Science. Not *Just* For Scientists.

A Historiographical Analysis of the Changing Interpretations of the Scientific Revolution

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Traditionally, the Scientific Revolution has been portrayed as an era in history when new developments in fields of 'scientific' thought eclipsed the long-held notions presented by religion and philosophy. Historical interpretations subscribing to this view have often presented the Scientific Revolution as a time when significant changes occurred in the way societies understood their world. These historical analyses have focused on a limited suite of ideas – the iconic figures of the Scientific Revolution, the intellectual, methodological and theoretical developments of the era and the shift away from antiquated worldviews. Owing to the decidedly intellectual foci of these investigations, the Scientific Revolution, and the influential figures therein, are depicted as the impetus for modern thought and society as we know it today. However, in recent decades, historical studies of the Scientific Revolution have shifted away from investigations emphasizing the supposedly progressive nature of the era and have chosen to observe aspects of the historical period that are significantly more cultural in tone. For instance, aspects such as the economic impacts of intellectual developments, the self-fashioning practiced by figures during the period and the importance of cultivating various social relationships are observed in order to provide a richer, more socially contextualized presentation of the Scientific Revolution. This paper will compare two modes of historical investigation – Intellectual and Cultural Historical, examine the changes that have occurred in historical interpretations of the Scientific Revolution and illustrate the motivations that have guided these two distinct approaches to history. This historiographical analysis will show how portrayals of the Scientific Revolution have changed over time and developed from something decidedly intellectual in focus, into a much more nuanced, culturally focused form of scholarship.

The Scientific Revolution is a period that has often been painted by historians as a great, triumphal moment for the Western world – the moment when 'science' overtook religion and philosophy as the primary guiding force in society.[1] This period in time is considered to be the domain of a select few intellectual colossi – Galileo, Descartes, Boyle and Newton for instance – who, with their feats of scientific and mathematical intellect, effaced the authority of antiquated philosophical and religious traditions. In these historical analyses, the Scientific Revolution and the influential men who acted within it are regularly depicted as the catalysts for modernity and society as we know it today. However, in recent years, histories of the Scientific Revolution and its associated personages

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[1] The men practicing "science" at the time of the Scientific Revolution did not view their work as science how we see it in the modern sense, nor did they view themselves as scientists (a term "not even invented until more than 100 years after [Newton's] death"). - Patricia Fara, *Newton: The Making of Genius*, (New York: Columbia University Press, 2004), pp. 1-2; - What the men of the 16th, 17th and 18th century practiced was generally termed "Natural Philosophy" and it encompassed topics which we today would not consider to be under the purview of science. In this regard, the term "science" is employed anachronistically throughout this essay (in the style of Mario Biagioli) as a synonym for the term "Natural Philosophy."

have moved away from the notions of progression and the binary of religion versus science ensconced within older historical traditions.[2] Instead, these histories have sought to depict the Scientific Revolution as something more *nuanced* – that is, as something that is not simply the result of the theoretical work of great scientific thinkers; and *dialectical* – that is, as a process of exchange between religious, political and scientific points of view. This paper will evaluate the focal shifts that have occurred over time in the historical scholarship of the Scientific Revolution and how these new foci have influenced interpretations of the era. Throughout this analysis, the merits of the culturally focused historical approaches will be illustrated; it is important to note that, despite a general preference for historical approaches cognizant of socio-cultural impacts, this presentation does not seek to suggest that intellectual histories are unimportant or invalid interpretations of the past. Accounts of Galileo and his theories will also be highlighted to represent how new modes of historical investigation have allowed for the creation of a more varied interpretation of developments, people and events during the Scientific Revolution.

