be a case of asking "who is the monster and who is the man," or perhaps "which is the more absurd: Gregor's situation or the public world that created the conditions that led up to it," it does reveal how pervasive the *sequential timescape* had become during the period before World War I, and the fact that there was another time sense that existed alongside it: a time sense divorced from the regimented schedules and anxiety-inducing demands of relentless, mechanical time.[530] This was the subjective, relative

[528] Ibid.

[529] Ibid.

[530] *The Metamorphosis* is generally referenced as a prime example of the 'Kafkaesque' experience, "one in which the everyday becomes uncanny, weird, and anxiety ridden." This was often a fictionalized representation of his own experiences and feelings: "…for Kafka, the everyday meant going to an office job he hated. It meant dealing with business matters that made him want to run away and at one point even to contemplate suicide. It meant living a double life, one during the day, the other during the night. But for Kafka day time was the dark side of existence. Only at night did he have the hours to write…to do his own 'work' and to live the existence he felt was the only real one for him…" In this sense, the demands of the sequential timescape made his time-sense 'absurd,' in that the structured working day was unreal and the flowing thoughts of night were real. Ruth V. Gross, "Kafka's Short Fiction," in Preece, ed., *Kafka*, p.80.

time sense Gregor encountered once he understood he could no longer work outside his apartment, but never had a chance to fully explore before succumbing to hunger and his family's disregard.

The turn of the century was highly significant to many Europeans. It carried with it an ominous sense of ending, as well as hope for a new age for Europe.[531] This sense of disjunction with the past mixed with anticipation for the future is described in Stephen Kern's *The Culture of Time and Space* and Philipp Blom's more recent *The Vertigo Years.* Both authors approach the issue by examining the art, music, and literature of the period, and the anxieties and dissatisfactions that drove the artists to create them. In both books, the limitations of language and the static canvas are contrasted with the undeniable sense of accelerated time and accelerated social change that permeated the era. During the early twentieth century, the rigid social classes and gender roles of the Victorian age were becoming more fluid, questions of identity and self that had previously been viewed as an inextricable part of an assumed social construct seeming to fragment into individual accumulations of sensations and experiences. The new and rising medium of the cinema effectively translated these disjointed impressions and ideas into something palpable, capturing motion, intercutting between various perspectives, and employing trick photography to create a new way of telling, experiencing, and thinking about stories that was not necessarily linear. In this flexible medium, men could become women, women could become men, little tramps could be self-made heroes, wealthy elites immoral villains. Writers, painters, and photographers began imitating the kind of cut, fragmented, highly manipulated time they saw on the screen, attempting to portray multiple vantage points in one

[531] See: Marshall, ed., *The Fin de Siècle*, (Cambridge, 2007); Bartkey, *Triumph of Time*, (Cambridge, Mass., 1966).

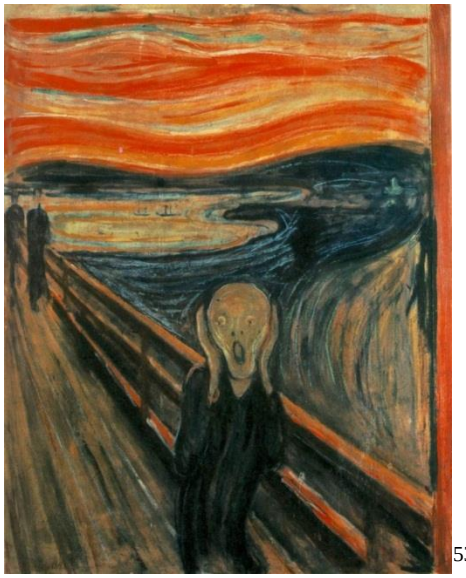
frame, or dissecting a fluid movement into its component motions. [532] The French term *fin de siècle* was used across Europe to describe this as a period of opulence and decadence, mixed with a shared anticipation of unavoidable radical change in the coming century that characterized Europe between the 1890s and the First World War. It was a melancholy period of intense self-awareness, particularly for European writers, like Franz Kafka, and artists like the Norwegian Symbolist Edvard Munch.[533]

Between 1893-1910, Munch created four versions of his famous work "The Scream," as part of his Frieze of Life Series, meant to explore the experience of modern life by depicting themes like love, angst, and death. His image of an agitated figure frozen in a voiceless, open-mouthed scream has since captured the imagination and discomfited sympathy of generations of viewers embedded in a competitive tug-of-war world where the demands of the sequential, *public timescape* take precedence over the private time of the individual.[534]

[532] Examples include the French painter Marcel Duchamp's *Nude Descending a Staircase Number 2* (1912) and the Italian Futurist Giacomo Balla's *Dynamism of a Dog on a Leash* (1912). Blom, *Vertigo,* pp.295-296; Kern, *Culture,* p.84; *A Florida Enchantment* (1914) included in *The Origins of Film*, The Library of Congress Smithsonian Video, 1993.

[533] In a lecture delivered at Cambridge in 1923, the British author Virginia Woolf argued "in or around December, 1910, human character changed," alluding to a mental transformation that subtly but definitely distinguished her generation and their successors from their predecessors. The transformation she referred to was a greater fluidity in social relationships, "those between masters and servants, husbands and wives, parents and children" and the resulting change in "religion, conduct, politics, and literature," but the changes she describes, the heightened self-awareness and stream-of-consciousness reflections that permeated the literature of the age, also reflect the pervasive if, largely unspoken, later stage of the long nineteenth-century's temporal revolution and the conflict between the sequential and simultaneous timescapes. Virginia Woolf quoted in Blom, *Vertigo,* pp.277-279.

[534] Heller, *Munch: The Scream,* (London, 1973); Wood, ed., *Edvard Munch: The Frieze of Life*, (London, 1992).

 [535]

During the war, in retrospect, this time was called *La Belle Époque*; a period of intense nostalgia for Europe's wealthy classes that the war had killed forever. But, *La Belle Époque* was only getting started in 1900. Considered a "golden age" of peace and creativity, it witnessed a series of artistic movements from Impressionism through Symbolism and Art Nouveau, sometimes called the "Belle Époque style" as it spread around the world.[536] Theatre and literature became darker and far more critical of European society and its inherent hypocrisies. Joseph Conrad's 1899 novel, *Heart of Darkness*, showed how the "light of civilization" Britain claimed to cast over its Empire revealed some horrific shadows and ambiguities in European claims of superior morality, while the Anglo-Irish author Oscar Wilde, who shocked a conservative Britain with his homosexuality, pointedly satirized Victorian conventions and values in works like *The Importance of Being Earnest* (1895) and *The Picture of Dorian Gray* (1890).[537]

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[535] http://upload.wikimedia.org/wikipedia/en/archive/f/f4/20100830193250!The_Scream.jpg

[536] Shearer West, "The Visual Arts," in Marshall, *Fin de Siècle*, pp.131-151.

[537] See: *The Cambridge Edition of the Works of Joseph Conrad: Youth, Heart of Darkness, The End of the Tether*, (Cambridge, 2010); Stefano Evangelista, ed., *The Reception of Oscar Wilde in Europe*, (London, 2010), e-book, https://www.dawsonera.com/abstract/9781441173683 (last accessed, 31/3/2016); S.I. Salamensky, *The Modern Art of Influence and the Spectacle of Oscar Wilde*, (Basingstoke, 2012), e-book, http://www.palgraveconnect.com/pc/doifinder/10.1057/9781137011886.0003?focus=true (last accessed 31/3/2016).

