HISTORICAL ENCOUNTERS
A journal of historical consciousness, historical cultures, and history education
ISSN 2203-7543 | Peer-Reviewed Open Access Journal

The language of power: Science, civilization, and words

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ABSTRACT: This paper considers how concepts drawn from scientific inquiry inform our understanding of history, and more specifically, the discourse of civilization. Its intent is to explore how terms with origins in Early Modern and Enlightenment era scientific thought became part of the lexicon which we still use to describe social, political and economic conditions. Words like Power, Force, Mass, and Energy are integral to our understanding of the world and the idea of civilization that frames our impressions of it. Similarly, concepts like Order and Chaos also have a profound impact on our worldview, and are fundamental to our perception of civilization as a concept. By exploring how these words came to be used to describe society as it was developing in the 16th-19th centuries, we can better appreciate how our present understanding of the world is shaped by the historical forces that were unleashed during this important period. Through an examination of the words we use to explain the world we live in, and inquiring as to how their origins inform and shape our perspectives of it, we can begin to appreciate how truly subjective our understanding of the world really is. In doing so, we can more fully understand a historical past before such language was prevalent, and also begin to conceive of a future which moves beyond it.

KEYWORDS: Civilization; language; energy; power; force; mass; entropy; chaos; order

Introduction

Words mattered to Thomas Hobbes. In Part I of his 1651 treatise *Leviathan or The Matter, Forme and Power of a Common Wealth Ecclesiasticall and Civil,* the author complained that much of the intellectual discourse of his day confused everyday terms in ways that obfuscated or otherwise negated meaning:

> When a man upon the hearing of any Speech, hath those thoughts which the words of that Speech, and their connexion, were ordained and constituted to signifie; Then he is said to understand it…but when we Reason in Words of general signification, and fall upon a general inference which is false; though it be commonly called Error, it is indeed an ABSURDITY of senseless Speech.' (Hobbes, 1651/1914, pp. 17-20.)

My interest in invoking Hobbes' complaint is twofold. Firstly, it provides us with an intellectual precedent to examine the words we use to describe historical and contemporary circumstances. Secondly, his alternative title invokes the very concepts I seek to explore in hopes of advancing an understanding of those past and present conditions. *The Matter, Forme and Power of a Common Wealth Ecclesiasticall and Civil* combines the language of physics and statecraft in a way that has historically served to mutually reinforce the legitimacy of each other.

This paper is about the words we use to describe history. Certain words in the historical vocabulary carry scientific connotations, and it's hard not to wonder how that came to be. We use words like 'power,' 'energy,' 'force,' and 'mass' quite a bit when we're explaining historical conditions, circumstances, and events. They appear early in the professionalization

PLEASE CITE AS: Kimaid, M. (2019). The language of power: Science, civilization, and words. *Historical Encounters: A journal of historical consciousness, historical cultures, and history education*, *6*(1), 40-53.

ISSN 2203 7543 | © Author | Publication Date: 15 August 2019

of the discipline. Hegel, Marx, and Von Ranke used the words recurrently in their analyses of historical conditions. Did science influence history, or did statecraft influence science? When we use these words, do they legitimize our observations because we appropriate the factual nature of scientific inquiry, or do they obfuscate or otherwise misrepresent the very things we're trying to explain?

Science, and more specifically physics, became a popular and authoritative means of inquiry in the age of Enlightenment. Its language and terminology, borrowed from ancient Greek and Latin, served to underscore and legitimize the emergent political structures, economic theories, and social hierarchies of the era. Ultimately, the language of physics became knotted with the language of civilization itself as the concepts contemporaneously emerged alongside each other. Their reciprocal terminology and conceptual frames: energy, power, force, and mass; order and chaos, became transposable and mutually reinforcing. By examining the origins of their connections, we can better understand the historical conditions in which these terms and understandings derived, and their implications for us in the present.

History, as an emergent discourse during this period, was largely an instrument for elites to explain, rationalize, and justify their beliefs and actions. To that point, their stadial view of history placed civilization as the pinnacle of human development and achievement, while their writing on the subject sought to institutionalize that view as factual and absolute (McCoy, 1980). Political economists, philosophers, and politicians wrote history in a way that tracked a linear progression of human social, political, and economic endeavor that they perceived as increasingly sophisticated, refined, productive, and purposeful. Writers like Adam Ferguson, Mirabeau, David Hume, Jean-Francois Melon, and Voltaire framed these concepts as justifications for new structures and institutions that enforced the interests of civilized society. To that end, history was a device with which the emergent commercial ruling classes imposed the ascendency of civilization as a concept and as an organizing principle upon those subject to their increasingly comprehensive authority.