In recent decades, historical studies of the Scientific Revolution have transitioned from an intellectual to a cultural mode of interpretation. This shift has meant that rather than focusing explicitly on theoretical, technological and methodological advancements and how these advancements fomented change in the Scientific Revolution, historians have chosen to highlight aspects such as religiosity, patronage networks, economy, identity construction, and social relationships in order to construct their interpretations. In addition to allowing for this wider focus, the cultural-historical approach does not necessarily imply the sense of outright progression that is a common theme in traditional, Whiggish and intellectual approaches to the Scientific Revolution. In the examination of these historical methods, some of Hayden White's theories regarding the construction of historical narratives are pertinent to consider. White – a historian and literary scholar well known for his work discussing the construction of narratives – proffers that all historical narratives are subject to a process of creation by the historian wherein elements are organized into a temporally oriented "chronicle." This chronicle of events is further arranged into a cohesive narrative, "which is thought to possess a discernable beginning, middle, and end."[3] There is an inherent selective bias that accompanies the arrangement process, as the historian must pick and choose elements from the historical chronicle in order to construct a narrative that answers specific questions and offers specific interpretations of the past. It can then be seen how a historian could easily aggrandize certain aspects of history and downplay others by selecting only specific elements from the chronicle. In view of this idea, White cautions one must analyze the structure of the narrative in question (including the possible functional reasons for the structure) and consider the alternate narratives "might be 'found,' 'identified,' or 'uncovered' in the chronicle."[4] White notes the structure of a historical narrative can be explained by emplotment, argument and/or ideological implication.[5] In this analysis, I do not intend to focus on the specific modes of emplotment or argument of each individual history, but rather to discuss the overall ideological purpose of each method's historical interpretation. I have also chosen to cite Hayden White in order to emphasize the idea that a multiplicity of interpretations can – and arguably should – exist within a historical

[2] As Allison P. Coudert notes, "there are many ways to broach the Scientific Revolution, ways that run from the strictly scientific to the social, historical, and psychological, and in recent years most historians of science have become resolutely eclectic, using all these approaches." - Allison P. Coudert, *Religion, Magic, and Science in Early Modern Europe and America*, (Santa Barbara, CA: ABC-CLIO, 2011), pp. 134

[3] Hayden White, *Metahistory: The Historical Imagination in 19th-Century Europe*, (USA: John Hopkins University Press, 1973), pp. 4

[4] Ibid, pp. 7

[5] Ibid, pp. 7

field of investigation. With White's theories in mind, it is necessary now to more thoroughly define and critique the foci of each historical mode – Intellectual and Cultural-Historical – in order to affect a greater understanding of each method and the historical pictures they create.

As noted above, intellectual histories of the Scientific Revolution have tended to focus on the developmental (theoretical, methodological and technological) aspects of the era in order to create a certain picture of how changes occurred. With the idea of developmental change as their core focus, intellectual histories have broached topics within the Scientific Revolution in a way that emphasizes the progressive nature of the era. Intellectual history's presentation of the Scientific Revolution as a catalyst for progression and modernity most likely stems from Herbert Butterfield's *The Origins of Modern Science: 1300-1800*.[6] Butterfield's historical narrative is one of the foundational texts upon which many subsequent interpretations of the Scientific Revolution have been based, and it expounds the belief that the Scientific Revolution "outshines everything since the rise of Christianity and reduces the Renaissance and Reformation to the rank of mere episodes."[7] Additionally, Butterfield proselytizes that this era in history "changed the whole character of men's habitual mental operations" and can be seen as the "real origin both of the modern world and the modern mentality."[8, 9] William E. Carroll describes how Butterfield's interpretation has become what could be called the "master narrative of the Scientific Revolution."[10, 11] Indeed, Butterfield's views of progress and modernity percolate into interpretations of the topics analyzed by intellectual historians. The topics that shall herein be discussed are the "Great Men" of the Scientific Revolution and, more specifically, how the theoretical developments of these men altered the way people perceived the world; and the juxtaposition of "Ancient" and "Modern" peoples, which carries with it the idea of a decisive break between religious/philosophical traditions and rational, scientific thought.[12]

In the "Great Men" histories so often embraced by intellectual approaches, figures such as Galileo and Newton – though undoubtedly important in the development of scientific conceptions – are given primacy over the myriad other contributors who also influenced the evolution of natural philosophical thought. As a result of this focus, these narratives are essentially devoid of any sort of dialogue between historical actors, and supposedly modern thinkers like Newton or Galileo come to

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[6] In a review of the book C.T. McIntire's *Herbert Butterfield: Historian as Dissenter*, Daniel Ritschel highlights Butterfield's groundbreaking scholarship in a number of fields including historiography, history of science, religion, and international relations. Regarding Butterfield's approach to history, Ritschel states that Butterfield was a "lifelong champion of "scientific" or "technical" history," and that he espoused the view that an appropriate historical scholarship required a knowledge of the past "based strictly on "facts" derived from detailed archival research." - Daniel Ritschel, "The Politics of the Whig Interpretation of History," review of *Herbert Butterfield: Historian as Dissenter*, by C.T. MacIntire. H-Albion, H-Net Reviews, December 2005, Accessed at: http://www.h-net.org/reviews/showrev.php?id=11043.