The great scientific achievement of universal standard time also fell victim to criticism during this period as individuals who had come of age in a world informed by the *sequential timescape* came to understand that another time sense existed around, between, and underneath the ordered minutes of the clock, standing in direct opposition to the bourgeois sense of future-oriented progress, order and punctuality.[538] This was the time of the itinerant worker, the unemployed, the juvenile delinquent…the philosopher, the author, and the cutting-edge theoretical physicist.[539]

It is a common modern assumption that a standard time system is more straightforward, convenient, and profitable for workers and employers than any local, seasonal, or task-based system.[540] Yet, as the long nineteenth century drew to a close, this assumption was challenged by a generation of thinkers, writers, and innovators, leading to a temporal understanding that would inflate the flat, Newtonian concept of time, enhancing it with Einstein's concept of a unified spacetime continuum.[541] This transition from a sequential

[538] Richard D. Brown, "Modernization: A Victorian Climax," *American Quarterly*, Vol. 27, No 5, Dec. 1975, pp. 533-548. "Many patterns of Victorian culture (steady work, punctuality, compulsive behavior in general) were of direct practical utility to capitalist employers, and they were active agents in propagating them. Older artisan and peasant work habits often were suppressed through the efforts of the new industrialist." Yet, as this project argues, older timescapes do not disappear once displaced but continue to influence thoughts and attitudes, and values. Daniel Walker Howe, "American Victorianism as a Culture," *American Quarterly*, Vol. 27, No 5, Dec. 1975, 507-532; p.514.

[539] Such as Albert Einstein, daydreaming about the relative perceptions of motion held by passengers riding accelerating and decelerating trains and the people standing still at station platforms while he worked at a patent office in 1904.

[540] The temporal straightjacket of the sequential timescape criticized in Kafka's *Metamorphosis* is a theme that is revisited often in the science fiction and cinema of the early twentieth century, notably in Fritz Lang's 1927 film, *Metropolis*, which depicts wealthy industrialists living in leisure while the lower classes work endlessly in the utilitarian depths of the machine rooms to provide them with power, and Charlie Chaplin's satire of the factory experience, *Modern Times* (1936). Such works rarely approach the question of a sequential vs. a simultaneous sense of time directly, but they do develop a definite suggestion of the artificiality of imposed mechanical time, and a sense of liberation when the system is abandoned or breaks down, evocative of the ongoing conflict between the simultaneous and sequential timescapes.

[541] "That we are able to internalize and live with many different time notations, astronomical, biological, private and public was recognized by some of the great writers and musicians of the early twentieth century...More formal attempts to relativize time…are exemplified, in the social sciences, by Durkheim's search for the social origins of different time notations, and, in the physical sciences, by Einstein's idea that 'every reference body has its own particular time.'… [Joyce shows us] Time is neither homogeneous nor linear." Gay, "Clock Synchrony," p.111, footnote 14.

to a simultaneous understanding of time is exemplified by the sense of "temporal rebellion" that is readily apparent in the writings of Joseph Conrad, Franz Kafka, James Joyce, Harpo Marx, and Albert Einstein, and in the newly developed technological marvel that would come to dominate popular culture in the twentieth and twenty-first centuries: moving pictures.[542]

The American harpist and comedian Harpo Marx is best known for not speaking on stage and screen, where he forged a successful career playing the zany pantomimic counterpoint to his brothers' quick tongues and biting wit. Yet, his understanding of time was almost as unique as he was, in that it was representative of a *timescape* that was common before the *sequential timescape* took hold, yet was rarely written about by contemporaries. A shared sense of time is one of those universal presumptions people tend to make and take for granted and, so, rarely directly discuss unless something out of the ordinary happens to make them take notice, similar to the way diary writers tend not to mention a sunny day unless it has been raining for several weeks. But, Harpo's sense of time was so different from that of his younger brothers, his children, and most of his later contemporaries, that both he and his oldest son, Bill Marx, made note of it several times in their respective autobiographies.[543]

Although he was born in New York City in 1888, Harpo had very little exposure to the *sequential timescape* as a child. He dropped out of school in second grade (literally – as the only Jewish kid in his class he was harshly bullied by his Irish classmates, several of whom would gang up to drop him out the classroom window whenever the teacher left the room) and spent most of his youth as a delinquent, lone wolf street kid, picking and selling

[542] See: Kern, *Culture*, (Cambridge, Mass, 1983); Thorold Dickinson, *A Discovery of Cinema*, (Oxford, 1971); Gilbert Seldes, *Movies for the Millions: An Account of Motion Pictures, Principally in America.* Preface by Charlie Chaplin, (London, 1937); *The 7 Lively Arts: The Classic Appraisal of the Popular Arts*, (Michigan, 1957).

[543] Harpo Marx with Rowland Barber, *Harpo Speaks!* (New York, 1961), pp.28-29.

junk to local pawn shops, helping his older brother Chico hustle scratch for cards, pool, and craps games, and taking a long string of odd jobs to help support his family.[544]

"Today, I guess, a kid like me would get all kinds of special attention from the authorities. They'd call me an 'antisocial nonconformist' – and worse," he wrote, looking back in 1961.[545]

> As for myself, I never doubted I had done the right thing when I walked away from the open window of P.S. 86, never to return. School was all wrong. It didn't teach anybody how to exist from day to day, which was how the poor had to live. School prepared you for Life – that thing in the far-off future – but not for the World, the thing you had to face today, tonight, and when you woke up in the morning with no idea of what the new day would bring.[546]

In his article "The Future Cannot Begin: Temporal Structures in Modern Society," Niklas Luhmann noted that it was the expanding influence of bourgeois culture and values during the later nineteenth century that had extended the time horizons of past and future, and oriented the present toward that difference.[547] Separated from the acculturating influence of the highly scheduled, forward-looking public school environment, Harpo remained largely unaffected by that shift. In fact, his writings, and the writings of those who knew him, indicate that he never did come to fully internalize the time management and time planning values associated with the modern, future-oriented *sequential timescape* – a *timescape* that heavily influenced his younger brothers in their later investment, business, and career decisions.[548] Instead, his days were shaped by one-off tasks, odd jobs and chance

[544] Ibid., p.18.

[545] Ibid., p.37.

[546] Ibid., p.27.

[547] Luhmann, "Future," pp.133-134.