These issues are bound up in a larger question worth considering: 'what is civilization?' These terms: energy, power, force, and mass; order and chaos, are woven into the intellectual fabric of our present day concept of civilization. Therein lie all the necessary features for a preliminary conversation of the subject: We rely on these concepts to understand and express the complexities of cities, agriculture, the arts, technology, religion, economy, and politics. Most articulations of civilization as a definition include these elements in some form or another. Still, the concept remains a vague one. Even Lord Kenneth Clark, whose 1969 BBC documentary on the subject was broadcast in sixty countries, conceded in his accompanying book: *What is civilization? I don't know* (Clark, 1969).

What Is Civilization?

But what is this thing that, like Saint Augustine's reflection on time, we know until we are asked to describe it? The term civilization appears as a noun in the mid-18th century. Mirabeau first used the term as we understand it currently in his economic treatise *L'ami Des Hommes ou, Traite de la Population* (1759-62), and the philosopher Adam Ferguson followed shortly thereafter with an English application of the term in his *Essay on the History of Civil Society* (1767). Both Mirabeau and Ferguson applied the concept of civilization to a progressive or stadial view of history, viewing it in an ideal frame consistent with Enlightenment models of social, political and economic improvement over time. From its inception, the idea of civilization has been held up as the apotheosis of human endeavor, something to aspire to, achieve and uphold at all costs.

Definitions are often bound up with agendas. Lord Kenneth Clark (like Mirabeau and Ferguson before him) was preoccupied with validating Western Civilization as an ideal; something preferable to 'barbarism.' Others since have articulated a more inclusive worldview, but still hold the concept of civilization up as something model, aspirational and exemplary. Susan Wise Bauer suggests that in the wake of the Neolithic Revolution, where nomadic hunter-gatherer models of social organization gave way to more permanent agricultural settlements, life became so complicated, society needed a hierarchy. From this need arose a fundamental aspect of civilization: order, as something distinct from chaos previous to its inception. Chaos, among people or the natural world they inhabit, then required management which imposed order, resulting in a civilized condition (Bauer, 2007).

Others have taken exception to the congratulatory tone of writers like Mirabeau, Ferguson, Clark and Wise-Bauer. Fredy Perlman argued that civilization is an inherently destructive entity, a beast. Directing his ire toward 'The Western Spirit' in particular, he argued that civilization takes away our freedom rather than protecting it, and renders us subservient to systems that exploit us and rob us of our essential nature as human beings (Perlman, 1983). John Zerzan maintains that everything we've been taught to fear about primitivism, Hobbesian ideas of a 'war of each against all' in which life is 'short, nasty and brutish' are in fact manifestations of civilized life (Zerzan, 2002). Derrick Jensen contends that civilization is neither sustainable nor redeemable, and that its entire existence is a result of systematic violence and privation (Jensen, 2006).

Whether congratulatory or critical, most analyses of civilization as a concept agree on basic elements. Modern scholars generally affirm an urban axis of some sort. The root of the word comes from the Latin *civitas*; city. From this geographical concentration of people and resources, the academic concept of civilization expands to include patterns of intellectual, social, political and economic interaction. Chester Starr suggests that civilization is 'the presence of firmly organized states which had defined boundaries and systematic political institutions, under political and religious leaders who also maintained society; the distinction of social classes; the economic specialization of men as farmer, trader, or artisan, each dependent upon his fellows; and the conscious development of the arts and intellectual attitudes' not the least of which included the development of writing (Starr, 1991). The multiple authors of the eleventh edition of the Pearson textbook *Civilization: Past & Present* echo Starr's assertions:

> …civilization is a culture that has attained a degree of complexity, characterized by urban life and the interdependence of those urban residents. In other words, a civilization is a culture capable of sustaining a great number of specialists to furnish the economic, social, political and religious needs of a large social unit. Other components of a civilization are a system of writing (originating from the need to keep records); monumental, permanent architecture in place of simple buildings; and art that is not merely decorative, like that of Neolithic pottery, but representative of people and their activities (Brummett, Edgar, Hackett, Jewsbury, & Molony, 2006, p. 10) .

J.M. Roberts is in agreement, though somewhat more indirect, using 'complexity' as a litmus in contrast to 'primitive' communities, and citing writing, cities, monumental architecture, technological achievement, agricultural surpluses and a human capacity 'to take advantage of an environment or rise to a challenge' as elements which mark out a particular society as civilized (Roberts, 2003). This idea of complexity, a term with implications in physics, offers a bridge between the two disciplines that may offer us some insight as to what it is we are considering.