[7] Steven Shapin, *The Scientific Revolution*, (Chicago and London: The University of Chicago Press, 1998), pp. 1

[8] Herbert Butterfield, *The Origins of Modern Science: 1300-1800*, *New Edition: Revised and Enlarged*, (London: Lowe and Brydone Printers, Limited, 1968), pp. vii

[9] Shapin, pp. 1-2

[10] William E. Carroll, "Creation and Intertia: The Scientific Revolution and Discourse on Science-and-Religion," In *Science and Faith within Reason*, ed. Jaume Navarro, (Surrey: Ashgate Publishing Limited, 2011), pp. 64

[11] William E. Carroll is an intellectual historian and historian of science at Blackfriars, Oxford University. He takes special interest in the subject of Aristotelian science and how it was accepted in the medieval Islamic, Jewish, and Christian worlds. – "Notes on Contributors," In *Science and Faith within Reason*, ed. Jaume Navarro, (Surrey: Ashgate Publishing Limited, 2011), pp. ix

[12] Herbert Butterfield describes this idea as "the famous quarrel between the Ancients and the Moderns." –Butterfield, pp. 213

represent the prevailing type of thought that occurred during their historical periods.[13] This homogenizing interpretation belies the multiplicity of scientific discourses and opinions that were occurring during the Scientific Revolution. In *The Scientific Revolution*, for example, Steven Shapin highlights how "there were importantly different versions of what it was to do astronomy and believe as an astronomer believed." He goes on to discuss how the "'sciences' of astronomy and chemistry" had an "intensely problematic" relationship with the "'pseudo-sciences' of astrology and alchemy."[14] From this brief example, and others presented throughout Shapin's text, it is clear there are different interpretations from those offered by the traditional narratives, which simplify and aggrandize the lives of past natural philosophers. Furthermore, by focusing heavily on the theories and methods of these scientific figures, intellectual history tends to create historical characters that are defined solely by their discoveries; they are isolated from their historical, political, religious and social contexts. For Shapin, this practice is one that should be avoided. We as historians cannot treat theoretical ideas "as if they floated freely in conceptual space," nor can we treat the genitors of these ideas as individuals uninfluenced by other thinkers of their time. Both the theoretical developments and the people who create them need to be placed within "their wider cultural and social context."[15] Intellectual history's tendency to focus on developments alone (rather than social interactions or economic influences, for instance) has turned historical figures of the Scientific Revolution from real men with varied interests into paragons of pure scientific virtue and reasoning.

It is important to note that these simplified historical narratives, which focus on specific individuals and their triumphs, serve a definite pedagogical function. The function is to validate modern, scientific ways of thinking. By removing contextual aspects that might distract from the theoretical standpoints we find important, these historical characters and their ideas can be appropriated by our current society and used as foundational supports for modern modes of thought. This appropriation not only stems from our own modern interest in our ancestors, but also reinforces the traditional beliefs we have of these ancestors.[16] As Shapin discusses, we – "the late twentieth-century [now twenty-first century] scientists" – see import in the ideas of men like Descartes, Galileo, Boyle or Newton. We seek to promote their stories and theoretical developments over countervailing narratives because it is these stories that have impetus on our own worldviews.[17] The appropriation of and identification with these past figures is not, however, unique to our time period; as Coudert notes, a "narrative of the triumph of science and rationalism in the West" had already been created by the mid-eighteenth century. These narratives created a "new type of culture hero" – "the selfless, objective, stoical man of science."[18] It can be seen, then, that the historical process of heroizing certain individuals because of the rational, scientific and philosophical values they represented also took place in the past. The complex, sometimes ideologically conflicted lives of historical figures are distilled (by selecting only certain information from the historical chronicle) into idyllic caricatures that reinforce and lend credence to the values we find important. Thus, the multi-faceted narratives