[548] Unlike Harpo (Adolph/Arthur), the remaining four Marx Brothers remained in school into their teenage years. As adults, after respectively making the decision to quit performing as part of the Marx Brothers team, Harpo's two youngest brothers, Gummo (Milton) and Zeppo (Herbert), became successful businessmen: Gummo a New York dressmaker, then theatrical agent for his brothers and other clients; Zeppo a theatrical agent before turning to manufacturing and, later, agriculture – all of which required a keen aptitude for making schedules, keeping appointments, and living by the clock. Throughout his life, Harpo's younger brother Groucho (Julius) associated money with success and security. Groucho suffered from anxiety-related insomnia,

meetings.[549] He learned to estimate the local time outside the classroom setting by watching shadows move across the walls of city buildings, a skill that came in useful later in his life when he toured the country as a vaudeville performer – and that his son noted while accompanying him on tour in Britain, when Harpo amazed him by casually giving an accurate estimation of the local time just by glancing at a shadow cast on a wall during their visit to York Minster Cathedral. "Astonishingly," Bill Marx wrote, "Dad was only five minutes fast, and close enough to the real time that we decided that we wouldn't have to buy him a watch for his next birthday."[550]

Recalling his early childhood in 1890s Manhattan, growing up as the second of five surviving sons of poor, immigrant parents, Harpo wrote:

> …I learned to tell time by the only timepiece available to our family, the clock on the tower of Ehret's Brewery at 93rd Street and Second Avenue, which we could see from the front window, if Grandpa hadn't pulled the shade… [When] the shade was drawn, we had to do without the brewery clock, and time ceased to exist. I've had, ever since then, the feeling that when the shades are pulled, or the sun goes down, or houselights dim, time stops… When the sun is out and the shade is up, the brewery clock is back in business. Time is in again, and something might be going on that I'd hate to miss.[551]

particularly after the stock-market crashed in 1929, and was known for a highly punctual attitude that contrasted sharply with his older brothers' more flexible temporal sensibilities – something he repeatedly complained about in his own autobiographies as well as in later published interviews, and which was noted by other family members, friends, and co-workers. From all accounts, Harpo's older brother Chico (Leonard)'s time sense was ruled by his lifelong gambling addiction…a timescape in itself. Groucho Marx, *Groucho and Me*, (New York, 1974); Groucho Marx, *The Groucho Phile: An Illustrated Life*, (New York, 1976); Groucho Marx and Richard Anobile, *The Marx Bros. Scrapbook*, (New York, 1973); Arthur Marx, *My Life with Groucho*, (New Jersey, 1988); Maxine Marx, *Growing up with Chico*, (New Jersey, 1980).

[549] In *Time: The Modern and Postmodern Experience*, the Austrian sociologist Helga Nowotny noted that "In Western industrial societies, the unemployed live in a different time," inhabiting a timescape "where a whole morning's activity is summed up in the statement 'meanwhile it's getting on for lunchtime.'"[549] The early temporal experiences Harpo described in his memoirs are indicative of this "different time," evoking a temporal landscape that sharply contrasts with the sequential, bourgeois temporal construct that dominated (and continues to dominate) the middle and upper-class business world. Instead, it represents the too often overlooked or misunderstood time sense of the poor, underprivileged working and artisan classes who, unlike the self-reflective authors and artists of the era, could rarely afford to buy personal timekeepers and – outside of strikes, rallies, and protests – had little time or inclination to leave records attesting to their understanding and use of time. Nowotny, *Time*, pp.35-36.

[550] Bill Marx, *Son of Harpo Speaks!*, (Milwaukee, 2010), p.79.

[551] Harpo Marx, *Harpo Speaks*, pp.28-29. Although this autobiography states the author was born in 1893, almost every other biography and official source records his birthdate as November 23, 1888. It was a common convention for performers to shave several years off their age, usually for booking and publicity reasons, but

In this brief passage, Harpo quite eloquently describes the distinction between the sequential and *simultaneous timescapes*. The *sequential timescape* is the stratum of the temporal landscape fashioned by the regulated hands of the brewery clock – itself just one hub in a vast, international network of public clocks and private timekeepers all set by their owners to tick in accordance with a global time standard established by the International Meridian Conference in 1884. By contrast, the *simultaneous timescape* is what Harpo experienced when his grandfather pulled down the shade on the front window, blocking his view of the clock and, consequentially, cutting him off from the measured pulse of public time. The *simultaneous timescape* can be described, in a sense, as an 'extended present' – a present that "embraced the entire globe and included halos of the past and future which made it perceptible in the flux of time."[552]

In the temporal landscape of the *simultaneous timescape*, time does not stop or even slow down, but it is measured by relative, subjective experience rather than even, mechanical beats. Each subjective moment is a slice of present time that can be stretched and elongated from the micro-level of the individual mind to the macro-level: a world-scale frieze of all individuals thinking and moving and perceiving that shared expanse of time.[553] This is the

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Harpo's strikingly casual attitude toward pinpointing the calendar year of his birth and sorting out the chronology of his career – "What follows is what I remember," he wrote. "The itinerary is therefore mixed up regarding chronology, places, and names of persons living or dead. But it's Harpo's itinerary, not History's." – along with the fact that, as a teenager, he earnestly maintained a ticking pocket watch without any hands, illustrates a general detachment from the sequential timescape and an affinity for the simultaneous timescape – an affinity Harpo shared with many other contemporary artists, authors, and even scientists (although not with his brother Groucho, who was more a product of the sequential timescape). Harpo Marx, *Harpo Speaks*, pp.103, 58; Bill Marx, *Harpo's Place: The Official Arthur Harpo Marx Family Online Collection*, http://www.harposplace.com/ (last accessed, 21/4/2016).

[552] Kern, *Culture*, p.88.

[553] Regarding the connection between the micro and macro, local and universal, Hopkins wrote: "…there are few, if any, pristine universals. Wherever universals appear, they bear the marks of the locality that produced them and of the contributions made by other sources…Universals succeed best, it seems, when they tolerate difference, concede validity to others, and thus contribute to a cosmopolitan outcome." The same can be said of timescapes. Time may be a universal, but the experience of time is highly subjective and colored by such local markings as individual temperament, cultural upbringing, and even language. The simultaneous timescape is a multi-perspective continuum of these individualized temporal experiences. A.G. Hopkins, ed., *Global History: Interactions Between the Universal and the Local*, (New York: 2006), pp.27-28.

*timescape* that influenced Harpo's idiosyncratic sense of time as well as the time-sense of many who, like him, grew up in poverty at the turn of the century: a highly personal temporal landscape with a keen emphasis on the here and now, while acknowledging the *sequential timescape*, with its emphasis on steady, forward-moving progress, as an integral part of the public, outside world. Harpo explained: "When I was a kid there really was no Future. Struggling through one twenty-four-hour span was rough enough without brooding about the next one. You could laugh about the Past, because you'd been lucky enough to survive it. But mainly there was only a Present to worry about."[554]

Harpo's "now"-centered sense of time was actually more progressive than he, or his family, could have known. While the future-oriented *sequential timescape* that ruled public life might have seemed more tech-forward, it was more suited to the flat chronological framework of Newtonian physics – existing as an abstract overlay that tends to separate the flow of mechanical time from the rhythms of nature and individual perceptions.[555] The *simultaneous timescape,* by contrast, reflects a flexible temporal mentality more in tune with the Einsteinian concept of *Eigenzeit*, or Proper Time: the notion that every individual, clock, or system possesses its own, unique experience of time.

Einstein wrote: "The object of all science, whether natural science or psychology, is to co-ordinate our experiences and to bring them into a logical system. How are our customary ideas of space and time related to the character of our experiences?"[556] The same can certainly be said of the social sciences; and history in particular. The question is, how

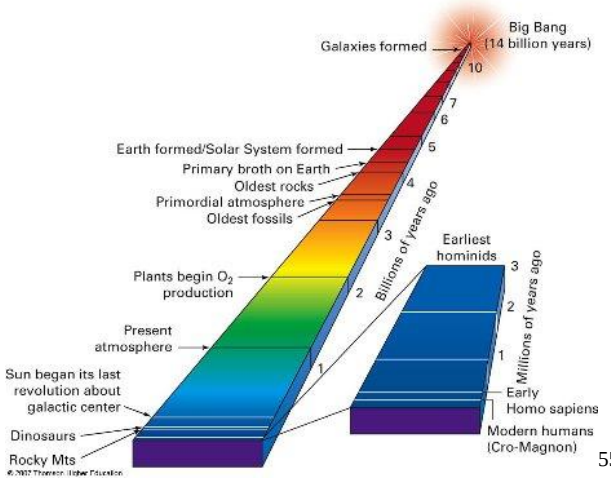
[554] Harpo Marx, *Harpo Speaks,* p.27.