Hypothesis, Thesis, Exegesis

Most considerations of civilization as a subject of inquiry contain some arrangement of these elements: Cities, religion, hierarchy, trade and commerce, technology, intellectual progress, and so forth. What this inquiry seeks to address is: what are the underlying factors that drive these patterns? What does critical analysis of the concept of civilization expose beneath these recognizable, oft repeated conditions? Not necessarily criticism in the sense of disapproval or condemnation, but a critical approach driven by inquiry and a search for a fuller understanding of civilization as an overarching concept. It is a term that adorns course catalogs, library keywords, political speeches and social dictates. Beyond a vague and general understanding, there is little attention to what the word actually means or represents.

Underneath the constants and variables that comprise its myriad definitions, at its core, civilization is really a process which transforms energy in to power. Over the course of history, civilization became the catch all term that describes the appropriation and consolidation of various forms of energy from the ecological biosphere in to hierarchical structures which transform these myriad energies into both physical and metaphysical power. These power structures seek to enforce and reinforce the hierarchical ordering of everything animate and inanimate, through a comprehensive and expansive framework that includes religion and science, politics and law, the military and police, economy and culture. All of these are ordered in a way that promotes the transformation of biological and biospheric energies into an increasingly comprehensive power structure, which over time has become simultaneously comprehensive and exclusive.

The language and laws of physics help to make the point. Energy, by definition, is life itself. While Aristotle first applied the term to philosophical concepts such as happiness and pleasure in the 4th century BC, Gottfried Leibniz considered its applicability to the physical world in terms of mass and force in his 1686 treatise *A Brief Demonstration of a Notable Error of Descartes and Others Concerning a Natural Law* (Leibniz, Brief Demonstration of a Notable Error in Descartes and Others Concerning a Natural Law, 1989). Mass and energy are closely related concepts in the history of civilization. Hierarchical structures over the course of history have looked to counter the insurgent energies of the masses, which (like in physics) have transformative properties, through the use of force. Force, another term of physics which carries over to analyses of political economy, is another fundamental aspect of civilization. Force only exists with an interaction, and results in a push or pull effect dependent on the relative mass and energy of the two interactive bodies. Newton's observations in his 1687 masterwork *Philosophiæ Naturalis Principia Mathematica* (Mathematical Principles of Natural Philosophy), first articulated these concepts in the three laws of motion (Newton, 1687/1995). Throughout the history of civilization, hierarchical power structures have sought to transform and absorb the chaotic energies of the planet and its inhabitants into its framework through the use of force.

As Arthur Iberall wrote in his essay 'A Physics for Studies of Civilizations:' 'Comparing the dynamics of humans with those of atoms or molecules in a statistical thermodynamic ensemble does not trivialize man's endeavors; rather it illuminates or explains them' (Iberall, 1987). Where Iberall's work explores early settlement patterns in Mesopotamia and Egypt and their subsequent trade networks to compare them to matter condensation and macroscopic convection processes respectively, the concept of applying the language of physics to historical phenomena opens the possibility of developing broader understandings of our subject and the conditions in which it has developed over time. Iberall concludes in another of his essays that, "Whenever a complex system is studied at its own organizational level from a physical point of view, one finds a commonality of operating principles" (Iberall, 1987, p. 281).

With this understanding in place, consider how the following concepts in physics came to become integral to the discourse of history and represent the conditions of civilization: Energy, Power, Force, and Mass.

Energy (Chaos)

The Proto-Indo-European root of the word 'energy' is '*werg*,' meaning 'to do,' or its phonetic descendent 'to work.' There are three forms of the root in Ancient Greek vocabularies: *Energeia*, *Energos,* and *Ergon*. All share a common indication of activity and action. Aristotle used the concept of *Energeia* in his 4th century BCE works *Metaphysics* and *Nichomechean Ethics* as a manifestation of being in the philosophical sense and activity in the physical sense. It was a comprehensive, open-ended term with existential and metaphysical implications.

Etymological dictionaries suggest the term comes to signify 'power' in England during the 1660's. The political context in which this usage manifested is interesting. 1660 was the year of Restoration in England. Charles II reclaimed the throne after the English Revolution, and it would make sense that in the aftermath, the term moves from a philosophical/metaphysical to a political/physical meaning. Indeed, this was in this context that Hobbes wrote Leviathan, articulating a concept of a 'body politic,' which applied his corporeal allegory to an otherwise abstract idea (Harvey, 2007).

The 1660's also saw Gottfried Wilhelm von Leibniz beginning his work which would ultimately result in his articulation of the *vis viva* or 'life force,' a prototype for the scientific concept of energy. While Leibniz did not formally articulate his formula for the *vis viva* as an object's mass and it's velocity squared, mv^2, until 1695, its roots in his 1666 work *De Arte Combinatoria* are evident in his argument that there exists a universal way to represent and analyze ideas and relationships by breaking down their component pieces (Leibniz, 1969).