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[13] Shapin notes, "Stories of the ancestors as ancestors [to our modern world and thoughts] are not likely to be sensitive of how it was in the past: the lives and thoughts of Galileo, Descartes, or Boyle were hardly typical of seventeenth century Italians, Frenchmen, or Englishmen, and telling stories about them geared solely to their ancestral role in formulating the currently accepted law of free fall, the optics of the rainbow, or the ideal gas law is not likely to capture very much about the meaning and significance of their own careers and projects in the seventeenth century." - Shapin, pp. 7

[14] Ibid, pp. 6

[15] Ibid, pp. 4

[16] As Shapin notes, "the people, the thoughts and the practices we tell stories about as "ancestors," or as the beginnings of our lineage, always reflect some present-day interest." -Ibid, pp. 7

[17] Ibid, pp. 6

[18] Coudert, pp. 134

– those of Newton the Alchemist, Newton the Master of the Mint or Galileo the Renaissance socialite – are disregarded by intellectual histories because they detract from the mythos of these scientific and reasoned individuals.

As noted above, in intellectual history's portrayal of the Scientific Revolution, there is a juxtaposition between the thoughts of "ancient" and "modern" society. Ancient society is described as stagnant and subservient to Aristotelian conceptions of the world, whereas modern society is characterized by a great flourishing of new modes of thought. In *The Origins of Modern Science: 1300-1800*, Butterfield notes that, "there does not seem to be any sign that the ancient world was moving towards anything like the Scientific Revolution."[19] He further illustrates that "the general appearance of the [ancient's] world and the activities of [the] men [therein] had varied astonishingly little." These ancient people had no concept of change, according to Butterfield – "the skyline was forever the same."[20] Butterfield's depictions of the seventeenth century, on the other hand, highlight how "change came so quickly as to be perceptible."[21] It is evident Butterfield has a very particular, somewhat derogatory way of describing the people of the "ancient" world in comparison to those of the "modern." In Butterfield's interpretation, one is confronted by the notion of the incredible progress that occurred during the Scientific Revolution. The progression of modern thinkers directly contrasts to the ancients, who were set in their Aristotelian view of the world. With the focus on progress, the Scientific Revolution is depicted as an "epoch of crucial transition" from the antique to the modern, "where new things are palpably born, and the face of the earth is said to be changing."[22] In concordance with Butterfield's interpretations, H. Floris Cohen characterized the Scientific Revolution as "the crucial event in the transition from traditional to modern modes of thinking and acting."[23] In the depictions highlighted here there is a sense that the thinkers of the Scientific Revolution were considerably more productive than their predecessors; they broke from the Aristotelian philosophical paradigm and developed a rational conception of the world that allowed humanity to progress forward towards *our* way of thinking. For Shapin, however, "the past is not transformed into the 'modern world' at any single moment." Rather, the notions of seventeenth century practitioners often had "as much of the ancient as the modern" and "had to be successively transformed and redefined by generations of thinkers" into our twenty-first century conception of modern thought.[24] Although the Scientific Revolution can be seen as a period where new modes of thought arose, it is important to keep in mind the continuation of older modes of thought – both religious and philosophical – that occurred during this time period. That is, early modern thinkers did not necessarily completely divest themselves of the theories of ancient society as traditional depictions purport; rather they altered these theories, reapplying them to the questions that were of interest in their own historical period.[25] Intellectual histories seem to downplay these continuities, instead emphasizing the distinct and discontinuous nature of ancient and modern thought. Furthermore, traditional conceptions of the Scientific Revolution as a triumph of the secular,