[555] Paul Davies, "Newtonian Time, Einstein, Event Horizons and Black Holes," in Christopher Rawlence, ed., *About Time* (London, 1985), pp.179-180.

[556] Einstein, *Relativity,* p.1.

can such a multifaceted universe of individual and group experiences be ordered, investigated, and analyzed in any meaningful way, and what might that order look like?

The rigid, Newtonian timeline sets up historical experiences like pages in an animator's flipbook, or individual frames in a reel of film. Each page, or frame, would be uniform – a single slice of time, or "now" slice – and would contain a series of individual, frozen snap-shot "now" images all neatly stacked in chronological order. This image of time is intrinsic to the *sequential timescape*: a straight, flat, orderly reel of film rolling itself out from past to future at a steady, measured pace. Though each "now" slice would contain a slightly different "now" image, they would all be the same size and shape, and any slicing or splicing of this linear reel (shared experiences, connected memories, historical analyses) would be from the same angle.



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This rigid, sequential linearity came to represent the accepted, educated, scientific understanding of time in the Western world during the Scientific Revolution, and has since been enhanced by developing technologies: the railway, telegraph, telephone, and synchronized mechanical clocks. Yet, proponents of the *simultaneous timescape* have a different sense of time.

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557 http://www.ifa.hawaii.edu/~barnes/ast110_06/sosat/0101a.jpg (last accessed 10/3/2016).

Physicist Brian Greene explained:

> Until 1905, it was thought that everyone experiences the passage of time identically, that everyone agrees on what events occur at a given moment of time, and hence, that everyone would concur on what belongs on a given page in the flipbook of spacetime. But when Einstein realized that two observers in relative motion have clocks that tick off time differently, this all changed. Clocks that are moving relative to each other fall out of synchronization and therefore give different notions of simultaneity. Each page [or "now" frame]…is but one observer's view of the events in space taking place at a given moment of his or her time. Another observer, moving relative to the first, will declare that the events on a single one of these pages [or frames] *do not* all happen at the same time. This is known as the *relativity of simultaneity*, and we can see it directly.[558]

In Einstein's vision, spacetime is an absolute – the vast continuum in which all things have occurred, are occurring, and will occur. It is our perceptions of that continuum that are relative, based on motion and experienced in time. Here, time does not roll itself out like a flat reel of film, evenly divided into uniform "now" frames. Instead, all events exist together, as if all of spacetime were a vast block, or loaf of bread which can be sliced at any angle, depending on whether the person doing the slicing is moving fast or slow, forward or backward, or simply standing still. Each of these angled slices would therefore encompass a unique, but completely valid, "now" frame, and no two "now" slices would have exactly the same shape. This is the flexible, individualized, subjective time sense intrinsic to the *simultaneous timescape*, and to the notion of *timescapes* in general. In the *simultaneous timescape*, all of history is that loaf of bread, encompassing all events that have occurred, are occurring, and will occur. Each individual slice is, therefore, a *historical timescape*, a slice of history angled to encompass the evolution of a trend, movement, ideology, revolution, or any other development.

Such angled slices can easily cut across the periodizations that divide the flat Newtonian reel of film and encourage comparisons with other uniquely angled, layered,

[558] Brian Greene, *The Fabric of the Cosmos: Space, Time, and the Texture of Reality*, (New York, 2004), p.55.

and/or stacked slices (*timescapes*) wherever they might parallel or intersect. In this way, the *simultaneous timescape* has already, if unspokenly, come to inform the modern concept of history with the Newtonian timeline remaining as a complimentary, regulatory layer differentiating past, present, and future. Braudel pointed out, "Even historians may not notice…at first [the realities we call "structures"]: their habitual chronological narratives are often too busy to see the wood for the trees. To perceive and trace underlying structures one has to cover, in spendthrift fashion, immense stretches of time."[559]

This project aims to stand as an example of this development, illustrating that the ascendance of a new mode of thought – whether it be the long evolutionary timeline supported by Darwin's theories or the Einsteinian concept of block time – does not necessarily invalidate an old one or render it obsolete. Rather, the old and new can take on complementary roles to further historical debate from a variety of angles: particularly from the perspective of the modern world's changing understanding and expectation of time. In that sense, this project is itself a product of the sense of time inherent to the *simultaneous timescape*.

Yet, despite the modern mind's public adherence to the *sequential timescape* at school, in the workplace, and even in sports and other recreational activities, the modern time sense expects time to be relative – viewed by different people from different perspectives like in a movie that, though tied together by a rigid, linear timeline, can be edited to fit commercials (distractions), fast-forwarded to get to the action ("time flies when you're having fun"), or backed up to review the action (reviewing the day's events with friends, family, or in a diary layers the initial experience with a series of related "now" memories in a continually changing context). The notion of history may be "clear cut" in Newtonian

[559] Fernand Braudel, *A History of Civilizations*, Translated by Richard Mayne, (New York, 1995), p.28.

physics – essentially a path, or number of paths, cultures in space follow through time – but "even if history is a unique succession of instants, modeled by a path in configuration space, it can be studied only through records, since historians are not present in the past. This aspect of history is not captured at all by a path."[560] Removing the path – the notion of teleological progress and/or linear movement – in a sense removes history from the Newtonian system, placing it instead into the realm of quantum mechanics – a system that, by its very nature, selects for the most probable configurations.[561] Julian Barbour argued, "quantum mechanics could create a powerful impression of history by direct selection of special configurations that…appear to be records of history. There will be a sense in which the history is there, but…its record, will be the more fundamental concept."[562]

In other words, there are ways to order history beyond the linear Newtonian configuration – organizational, methodological scaffolds that reflect the layered, interpretive nature of the documents historians study and the flexible time sense inherent to a *simultaneous timescape*. Proponents of the *simultaneous timescape* can, therefore, use their flexible understanding of time to manipulate ordered, mechanical time to their individual advantage.

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[560] Julian Barbour, *The End of Time: The Next Revolution in Physics* (Oxford, 1999), p.283.

[561] Despite some debate over the meaning of Einstein's claim that "God does not play dice with the universe," Einstein was not opposed to quantum mechanics (which his own theories helped to inspire and guide). Rather, he objected to aspects of the 1926 Copenhagen interpretation that the observed randomness of quantum physics should be accepted at face value – he felt all theories, including his own, were not final results, just stepping stones on the way to greater knowledge. After all, "the atoms in our brain can behave in a completely deterministic way while still giving us freedom of action because atoms and agency operate on different levels. Likewise, Einstein sought a deterministic subquantum level without denying that the quantum level was probabilistic." In other words, reality – like history – is deeply layered, and the layers, though coexistent, are largely autonomous, allowing for particle-level determinism and human free will, a mechanical time sense (sequential timescape) and an organic time sense (simultaneous timescape), because these aspects of reality operate at different levels. With that famous soundbite, Einstein "was trying to explain the randomness [of quantum physics], not to explain it away." George Musser, "What Einstein Really Thought about Quantum Mechanics: Einstein's Assertion that God Does Not Play Dice has been Misinterpreted," *Scientific American*, Volume 313, Issue 3, (September, 2015), pp. 88-93, /Academic Search Complete/, EBSCO/host/, (last accessed 11/3/2016).