It wasn't until 1807, as the Industrial Revolution began to sweep the English midlands, that physicist Thomas Young specifically applied the term 'energy' to scientific use. In his 'Course of Lectures on Natural Philosophy and the Mechanical Arts,' he posited that 'The product of the mass of a body into the square of its velocity may properly be termed its energy' (Young, 1807). It wasn't long after that energy was linked to the concept of 'work' in the physical sense. Gustave Gaspard de Coriolis connected the two in 1829, in his paper 'Du Calcul de l'effet des machines,' arguing that units of work could be standardized and measured. Therefore, a certain amount of energy input would result in a proportional amount of work output (Coriolis, 1829).

The nineteenth century is marked by an inherent tension between human and machine that has come to define much of the modern experience. It was also an age of imperialist expansion into parts of the world rich in resources that would fuel much of the industrial revolution in the metropolitan centers of Europe. It was in these circumstances that Julius von Mayer, James Prescott Joule, and Hermann Ludwig Ferdinand von Helmholtz first articulated the concepts that would eventually result in the law of conservation of energy: 'Energy cannot be created or destroyed; it can only be transferred from one form to another.' At the time they were working, Karl Marx was busy challenging the work of classical economists with regard to the nature of wealth and value; specifically whether or not its transfer (appropriation) from nature and the working classes was moral and ethical.

And so we see that the term 'Energy,' initially an open ended, metaphysical concept, came to take on distinctly political, economic, and cultural meanings during the Ages of Enlightenment, Industrialization, and Empire. Here, scientific observations, recognized as 'immutable laws,' reinforced and authorized systems of exploitation and control which defined much of the modern condition. Energy, once an indicator of activity and action (both physical and mental), came to represent standardized and measurable units of work. The transfer of

energy from the proletariat to the bourgeoisie, from the colony to the metropolitan center, was legitimized in the process. In doing so, civilization applied the language of science to its own mission, and began to remake the world in its own image.

What physics considers energy, civilization largely regards as chaos. The energy of people, unless properly channeled within the bounds of civilized interaction, results in disorder. Over the course of history, institutions have developed to channel these energies in an orderly fashion: schools, prisons, corporations, nation-states. Collective resistance to these institutions is often resonant with the ideas of freedom and liberty. Peter Linebaugh and Marcus Rediker demonstrated in their 1999 book *The Many Headed Hydra* that a combination of sailors, slaves and commoners in the transatlantic 17th and 18th century Atlantic World were responsible for the revolutionary character of the period. It was only after the practice of revolution was halted while the theory was coopted by the ruling classes that order was restored (Linebaugh & Rediker, 1999). To that point, it would seem that Will Durant's observation in his 1957 book *The Story of Civilization* that "Order is the mother of civilization and liberty; chaos is the midwife of dictatorship" might warrant reconsideration and revision. (Durant, 1957, p. 145)

Civilization regards the ideological energy of human beings and the physical energy of the biosphere as equally chaotic. Certainly, much of the history of civilization involves the willful separation and subjugation of nature. Early perceptions of nature are bound up with concepts of chaos. Much of the intellectual effort concerned with establishing a concept of civilization is something inherently antithetical to the nature; civilization stands in sharp contrast to the natural world. From the walls of Uruk which first insulated civilization from nature, to the system of enclosures in early modern England, the emergent political hierarchies of the ruling classes sought to insulate themselves from the chaotic energies of nature, and subjugate the masses on the eve of the Age of Revolution.

Power (Order)

The Proto-Indo-European root of the word power is *poti-s,* which arguably stood to mean 'owner, host, master, husband' (Pokorny, 1959). This root manifest in Latin as *potis*, which meant 'powerful,' and as *posse* which meant 'to be able.' In Old French, the variant *povoir* meant 'to be able,' and by 1300 in English the word Power carried martial connotation: 'ability; ability to act or do; strength, vigor, might; efficacy; control, mastery, lordship, dominion; legal power or authority; authorization; military force, an army.'

Beginning with the onset of conditions we generally associate with modernity, the meaning of the word became more complex. Like 'energy,' it became representative of conditions that were manifesting in both statecraft and science, as the two mutually reinforced each other. The idea of someone having power in the political sense comes from the late 14th century, but was associated with individual persons. The word came to mean 'a state or nation with regard to international authority or influence' in 1726. A year later, in 1727, it was used to suggest 'energy available for work.' Power became associated with 'electrical supply' in 1896 (Harper, 2017).

We can see from its root that power as a concept is connected to both ability and authority. In physics, energy becomes power through work in the mechanical sense. In statecraft, energy becomes power through work in the political economy. In science and in society, power is generated by *harnessing* energy. The conversion of energy in physics is measured in terms of horsepower. James Watt applied the idea in the late 18th century, to compare the output of steam engines with the work rate of horses.