[19] Butterfield, pp. 179
[20] Ibid, pp. 187
[21] Ibid, pp. 187
[22] Ibid, pp. 180
[23] Coudert, pp. 135
[24] Shapin, pp. 7
[25] William E. Carroll highlights how "the developments in the natural science in the seventeenth century, … do not so much represent a rejection of the *principles* of Aristotelian physics as mark a great advance of our understanding of the ways in which mathematics can be applied to the study of physical reality. The science of Galileo and Newton, strikingly original as they are, remain full consistent with a general Aristotelian science of nature." - Carroll, pp. 78

rational world over the religious world can also be called into question.[26] As Allison P. Coudert notes, "it is impossible to distinguish between religion, magic, and science in the early modern period" because early modern natural philosophy was concerned with myriad "theological issues" such as "creation, providence [or] the immortality of the soul." These concerns, in many instances, "fostered scientific developments."[27, 28] New methods in natural philosophy arose to address questions that were theological in tone because these "modern" thinkers were still concerned with issues of religion and philosophy. As with the studies of the "Great Men" of the Scientific Revolution, intellectual history's portrayal of philosophical "ancients" and rationally minded "moderns" can be seen as performing a pedagogical function. These depictions place the seventeenth century "moderns" in an intellectually elevated position vis-à-vis their ancient counterparts because we more readily identify with the values of the modern thinkers. The narratives juxtaposing ancient religiosity/spirituality and modern rationality put forth by intellectual historians reinforce the belief that we are the intellectual legatees of the 'modern' individuals of the Scientific Revolution.

Owing to the strong emphasis on the progress of the era and a focus on the acts of specific individuals, intellectual histories tend to illuminate only the aspects of history that reinforce the idea that the Scientific Revolution and the actors therein led to our modern world. These narratives focus on the developments that occurred during the era, but often fail to situate these developments within the wider cultural, social and historical context. They discuss the "what" of the Scientific Revolution – the discoveries, theories and influential figures – without discussing the "how" or "why" – the type of cultural atmosphere that allowed for such developments, the reasons certain scientific knowledge was pursued over others, the extent to which the ideas were accepted, etc.[29] The intellectual method of investigation thus tends to create linear, circumscribed narratives that belie the multiplicity of interpretations, practices, beliefs and cultural aspects that exercised influence on the thought developments during the Scientific Revolution. The multi-faceted nature of history is simplified and unified in order to lionize certain men and developments that we find meritorious in our current view of the world. Therefore, one should be critical when approaching intellectual histories. Although intellectual histories present interesting accounts of how theoretical developments affected thought, these accounts are not the *only* way of interpreting the changes that occurred during the Scientific Revolution.

In contrast to the development-focused interpretations of intellectual historians, cultural historians understand that there are many ways to broach the subject of the Scientific Revolution, running from "the strictly scientific to the social, historical and psychological."[30] While cultural histories may observe some of the same topics of interest as intellectual histories (the influential figures of an era, theoretical developments, changes in worldview, etc.), the wider range of ways in which these areas

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[26] On the topic of this triumph, Butterfield describes "a colossal secularization of thought in every possible realm of ideas at the same time." – Butterfield, pp. 182; - It can be seen how this statement could be a problematical generalization of thought during the 17th century.

[27] Coudert, pp. 151

[28] Allison P. Coudert is a historian of religion and religious studies. Her primary focus is on the interrelation between religion and science, and the way both of these elements have historically shaped ideas about gender. She has also written extensively regarding the relationship between Christians and Jews and the role that the mystical teachings of the Jewish Kabbalah played in the emergence of modern science. – From the "About the Author" section in Coudert (un-paginated)

[29] Shapin, pp. 12

[30] Coudert, pp. 134

of interest are analyzed creates accounts of the Scientific Revolution that differ greatly from those of intellectual histories. Stillman Drake, for example, constructs a picture of the Scientific Revolution that focuses heavily on the rise of literacy and the advent of the printed book.[31] He posits "it is not at all likely that science would have acquired its modern form when it did"[32] had it not been for increases in the general literacy of the population. Drake further proposes that the printed book altered the scholarly landscape by affording a wider literate audience access to printed materials outside of a university setting.[33] These non-university situated scholars created a flourishing of new ideas that coincided with the ideas being developed in the universities. However, he also emphasizes that the new ideas developed by non-university scholars did not necessarily supplant the institutionalized university teachings, but rather became a second, coexistent stream of scientific thought.[34] Although Drake discusses theoretical developments in the history of science, his focus on literature and the dissemination of thought via the printed book allows one to see how scientific developments and the changes they fomented did not occur in isolation from the culture, but rather occurred within a larger cultural network of influence.[35] Additionally, even the chapter headings of many cultural histories of the Scientific Revolution evince the differences in analytical foci. In Allison P. Coudert's *Religion, Magic and Science in Early Modern Europe and America*, for instance, chapters such as "Religion and the Scientific Revolution" and "Esotericism and the Scientific Revolution" directly contrast with the work of Butterfield, where titles like "The Downfall of Aristotle and Ptolemy", "The History of the Modern Theory of Gravitation", and "The Historical Importance of Impetus" reign supreme. Whereas Coudert's titles show that she will consider the other, non-scientific aspects that might have influenced the production of thought in the Scientific Revolution, Butterfield's chosen topics are indicative of his heavy bias towards scientific and theoretical developments as the catalysts for change.