[562] Ibid.

For example, in his autobiography, Harpo Marx described an episode – his family's 1957 New Year's Eve celebration – that notably demonstrated his innate understanding of the inherent flexibility of private time and arbitrary nature of measured public time. "That year we promised the kids they could stay up until midnight on New Year's Eve for the first time," he recalled.

> But then I got to thinking about it. I didn't mind their staying up this late, for one night, but I was afraid [my wife] Susan and I wouldn't be able to make it. We loved holidays, but we were a couple of reformed night owls. I had become such an early bird that I could seldom stay awake long enough to see Groucho's television show, which came on at the ungodly hour of ten. On the morning of December 31, I was the first to get up as usual…I went through the house and set all the clocks ahead three hours. When the rest of the family woke up, they kidded themselves about oversleeping and nobody knew the difference. At nine o'clock on New Year's Eve, our clocks struck twelve. I poured everybody a sip of champagne. We sang "Auld Lang Syne," toasted 1958, kissed each other, and the kids ran off to bed. While I was turning out the lights I heard [my daughter] Minnie say [to her brother], "Hey Jimmy! I think I'm drunk!" Jimmy said, "Nah…it's just the wee small hours that makes you feel dizzy."[563]

W.F. Allen had speculated in his 1883 "Report on Standard Time," that if some mischievous trickster were to set all public clocks "simultaneously and surreptitiously…half an hour faster or slower, not one person out of a thousand would, during the entire month, discover for himself that any change had been made."[564] That was essentially what happened in Harpo Marx's home that New Year's Eve and, apparently, no one was the wiser.[565]

Harpo Marx was an instinctual artist, a self-taught musician, painter, and entertainer who danced to his own beat throughout his life. His *timescape* was the *timescape* of daydreams, of subjective moments within a vast, extended present where the past was already a part of you and the future was something you did not have to worry about until you first

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[563] Harpo Marx, *Harpo Speaks,* pp.455-6. Groucho's television show was the popular, long-running game show "You Bet Your Life."

[564] W.F. Allen, "Report on Standard Time," 1883, reprinted with permission from the New York Public Library. Quoted in Layer Three, p.103.

[565] A similar experiment would likely not work today, due to the ubiquity of digital devices and the televised clocks displayed on news and weather stations and program guide channels.

made it through today, today, and today. It was a *timescape* set in complimentary opposition to the prevailing *sequential timescape*, and it informed the time sense of many of the artists and authors whose work came to embody the ideas and attitudes of the transition from the long nineteenth century to the short twentieth.

Some of the most illustrative examples of the flexible temporal mentality of the *simultaneous timescape* are depicted in the literary works of the Irish author James Joyce. The structure of his books indicate his sense of historical circularity and deeply layered, multi-scaled temporal simultaneity.[566] *Finnegan's Wake* is actually written as an endless loop while, in his seminal work, *Ulysses*, Joyce consciously manipulates narrative time "to show the *simultaneous activity of Dublin as a whole*, not a history of the city, but *a slice of it out of time*, spatially extended and *embodying its entire past in a vast extended present.*"[567] From this perspective, the setting of *Ulysses* is not so much Dublin, the place, but a unique slice of time derived from the flexible temporal outlook inherent to the *simultaneous timescape*, extending from the microcosm of individual thoughts and daydreams to the macrocosm of the city of Dublin, the thoughts and actions of its inhabitants, and the thoughts and actions of all the inhabitants of the universe beyond. It even includes the *timescapes* of Joyce's earlier work, as some have speculated "the first three parts of *Ulysses* [1922], often called the *Telemachia*, may represent the completion of a cycle begun in the last chapter of *A Portrait of the Artist as a Young Man* [1916]…"[568] The *simultaneous timescape* of the book encompasses the time of every reader and every reading and re-reading that has taken, is

[566] M. Church "Fiction: The Language of Time – Thomas Mann and James Joyce," in J.T. Fraser, N. Lawrence, D. Park, eds., *The Study of Time III: Proceedings of the Third Conference of the International Society for the Study of Time* (New York, 1978), p.503.

[567] Kern, *Culture*, p.77. Italics added.

[568] M. Church, "The Language of Time," p.504.

taking, and will ever take place.[569] The historian Stephen Kern explained: "Joyce hoped his readers would go back to the book many times, continually building up the network of cross references scattered throughout until Dublin came to life."[570]

In the years since its initial publication – first as a serial, starting in 1918, and later as a novel published in 1922 – *Ulysses* has been praised and condemned almost in equal measure, in part for its controversial subject matter, but also for its structure, which has been described by some as unreadable, and others as transcendent. As a verbal depiction of simultaneity – a reality that directly contradicts the linear, sequential experience of reading (or speaking, or thinking) word after word, paragraph after paragraph – it takes a reader used to chronological storylines and character development a great deal of mental effort to accept the stream-of-consciousness flow of the writing, the historical and cultural allusions, and the jolting, half-formed impressions that make up most of the characters' internal monologues…particularly the rambling, unpunctuated final section that spans some forty plus pages, depending on which edition is being read.[571]

Explaining his decision to lift the ban imposed on the importation of *Ulysses* into the United States on the grounds that it was an "obscene" work, US District Judge John M. Woolsey wrote:

> Joyce has attempted – it seems to me, with astonishing success – to show how the screen of consciousness with its ever-shifting kaleidoscopic impressions it carries, as it were on a plastic palimpsest, not only what is in the focus of each man's observation of the actual things about him, but also in a penumbral zone residua of past impressions, some recent and some drawn up by association from the domain of the subconscious. He shows how each of these impressions affects the life and behavior of the character which he is describing. What he seeks to get is not unlike

[569] This also implies the shifting political, cultural, technological, historical realities of successive generations of readers, which often lead to differing interpretations of a literary piece, its value, and its continued relevance to modern audiences. As Hans Robert Jauss argued, the experience of reading is not merely individual, but enmeshed in "Horizons of Expectation" informed by each period's conventions. Hans Robert Jauss, *Toward an Aesthetic of Reception*, (Minneapolis, 1982), pp.3-45.

[570] Kern, *Culture*, p.77.

[571] James Joyce, *Ulysses: The 1934 Text, as Corrected and Reset in 1961*, (New York, 1992), pp.738-783.