The concept of power is closely linked to energy. Power comes from the conversion of energy in the physical sense, and is associated with control in the metaphysical sense. Over the

course of history, technology has played in integral role in the conversion of energy in to power, both in the literal and metaphorical sense. It is roundly regarded as a vanguard achievement of civilized minds. One technology in particular, the harness, serves as a useful model for examining the development of power as a civilized idea.

Harnessed animals provided early Neolithic communities with both a way to provide surplus and a way to transport it to markets for the burgeoning trade networks that would become a primary characteristic of civilization. There is evidence of harness use in Chaldea and Minoan Crete dating back to the third millennium BC; in Mesopotamia, New Kingdom Egypt, Shang Dynasty China in the second millennium BC; and in Classical Greece and Ancient Rome in the first millennium BC (Needham, 1986). The harness is ultimately a burden, and served to reinforce the new hierarchical arrangement with nature that civilized people would impose on the natural world. Similarly, civilization is built on slave labor, and humans were harnessed so that their energy would serve to reinforce the newfound hierarchical power of their masters.

Like animals, humans were harnessed and put to the task of transforming energy in to power. Rare among hunter-gatherer societies, slavery has existed in some form or another in every civilized society. As hierarchy was imposed by humans on the animal world with which it previously held a symbiotic relationship, so too was it imposed by humans on other humans as social stratification, a fundamental tenet of civilization, became more and more institutional. The literal harnessing of humans, with shackles, chains, and increasingly elaborate devices for controlling the human body became an industry in and of itself relatively quickly, as did the political, legal and economic means for controlling other human beings. The Sumerian code of Ur-Nammu, written in the later part of the third millennium BC, was foundational in its accounting for the institution of slavery (Roth, 1995).

Not only the living things of the planet were harnessed in the pursuit of converting energy into power, but so too was the planet itself. Irrigation, another fundamental aspect of civilization, harnessed the free flowing waters of rivers in Africa and Asia between the sixth and third millennia BC. Energy became power, and civilization developed independently on the Nile, Tigris and Eurphrates, Indus, Yellow and Yangtze Rivers, with the attendant political, economic, and cultural institutions that comprise a civilized condition. With earth and water enclosed and harnessed, their energies became sources of power. Similarly, the harnessing of fire brought the institutions of war and industry, and the harnessing of the winds brought the age of global capital.

What initially appears as productive progression gives way to a larger pattern of destructive regression in a longer view. It is not an anachronistic perspective. The Babylonian poet Kabti-Ilani-Marduk, who lived during Hammurabi's reign, reflected on the fact that any progress, advance or development often came in the wake of destruction, and often wrought even more destruction over time. This cycle, which Kabti-Ilani-Marduk relayed in religious symbolism in 'The Myth of the Pest-God Irra,' reflects a broad understanding of what civilization ultimately is. Irra, the god of fire, pestilence and death, was 'interested in change and destruction only as a necessary prerequisite to the bulding of a new order,' and sent his servant to explain the process to Marduk (Kriwaczek, 2012). Irra promises a return to a golden age when his plan of destruction has been carried out, but it never comes. Once harnessed, power is superficially productive (the trappings of civilization are indeed impressive), but inherently and ultimately destructive (the biosphere is straining under the load of the harness). This is because it is inherently dependent on the use of another physical and metaphysical property: Force.

Force (Oppression)

In political economies, the conversion of energy in to power is maintained through the use of force. The term, as with power, seems to have manifest in its English form around 1300, and was used as a noun to signify physical strength. Like the word power, it was borrowed directly from Old French, where from the 12th century it conveyed the meanings of strength, courage, and fortitude, and also of violence, power and compulsion. Its Latin root, *fortis,* meant strong, mighty; firm, steadfast; brave, and bold. The word manifest as a verb roughly around the same time, *forcen* or *forsen*, and was used to convey both martial and sexual violence (Harper, 2017). In the early 14th century, the word appears on record to describe the use of violence against an adversary, and the raping of women.

Force as a concept in physics comes with the Scientific Revolution of the 17th century. Concepts like the *vis viva* predated the term, but Isaac Newton articulated the present scientific theory of force in the field of physics with the Second Law of Motion in 1686 which states that motion is the rate of change of momentum of a body is directly proportional to the force applied, and this change in momentum takes place in the direction of the applied force. Force can be applied either through linear push or pull, or circular centrifugal or centipedal motion (Newton, 1687/1995). The absence of force, or an equal amount of it from either direction results in either static or dynamic equilibrium. Based on Newton's work, physicists have since argued that all the forces in the universe are based on four fundamental interactions at the subatomic level: strong and weak nuclear forces, electromagnetic force, and gravitational force.