Cultural histories are generally more holistic in approach, and seek to situate historical information within the cultural or social context it is a part of, rather than appropriating it for the benefit of our own modern beliefs. Although cultural histories do indeed discuss iconic characters of the Scientific Revolution, it is in a way that does not emphatically exhibit the greatness of these men; influential figures like Galileo, Boyle, and Newton are depicted with regard to the world that gyred around them. The contributions and critiques of other figures are illustrated along with those of the figures we most identify with in modern times. For instance, in *The Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*, Steven Shapin and Simon Schaffer discuss the theoretical and methodological conflicts that occurred between Thomas Hobbes and Robert Boyle. Hobbes is shown to be critical of Boyle's experimental method and is described as saying that "the systematic doing of experiments was not to be equated with philosophy," as Boyle claimed. In Hobbes's mind

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[31] In the words of James MacLachlan, "Stillman Drake was the pre-eminent interpreter of the life, work and times of Galileo. His scholarship ranged broadly and deeply throughout the renaissance of science to which Galileo contributed so much." - James MacLachlan, "Stillman Drake (1910-1993)," In *The Journal for the History of Astronomy 25* (1994), pp. 73

[32] Stillman Drake, "Literacy and Scientific Notations," in *Essays on Galileo and the History and Philosophy of Science, Vol. 3*, ed. Noel M. Swerdlow and Trevor Harvey Levere, (Toronto: University of Toronto Press, 1999), pp. 345-346

[33] Stillman Drake, "Early Science and the Printed Book: The Spread of Science Beyond the Universities," in *Essays on Galileo and the History and Philosophy of Science, Vol. 3*, ed. Noel M. Swerdlow and Trevor Harvey Levere, (Toronto: University of Toronto Press, 1999), pp. 122

[34] Drake, "Early Science and the Printed Book: The Spread of Science Beyond the Universities." - pp. 124

[35] For Drake, "the ferment of ideas on method and of opposition to the authority of Aristotle seems to be a product of the general broadening of discussion that followed the printed book, rather than a by-product of the new ideas in science itself." – Ibid, pp. 127

"it was not the case that one could ground philosophy in experimentally generated matters of fact."[36] However, Hobbes's ungentlemanly, argumentative and dogmatic style of presenting his ideas did not endear him to his contemporaries at the Royal Society and, thus, it was Boyle's experimental method that was taken to be the correct way of pursuing true knowledge.[37] In this illustration of the disputes between Hobbes and Boyle, "knowledge making and knowledge holding [is displayed] as a *social process*." It is not something created independently by solitary figures without recourse to, or comment from, the world around them.[38] Furthermore, by showing that these historical characters were indeed influenced by their surroundings, cultural histories efface some of the mythic qualities surrounding the "Great Men" of the Scientific Revolution. These interpretations illustrate that these figures were not men purely defined by their scientific work; they had their eccentricities and they also had ulterior, socially/politically/religiously influenced motives for performing the work they did. For instance, Newton took interest in a wealth of subjects we would consider well outside the purview of modern science and, in his time, was a "renowned expert on Jason's fleece, Pythagorean harmonics and Solomon's Temple."[39] The presentation of Newton's eccentricity is something that is disregarded by intellectual histories because it "unsettles his image as the idealized prototype of a modern scientist."[40] Cultural histories, however, discuss elements such as these because such a discussion creates a richer picture of characters in the past and allows for a better understanding of the different types of thought that influenced the developments in the Scientific Revolution. Because of the willingness to present historical narratives that may not contribute to the prevailing, idealized view of historic figures, cultural histories are decidedly less pedagogical than intellectual histories.