> the results of a double exposure on a cinema film which would give a clear foreground with a background visible but somewhat blurred and out of focus in varying degrees. To convey by words an effect which obviously lends itself more appropriately to a graphic technique, accounts, it seems to me, for much of the obscurity which meets a reader of "Ulysses." And it also explains another aspect of the book, which I have further to consider, namely, Joyce's sincerity and his honest effort to show exactly how the minds of his characters operate."[572]

In writing and structuring *Ulysses*, Joyce was inspired by the temporal, technological, political, and cultural triumphs and transitions of his time – particularly by the manipulation of time and emotion possible in music and the new, highly flexible medium of the cinema, which had the ability to visually portray simultaneous action by intercutting the perspectives of various characters, and by making use of the cinematic montage to flash back or flash forward from the 'present' – to "fan out" the traditional sequential narrative "into a 'continuous' or 'prolonged present,'" thereby creating an "elaborate image of simultaneity" representative of the *simultaneous timescape* that exists apart from the *sequential timescape*, yet remains connected to and punctuated by its linear beats.[573] In M. Church's view, Joyce's jolted descriptions and spiraling structures indicate "that development of civilization moves from stress on outer worlds to stress on inner worlds," the depths of the inner world turning out to be just as infinite as the "impossible space" of the outer universe.[574] The main idea, though, is that all time is shared time; that each moment that passes is its own unique frieze filled with the thoughts, actions, and experiences of a vast universe of chatting friends, cheating lovers, crumbling mountains and burning stars.

This structure-shattering epiphany lies at the heart of the complex, contradictory, multilayered nature of the modern understanding of time, and marks the culmination of a powerful, mind-altering temporal revolution that spanned the long nineteenth century;

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[572] John M. Woolsey, "The Monumental Decision of the United States District Court Rendered December 6, 1933, by Hon. John M. Woolsey Lifting the Ban on "Ulysses," in Joyce, p.xv.

[573] Quoted in Kern, *Culture*, pp.88, 80.

[574] M. Church, "The Language of Time," p.508.

namely, the conflict between two valid, concurrent, yet divergent temporal landscapes: the rigid *sequential timescape* of public, mechanical time and the flexible *simultaneous timescape* of relative experience. Ultimately, by identifying the various temporal landscapes that informed the conflicts that drove this temporal revolution, layer by layer, paradigm shift by paradigm shift, this project has shown that by using *timescapes* as an analytical tool, historians gain a more flexible methodology that can aid in the analysis of complex, layered events or movements at any scale, thereby supporting the hypothesis that Britain's nineteenth-century "temporal revolution" was not indicative of a sharp, irreversible break in linear time between the pre-industrial and the industrial world but, rather, of a multi-phased, ongoing conflict between layers of coexisting yet divergent *timescapes* – culturally-informed spatiotemporal archetypes that, once supplanted, did not fade but continue to this day.

*SIGNPOST 3*

The aim of this concluding chapter has been to examine the point where the various threads of the nineteenth-century's temporal revolution that have been explored throughout this project gather together before branching out again to diverge, intertwine, and burrow into the twentieth and twenty-first century experience of time: namely, the conflict between the divergent worldviews inherent to the sequential and *simultaneous timescapes*. Represented by the struggle between Ruth Belville and the Standard Time Company, the *sequential timescape* brings together aspects of the mechanical, progressive, and *public timescapes* to create a universal system of standard, synchronized clock time that starts at the Prime Meridian and strictly regulates the modern business world. This *timescape* is built on a population's trust in the technological infrastructure required to maintain a global network of standard, mechanical time. As seen in the case of the tech-forward Standard Time Company's competitive attack on Ruth Belville's quaint time service, until that trust is established, the temporal landscapes informed by new technologies struggle to take effective hold. The *simultaneous timescape*, by contrast, represents the more subjective, private, sensual aspect of time that exists beneath, around, above, and between the ordered seconds, minutes, and hours measured out so precisely by standardized mechanical clocks. Endorsed by the self-reflective artists, authors, critics, and theorists of the turn of the century, such as James Joyce, Albert Einstein, and Harpo Marx (in his memoir), this is a *timescape* that stands in opposition to the uniform beats of the future-oriented bourgeois temporal construct that dominates the public, business world and represents the often overlooked, discounted or misunderstood temporal experience of young children, the underprivileged working classes, the unemployed (such as Kafka's unfortunate character, Gregor Samsa), and any other group that finds itself separated from the acculturating influences of standard, sequential, mechanical time, purposefully or otherwise.

Despite their differences, these divergent *timescapes* are complimentary and rely heavily on an industrialized, technological network capable of maintaining a global time system in order to effectively influence a population's understanding and use of time. This is why the struggle between the sequential and *simultaneous timescapes* represents the culmination of the long nineteenth-century's temporal revolution, and a starting point for what, with the outbreak of the First World War, would soon develop into the even more complex and layered understanding of time that characterizes the twentieth and twenty-first century experience. After all, as this project has sought to illustrate, Britain's nineteenth-century "temporal revolution" was not indicative of a sharp, irreversible break in linear time between the pre-industrial and the industrial world but, rather, of a multi-phased, ongoing conflict between layers of coexisting yet divergent *timescapes* – culturally-informed spatiotemporal archetypes that, once supplanted, did not fade but continue to this day.

# CONCLUSIONS: IMPACTS OF THE TEMPORAL REVOLUTION

*We shall not cease from exploration*
*And the end of all our exploring*
*Will be to arrive where we started*
*And know the place for the first time.*[575]

In his 1999 article, "Time and History," Felipe Fernández-Armesto spoke of a "great upheaval" in the way modern science represents time, and of the subsequent effects that new representation has had on historians. He dated the upheaval to 1905,

> when Einstein emerged, like a burrower from a mine, to detonate a terrible change. The realisation that time is not objective or absolute, but that every observer has his own time, which varies according to his speed and vantage point…had a belittling effect on the kind of chronological researches in which historians traditionally engaged. The fashion for experimentation with chronology – or perilously neglecting it – is among its liberating or confusing effects…The order in which we perceive events – and therefore the structure of cause and effect we infer from this order – is negotiable.[576]

More than a century earlier, in 1882, Grant Allen made a comparable assertion regarding the impact made by Charles Darwin's work on evolution several decades before:

> In 1859, the *Origin of Species* at last appeared... It was nothing less than a revolution; it marks the year 1 of a new era, not for science alone, but for every department of human thought… [I]n its immediate influence upon the world the *Origin of Species* was the real proximate cause of the great mental revolution of the present century. There were many auxiliary forces, but Darwin was the general who led them to victory… [T]he influence of his thought upon the thought of the age has far outweighed any influence ever before exerted by a single man during his own lifetime. He has revolutionised, not biology alone, but all science; not science alone, but all philosophy; not philosophy alone, but human life. Man, his origin and nature, his future hopes and realisable ideals, all seem something different to the present generation from their seeming to the generations that lie behind us in the field of time.[577]

H.G. Wells described the mentality of his time in 1901: "It is as if a hand had been put upon the head of the thoughtful man and had turned his eyes about from the past to the

[575] T.S. Eliot, "Little Gidding," *Four Quarters*, http://www.columbia.edu/itc/history/winter/w3206/edit/tseliotlittlegidding.html (last accessed 19/4/2016).

[576] Fernánzez-Armesto, "Time and History," p.249.

[577] Allen, "Obituary," pp.306-7.

future."[578] A generation later, Virginia Woolf told her Cambridge audience that "in or around December, 1910, human character changed," alluding to a mental transformation that subtly but definitely distinguished her generation and their successors from their predecessors.[579] In each of these passages, these very different authors from very different times described a very similar paradigm shift – a socio-temporal transition that is often alluded to but rarely discussed directly or at length by historians. A temporal revolution.