While force can be measured, studied and controlled; otherwise put: ordered; the term still suggests uncontrollable conditions that create chaos and challenge the hegemonic principles of power. Force of Nature as a concept is a term that applies to environmental conditions which wreak havoc on the social, political and economic order of everyday life. As William Shakespeare so artfully showed in 'The Tempest,' written as the Scientific Revolution began to take hold, a force of nature can turn the world upside down.

In statecraft, the use of force is paramount to the maintenance and expansion of power. Domestic police forces and the international application of force of arms are much of the story of history itself. The term 'police force' came in to use in the 1820's, as immigration resulted in the rise of urban communities that threatened the established power structures (Mason, 2004). The military concept of a force of arms predates this by five hundred years. It is interesting to note that both were applied using concepts of 'the other' in the political and socio-economic sense. In physics, force depends on two separate and distinct bodies to manifest. In statecraft, the same rule applies.

In physics, force is calculated by measuring mass plus velocity. Mass is the measure of an object's resistance to acceleration when force is applied, and velocity is the amount of space a moving object covers in a particular amount of time. Force is any interaction that, when unopposed, will change the motion of an object. In civilization, power maintains itself through the use of force. Economic, political and social institutions, resist change by reacting with force. The history of revolutionary movements is entangled in this physics. Those seeking to change the direction of an institutional power often fail; energies from below meets power from above. When both use force, the institutional nature of power within the framework of civilization is often too massive to overcome. When revolutions are successful, they often promote the very conditions they sought to undo; their energies become power and their interests become institutional. The French Revolution produced Napoleon, the American Revolution produced the largest empire the world has ever seen.

Force can be applied by push or pull: centrifugal or centripetal. In civilization, centrifugal force pushes energy outward. Centripetal forces pull energy inward, where their energies become part of the mass that generates power. Geographically, this is the history of the core and peripheries of civilizations. Dynastic realms would project power outward, until it bumped

against another realm projecting its power outward. As Kenneth Clark observed in Civilisation, "All great civilisations, in their early stages, are based on success in war' (Clark, 1969, p. 18). Those Centrifugal forces pushing out would then become centripetal, pulling in the energies of a rival and assimilating them into the existing power structure of the dynastic center, establishing a new order within the framework of the old. This is the history of empires, from Ur and Uruk to Persia, Athens, Rome, Tenochtitlan, Cahokia, Peking, Kyoto, Paris, London, and Washington DC.

Civilization justifies the use of force which turns energy in to power by denying the obfuscation, or altogether denying the equation. Pre-civilized peoples tended to practice animism, recognizing the fundamental energy of the biosphere. The creation myths of civilized religions largely acknowledge a primeval chaos, but problematize it rather than venerate it, and quickly move to validate its subjugation through the use of force. The Sumerian Enuma Elish and the Hebrew story of Genesis both begin with the creation and subjugation of nature within a 'dominion' of humankind. First subjugating the earth, then the animals, and then other people, civilization converts energy into power through the use of force. These forces need not necessarily be physical; they can be ideological, extending to law, religion, and customs. Speciesism, racism and the general belief of man's 'dominion' over the earth are all examples of powers exercised by civilization through the use of force.

In politics, when a body with less power rises up against one with more power, we call it a mass movement. There is no equivalent for this phenomenon in physics.

Mass (Revolution)

Of all the words in this consideration so far, mass has maybe the most disparate meanings and origins. The word works as a noun, verb, and an adjective. As a noun, two forms exist. The first form, from the Proto-Indo-European root, *mag* meant 'to knead, fashion, or fit.' The Greek word *maza* signified 'barley cake, lump, mass, ball,' which became *massa* in Latin, referring to 'kneaded dough, lump, that which adheres together like dough.' The term *masse* appears in Old French beginning in the 11th century, meaning 'lump, heap, pile; crowd, large amount; ingot, bar,' and finally in English in the 14th century as 'lump, quantity, size.'

The second meaning as a noun derives from the Late Latin root *missa*, a term for 'dismissal' (Harper, 2017). The Vulgar Latin *messa*, referring to the Christian Eucharistic Ritual, is a reference to the last words of the service: '*Ite, missa est*' (Go, it is the dismissal). From those origins, the term *mæsse* appears in Old English, leading to its current form, mass. So, in its two original noun meanings, we have elements of food and religiosity.

In 16th century English, the word took on the properties of a verb, and its noun meaning evolved. As a verb, it identifies the action of 'gathering in a mass' beginning in the 1560's. In the 1580's, its noun form comes to signify 'a large quantity, amount, or number.' For context, this term evolves in between The Prayer Book Rebellion of 1549 and the Treasons Act of 1571. Group association and group action were evolving in ways that language had to adapt to. In 1586, a famine in England gave rise to the Poor Law System. Religion and Food were on the minds of the people who would come to be known as 'the masses.'

As an adjective, the idea of mass took on proportional properties in the 18th century, as the industrial revolution laid a foundation for the exponential scale of production and population that would define the modern era. Like industry, knowledge became more incremental and specified, and the new academic discipline of sociology applied the concept to its subject writ large in the late 19th and early 20th century (Weber, 1930/2005). The economic phenomenon of mass production, along the biological phenomenon of mass reproduction, had cultural dimensions, producing mass movements, mass actions, mass communications, mass layoffs,

mass hysteria, mass murder, and the like. The concept of 'massification' has profound implications for civilization, as its impact spread more widely and deeply as its capabilities grew.

Arguably, the result of these capabilities is a trend toward standardization and homogeneity, somewhat discernable when considered through the processes of globalization. Mass, therefore, returns to its initial meaning: 'to knead, fashion, or fit.' The roots of modern globalization in its previous forms of colonialism and imperialism were early bound up with changing and fashioning the landscape and its inhabitants to make a uniform, consistent condition and erase any difference between place and people. As one of its earliest critics, J. A. Hobson, observed: "Colonialism, in its best sense, is a natural overflow of nationality; its test is the power of colonists to transplant the civilization they represent to the new natural and social environment in which they find themselves" (Hobson, 1905, p. 13).

The concept that makes mass a tool rather than a threat to civilization as an overarching construct is control. While energy, power, force, and mass are words that would eventually come to explain natural law and physics, control is a term of economics and engineering. Its origins as a word and a concept lie in late medieval accounting, but by the nineteenth century, control came to signify the imposition of authority to "regulate, dominate and direct action" (Harper, 2017). Its objective, scientific standard served as justification for the imposition of hierarchical order on the increasingly chaotic and disorderly masses. With regard to such arrangement in educational institutions, Adam Smith complained that "an extraneous jurisdiction of this kind…is liable to be exercised both ignorantly and capriciously," summarizing that "external control is ignorant and capricious" (Smith, 1776/1937, p. 718). Karl Marx observed more directly and comprehensively in Volume One of Capital that "Moreover, in respect to form, capitalist guidance and control are despotic" (Marx, 1867/1942, p. 348). Still, the assertion of control as a means to shape the masses became an increasingly comprehensive feature of civilization as the modern age took shape, and continues through today.

Isaac Newton first applied the concept of mass to physics in 1687 with the publication of *Philosophae naturalis principia mathematica*. The term appears in two different ways in the work: as an informal reference to a body of unspecified shape, or as a body comprised of an aggregate of particles (Roche, 2005). Attempts to refine the scientific concept of mass by Ernest Mach in the 19th century and Albert Einstein and Hermann Bondi in the 20th century resulted in a more dynamic concept of mass that included inertia, gravitational attraction and weight control. The result of such considerations brought physicist Max Jammer to conclude in 1999 that, "in spite of all the strenuous efforts of physicists and philosophers, the notion of mass, although fundamental to physics, is…still shrouded in mystery" (Jammmer, 1999, p. 167).

An Aside: Entropy (Apocalypse)

When force is unable to convert energy into power within a system, the second law of thermodynamics states that the result will be a decline in order and increasing chaos. The physical process of entropy is one that civilizations have reckoned for millennia in terms of their own existence. Preachers predict future apocalypses, historians wonder why civilizations fall. Behind the variables lies the physical law of entropy: a process in which energy is lost by dissipation and friction, which results in a particular system no longer being able to function. The Roman philosopher Seneca pitched of the concept of decline outpacing growth in 65 AD when he wrote, ''It would be some consolation for the feebleness of our selves and our works if all things should perish as slowly as they come into being; but as it is, increases are of sluggish growth, but the way to ruin is rapid."

The physical concept of entropy, first articulated by Rudolf Clausius in 1854, was first applied to questions of political economy by Sergei Podolinsky in the 1880's. Freidrich Engels argued it was "totally impossible to try to express economic relationships in physical terms," and Marx, who wasn't so much concerned with the ecological effects of modern industrialism as he was the distribution of its economic spoils, dismissed the applicability of the Second Law of Thermodynamics to matters of economy altogether. Scholars have debated the physics of entropy and its applicability to Marxism ever since. What has become an increasingly academic argument is ultimately at the expense of the question itself. Is a civilization sustainable if it no longer has the energy to sustain its power?