### *Temporal Revolutions: Reprised*

This project has argued that nineteenth-century Britain did experience a deeply transformative temporal revolution – a complex shift in mentality directly linked to changes in a culture's dominant temporal worldview – and that this primarily mental upheaval can be effectively analyzed using Einstein's flexible notion of relative times. The past four chapters have demonstrated that, when adapted to the analysis of history as individual temporal slices and used in conjunction with the traditional linear timeline, Einsteinian *timescapes* can serve as an effective, practical methodological tool for identifying, tracing, and parsing out the key elements and catalysts that drove this multifaceted upheaval.

The temporal revolution investigated here is a multi-phased, multi-generational conflict that increased in complexity at each stage, as new temporal frameworks developed and were assimilated into daily life: added to the continuum of relative individual and shared temporal experience. Each of this project's four main chapters (layers) identified and analyzed two divergent, yet concurrent, *timescapes* and key catalytic conflicts that fed the transition from one temporal outlook to another: conflicts that characterized contemporaries' changing concept, experience, expectation, and practical use of time. Labeled Seasonal to

[578] Wells, *Anticipations*, http://www.gutenberg.org/ebooks/19229 (last accessed 20/4/2016).

[579] Woolf in Blom, *Vertigo*, p.277.

Mechanical; Retrospective to Progressive; Private to Public; and Sequential to Simultaneous, these chapters followed the thread of the temporal revolution through an increasingly layered context of scientific and technological discovery and personal reflection, tracing Britain's evolving temporal understanding as it developed from a pre-industrial, highly local *seasonal timescape* of astronomical observation through the linear, abstracted beats of mechanical, industrial, public time, toward the inclusive spatiotemporal continuum of the *simultaneous timescape*, in which all time is shared time, and temporal experience – including accepted time standards – is viewed as relative and relational. In this case, the flexible, nonlinear structure *timescapes* afford proved useful, but can – should – they be applied more generally?

### *Revisiting a Temporal Crisis*

It has long been argued that the modern discipline of history is in crisis, that its narrow, chronological layout has increasingly been found to be too rigid for more subtle socio-cultural investigations, resulting in endless debates over periodization and the subjective nature of key historical dates. This project asked: in this post-'postmodern' era where history, instead of being interpreted as "one meaningful process," is understood as "a pluralism of narratives touching on the existential life experiences of many different groups," is the timeline that shaped the discipline of history back in the nineteenth century still the best way to go…or, in some ways, has it begun to hold the discipline back?[580] Is there a practical way to address this temporal crisis without threatening the fundamental structure of history? Through the preceding four chapters, this project showed how supplementing the historical timeline with individualized *timescape* slices, or layers, could be one potential route.

[580] Iggers, *Historiography*, (Middletown, CT, 1997), p.143; Bauman, *Liquid Times*, (Cambridge, 2007).

Yet, similar structural questions have been asked before and several attempts have been made to crack this puzzle, perhaps most notably Reinhart Koselleck's notion of the "Sattelzeit" – a term Koselleck coined to exposit the transition from Early Modern to Modern Western History in the decades around 1800. Koselleck's argument encompasses the perceived acceleration of time that took place during and after the French Revolution, often viewed through the lenses of political and social change, as well as nineteenth-century Europe's shift from cyclical, seasonal time to a linear understanding of past, present, and future.[581] But, because the concept of the transitional Sattelzeit is itself a function of the modern sense of chronologically organized historical time, it does not easily transcend the strict, sequential structure of the abstract, linear timeline, which makes it somewhat tricky to use as a methodological tool to analyze the layered story of time and temporal perception as a historical topic in and of itself.[582]

This difficult issue also applies to other paradigms. From the mid-nineteenth through to the early twenty-first centuries, the pervasive influence of the linear, historical timeline shaped the structure of historical works and provided firm scaffolding for the concepts and theories of the discipline's frontrunners, from Braudel to Foucault and beyond. Yet, since the short timeframes and the "long periods of time and imperceptible evolutions" of the past inherent to Braudel's *longue durée* are structurally informed by the linear, Newtonian timeline, this puts quick ruptures, or revolutions, and long-term shifts in mentalities or worldviews in separate, even contradictory timeframes.[583] Such contradictions make it nearly impossible to reconcile the intricate, individualized layers of the temporal revolution using a strictly linear historical framework, be it Braudel's *longue durée*, Emmanuel Le Roy

[581] Koselleck, *Conceptual*, p.x.

[582] Rosenberg, "Timelines", pp.283-295.

[583] Jacques Revel and Lynn Hunt, *Histories*, p.22.

Ladurie's history of mentalities, or Koselleck's notion of the *Sattelzeit*.[584] In addition, while in Foucault's view, the transition from one historical episteme to another was marked by crisis, conflict, and violence, his epistemes themselves were relatively homogenous periods of general intellectual consensus. The temporal revolution was characterized by intellectual frictions; by layered series of conflicts coexisting on multiple scales, from the individual to the global.[585] As this project has demonstrated, the nonlinear approach afforded by *timescapes* offers the flexibility necessary to deal with a multiplicity of scales and frameworks without abandoning the structure of the historical timeline.

As discussed in the Introduction, chronological complications seem to appear so frequently in modern history because history, like time, is more than a static, orderly timeline of ended events.[586] It is a complex spatiotemporal continuum; a spectrum of layered, overlapping, intersecting *timescapes* that, together, encompass the whole of recorded human experience – including the experiences and interpretations of historians and their ever-evolving methods and historiographies. This study was, therefore, structured to investigate the nineteenth-century's temporal revolution not as a timeline, but as a spectrum of *timescapes* organized, not strictly by chronology, but by theme. The primary aim of this project has been to support the argument that the nineteenth-century temporal revolution indicates – not a sharp break between the pre-industrial and industrial world (in Britain, or other industrialized nations, like the US) – but, a multi-phased, ongoing conflict between layers of coexisting yet divergent *timescapes*.

[584] Koselleck, *Conceptual*, p.x.

[585] For example: "timescape bias," discussed in Layers One and Four, and the gulf between the seasonal and mechanical timescapes neither Harrison nor the Board of Longitude could bridge, pp.60-104.

[586] See Introduction.

*TIME AND HISTORY, REVISITED*

One of the most persistent challenges facing this project has been the question of how to approach and frame a topic as complex and expansive as the temporal revolution: how to trace a predominantly mental revolution, find relevant primary source examples left by the people who lived through it, and how to organize the project effectively without constantly having to backtrack or make awkward jumps to trace and explain concurrent developments, or losing the thread in the convoluted historical tapestry woven by contemporaries and subsequent historians.

When viewed in conjunction with the limitations inherent to the traditionally chronological historical framework, such difficulties are likely a significant reason for the notably sparse amount of secondary literature that explicitly focuses on the understanding and use of time from a specifically historical perspective.[587] Studying time is, more often than not, like trying to see the wind – the wind itself is invisible, but the effects can be tracked: from softly rustling leaves and swirling sand to devastating tornadoes and hurricanes. The evidence for a nineteenth-century temporal revolution is there, in the records, but it is broadly and wildly scattered across disciplines, social classes, continents, and generations. In order to detect and trace the underlying threads of the transitional conflicts that drove this revolution, one must step back far enough to observe, not just the rustle of a leaf, or a tree, but the whole temporal landscape, which is why the scope of this project extends from 1750, the year Britain brought its calendar in line with Europe's, to 1914, to end just before World War I helped launch the ongoing temporal revolution into a new phase that would mark the twentieth and twenty-first century experience and expectation of time.

[587] For more regarding the significant gap in available secondary literature, see Introduction.

It can be argued temporal revolutions share similar triggers with geospatial revolutions. But, because they are less visible, they seem less immediate and, therefore, historians' general recognition and analysis of these highly transformative mental revolutions tend to lag behind geographically, politically, or economically mapable historical changes. This can be seen with the Copernican revolution, discussed in Layer Two, and its effects on the development of the long, geological, evolutionary timescale that rose to prominence during the age of Lyell and Darwin. In this case, the temporal conflict between proponents of the short, biblical timescale and the long, geological timescale stayed mainly a sideline until the 1859 publication of Darwin's research brought the concept of long, evolutionary time to the forefront of what quickly developed into the "Darwin vs. God" debate. A similar lag can be observed in the twentieth-century, starting with the shift in the global balance of power during the world wars and culminating in the rigid two-pronged standoff between the US and USSR that characterized the Cold War era. During that time, political maps and historical frameworks changed significantly, but it was not until the 1980s that a distinctly historical interest in time became apparent, and a brief burst of secondary literature was published the subject.[588] When the Cold War ended in 1989, a fresh geospatial revolution displaced this brief spike in interest until after the millennium turned. Only now is time coming back to the fore as a valuable topic for historical research, indicated by a recent increase in the number of time-related historical publications and the fact that several recent scholarly conferences have touted the question of historical time as a guiding theme.[589]

[588] For example, Fraser, Howse, Whitrow, Kern, Koselleck, Schivelbusch, Landes, Gould, Wilcox and even Hawking published their major works on time in history and the history of time during the 1980s, indicating a general peak in interest. Aside from popular physics books, like those by Brian Greene, there is a notable dearth of secondary literature during the 1990s-mid 2000s, remaining few and far between into the 2010s with notable contributions by Mansfield and Ogle.

[589] Examples include the interdisciplinary conference "Tales About Time" held at the German Historical Institute, London, 29 November, 2012 and the International Society for the Study of Time's Triennial Conference: "Time and Trace," held at the Orthodox Academy of Crete from 30 June - 6 July, 2013, as well as my own international, interdisciplinary workshop, "*The Changing Experience of Time in the Long Nineteenth-*

This peak and drop in general interest is not surprising given that a temporal revolution is a revolution of mental transition, of shifting identities and values, ideas and practices of time. As long as the transitional shift is still in progress, it can be difficult for contemporary historians to recognize the change, find perspective, or capture the full picture in their analyses. In many ways, undertaking an historical analysis of something as universal as time is to undertake an analysis of the obvious – to have to locate points and phases where the invisible or presumed becomes explicit, and identify the contentions between divergent ideas of what time is, what it means, and how it feels. Because temporal revolutions are more mental than physical and generally nonviolent, the buildup to distinguishable cultural, ideological change takes longer than social or political revolutions, even if symptoms indicate that change well before the shift is widely recognized.

All revolutions are triggered by some level of dissatisfaction with the way thing are, all revolutions result in a shift in mentality among affected populations, and temporal revolutions can ride the currents and eddies of those changing winds. As geospatial and political boundaries and blocs shifted after the end of the Cold War, views and expectations of time also changed, moving from Newtonian to Einsteinian, from inevitable to uncertain, from stiff and absolute to flexible and relative. A similar transition accompanied the aftermath of the American and French Revolutions as changing needs and expectations of time stimulated a shift from the short, biblical timescale to the long evolutionary timescale, from a sense that the future was inevitable to a sense that it was uncertain and changeable, to the notion that populations were static to the understanding that they were adaptable.[590]

Yet, as this project has endeavored to illustrate, despite these changes, previously dominant *timescapes* do not disappear, they carry on, influencing a population of increasingly

*Century: Local, Regional, Transnational and Global Perspectives," held at the University of St Andrews* 18-19 May, 2012.

[590] See: Layer Two.

diverse ideas, truths, and worldviews that often refuse to merge. Rather, they form complex layers, defined by records left by individuals, by mill girls and railway workers, authors and performers, scientists and inventors, historians and social theorists: the multitude of experiential and methodological angles that comprise the multifaceted continuum of ongoing history.

### *Navigating Scales: Revisiting a Flexible, Analytical Framework*

Each of the four main chapters, or overlapping layers, of this project was designed to identify, then investigate two divergent, yet related, *timescapes* and the key catalytic conflicts that fed the transition from one temporal outlook to another: conflicts that characterized contemporaries' changing concept, experience, and practical use of time. I labeled these transitions: Seasonal to Mechanical; Retrospective to Progressive; Private to Public; and Sequential to Simultaneous. Because this project's focus spanned the nineteenth century, with spillover into the eighteenth and twentieth, the cases investigated acted as specific examples grounding a necessarily broad framework and could not, therefore, be exhaustive regarding the subjects' lives and works. Britain was chosen as the principal focus of this study because, long recognized as the birthplace of the industrial revolution, it was the first nation directly influenced by industrial time. The geographic scope of this project remained limited, primarily, to British and American sources because of shared cultural, technological, and linguistic ties that informed how they perceived and discussed time.

This project has sought to demonstrate, not only the ongoing significance of the nineteenth-century's temporal revolution, but the viability of *historical timescapes* as a methodological, structural, and analytical tool: one that can complement, rather than displace, the traditional chronological structure of history. By employing *timescapes* to help identify and examine the various stages in which nineteenth-century Britain's shifting

understanding of time became explicit – and even revolutionary – this project showed how a deeply and repeatedly studied period can be viewed and analyzed from a fresh angle, supporting the argument that Britain's nineteenth-century temporal revolution did not indicate a sharp, irreversible break in linear time between the pre-industrial and industrial world but, rather, an ongoing conflict between layers of coexisting yet divergent *timescapes*.

Because *timescapes* are nonlinear temporal 'slices' delineated by themes and perspectives outlined by sources rather than by strict chronology, they have the flexibility to transcend scales, allowing an analysis to compare and contrast individual experiences and global trends, whether concurrent or generations apart. The structure of each chapter demonstrated this function: each chapter, or layer, being subdivided into two main sections – the first explaining the nature of the two *timescapes* to be discussed and the conflict between them, the second zooming in on a contemporary individual, or individuals, whose experiences exemplify the complex and layered nature of each shift – individuals who, in some significant way, straddle the divide between the two divergent *timescapes* in question, often becoming a focal point of contention for proponents on both sides. The structure of these chapters, and this project, demonstrate the usefulness of *timescapes* to historical investigations into highly subjective, often invisible or overlooked topics like time and temporal experience, allowing such studies to transcend scales and investigate concurrent developments without losing the familiar scaffolding of historical chronology.

Ultimately, this project employed the concept *timescapes* to bring the temporal revolution to the forefront of Britain's industrial experience and show that, like the printing press, the telephone, and the electric light, the advent of mechanical time (and all its implications) is a key transitional factor in the evolution of the modern world, worthy of further in-depth study. As the temporal revolution continues in a new phase, shaping and influencing the ever-growing complexity and sophistication of the twenty-first century

experience, expectation, use, and understanding of time, perhaps the flexible, relativistic nature of *historical timescapes* will encourage greater interest and a richer dialogue on the topic of time, history, and the temporal revolution.

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