In 2012, an ominous year to study questions of collapse (as it coincided with a widespread belief that the Mayan Calendar predicted the end of the world), the journal Ecological Economics published an interdisciplinary research paper titled 'Human and nature dynamics (HANDY): Modeling inequality and use of resources in the collapse or sustainability of societies.' Funded by NASA, its authors: Safa Motesharrei, Jorge Rivas, and Eugenia Kalnay argued that "Two important features seem to appear across societies that have collapsed: (1) Ecological Strain and (2) Economic Stratification." Historically, economic stratification and ecological strain are interdependent systems, and lay at the foundations of civilized societies. The question then becomes whether or not modern civilization is susceptible to the same patterns. On this question, the authors conclude that "the ubiquity of the phenomenon," combined with "the fact that advanced, sophisticated, complex, and creative civilizations can be both fragile and impermanent," collapse is all but inevitable. Of the three social models they base calculations on: Unequal society, Egalitarian Society and Equitable Society (with Workers and Non-Workers), only the third model proves itself mathematically sustainable over time (Motesharrei, Rivas, & Kalnay, 2014, p. 91). Energy and Power, both in the economic and ecological senses of the term, need to be balanced within the carrying capacity of the planet, otherwise entropy will lead to a breakdown of the system.

Conclusion

The words we use to describe our reality are neither arbitrary nor ahistorical. They come from specific circumstances and reflect a particular view and understanding of the world. In this case, the words I've chosen to examine: power, energy, force, and mass are intertwined with the evolution of statecraft and science in the early modern era. Their claim to scientific objectivism is complicated by their history and evolution, as tools of imperialism and warfare with roots in violence and oppression. By understanding the origins of these words and the historical conditions in which they became common and widespread, we can better appreciate the comprehensive nature of the modern worldview we inherit: martial aggression posing as rational scientism.

These words are used frequently to describe and question past and present conditions, yet their use arguably reinforces the very conditions and ideas they are to challenge. Arguably, 'power' seems the most pernicious. Can we describe history without using a word like 'power?' If so, what other words would we use? How would that history read? If we find a way to reframe this concept, to the other words in question take on new meaning or disappear altogether, making way for another vocabulary to take their place? Does knowing the roots of these words challenge us to find better ones, or does it strengthen our commitment to using them in historical writing? Even critics of hegemonic, Western, "top-down" history rely on the language embedded therein to respond and reframe their subject. Hobbes concluded in Leviathan that "No discourse whatsoever can end in absolute knowledge of fact, past or to come." (Hobbes, 1651/1914, p. 30) Was he right in this assessment?

Ultimately, the history of civilization as it is written is the transformation of energy in to power. Politics, economics, and culture are products of this process. In his book *Civilization: The West and The Rest*, celebrity historian and champion of neoliberalism Niall Ferguson makes the anachronistic argument that 'six killer apps' set the West apart from the rest of the world, and led the West's rise to global dominance. He lists competition, science, property, modern medicine, consumerism, and work ethic as unique products of Western Civilization, which provided the foundation of western ascendency for the better part of the modern historical epoch. While this argument resonates with notes of self-congratulatory triumphalism, and ignores the histories of the places subject to Western hegemony during the period in question, it does indirectly help to support the thesis of this inquiry. Those six qualities, which exist in civilization writ large are all the product of converting energy into power in the physical and/or metaphysical sense. Competition produces hierarchy, science produces technology, property produces class division, medicine produces treatments and cures, consumerism produces material culture, and work ethic produces a labor force. The resulting order of things that comes out of the process can be administered and imposed by force if necessary, until an imbalance of power and energy, or a lack of the latter entirely result in a comprehensive breakdown of the system that is civilization.

In conclusion, civilization's main flaw appears to be a dependence on destruction for survival, development and even advancement. That destruction comes at great cost, which grows exponentially with the systematic advance of civilization in spatial and temporal terms, broadly considered 'progress' from within its own lexicon. Studying the past should give us a sense of urgency to change this pattern, as with each destructive phase the conditions appear to be more dire than at the onset of the last. The scale with which energy is converted into power in this process is unprecedented. In borrowing from physiocratic principles, the energy of the biosphere is being converted to produce physical power, and at the same time, produces political, economic and cultural power. As scientists and economists are both observing, the result of ecological and humanitarian crises that undermine the stated intent of these very systems. Rather than viewing civilization as the most advanced form of human endeavor, we might do well to reconsider its more egregious injustices, and seek to reframe the human condition in greater balance: with each other and with the biosphere. To disarm the power structures, and return energy to a more symbiotic relationship with its primary carriers: the people and the earth we inhabit.

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Acknowledgements

My thanks to Debora Donnelly and Melanie Innes for helping me through the process of publishing this work, and to the anonymous reviewers who provided honest and constructive feedback of my draft.

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