The final aspect of cultural historical interpretations of the Scientific Revolution that differs significantly from intellectual interpretations is the analysis of self-fashioning; that is, the ways in which the thinkers of the era constructed particular images of themselves to be viewed by their contemporaries. This analysis adds an interesting personal dimension to the characters that is often absent in intellectual accounts of history. It allows one to see how, in order to be accepted and have their ideas validated, learned individuals had to construct their personal image in a way demarcated by the values of the society in which they lived. The notion that men of science had to conduct and present themselves a certain way so as to have their ideas taken seriously illustrates how the creation of scientific knowledge during the Scientific Revolution, and the early modern era in general, was a process influenced by non-scientific social aspects. Turning again to Shapin and Schaffer's analysis of Hobbes and Boyle, one sees evidence of the way a respectable scholar appeared and acted. Boyle by all accounts was "a renowned valetudinarian" and is depicted in images as looking noticeably wan.[41, 42] This image construction could have been a tactic on Boyle's part to engender sympathy and support from his colleagues. Additionally, it could evince the notion of a scholar so dedicated to his work that he disregards all else in the world, including his own health. Shapin and Schaffer also highlight the respectful way in which scholars of the Royal Society were expected to comport themselves when discussing theories. Modesty, humility and friendliness were valued qualities for a natural philosopher to possess, whereas dogmatism was demonized due to its socially disruptive

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[36] Steven Shapin and Simon Schaffer, *The Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*, (Princeton: Princeton University Press, 2011), pp. 129

[37] Shapin and Schaffer note, "When the leading lights of the Royal Society censured Hobbes's dogmatism, the tended to conjoin comments on his personal qualities with judgments upon his philosophical programme." – Shapin and Schaffer, pp. 137

[38] Shapin, pp. 9

[39] Fara, pp. 3

[40] Fara, pp. 3

[41] Shapin and Schaffer, pp. 137

[42] Boyle is depicted twice by William Faithorne in 1664. - Ibid, pp. 258-259

nature.[43] The authors demonstrate that the philosophical programs of Hobbes and Boyle were "predicated on [their] distinctive social relationships, and each valued a characteristic persona."[44] From the situation illustrated here, it is evident that the predication and acceptance of natural philosophical thought was as dependent on social factors – how the philosopher acted and appeared publicly – as it was on the theoretical merits of the idea. Intellectual histories generally efface the social nature of scientific developments. In addition to observing the ways in which men themselves constructed a public identity, cultural histories also highlight the way the people around the natural philosopher shaped how these men were to be seen by the greater public.

Images depicting Newton are a prime example of this idea, and Patricia Fara does well to illuminate how Newton became a cultural commodity through the construction and evolution of his personal image. Fara discusses how early portraits of Newton reflected the cultivation of his personal image as a "scholarly Cambridge recluse."[45] This image was not widely known by his contemporaries, as it was only distributed to his close friends. The limited distribution of this image may also hint at why Newton's prevailing modern image is not that of the scientific recluse. In contrast, later portraits of Newton depict him in trappings matching the "enlightenment ideals of fashionable, well-fed sociability." Newton also chose to distribute these images of himself more widely than those previous, commissioning engravings to be sent throughout England and abroad as gifts to selected colleagues.[46] In this way, we start to see how Newton became more concerned with having his image – and by extent, his achievements – more widely known. To round out her discussion of Newton's image construction, Fara highlights a portrait of Newton painted during the twilight of his years that depicts him as a mentally alert and venerable man of learning.[47] In the eighteenth century, portraits were "not so much for exposing individual idiosyncrasies," but rather "for providing the spectator with a morally improving role model." There was a conscious concern to leave a "flattering image for posterity."[48] The Royal Society would not have wanted to depict one of their own as "an incontinent invalid aged eighty-three" as it would reflect poorly on Newton's – and their own – lasting prestige.[49] Thus, they made sure to represent Newton in a way befitting such a vaunted intellectual hero. This "deceptive representation" was widely copied and distributed after Newton's death and, obscured by time, became accepted as looking "extremely like Sir Isaac."[50] The discussions of image and identity construction present in some cultural histories allow one to see how myths were built up around successful individuals. Unlike intellectual histories, where our modern day conceptions of the men of the Scientific Revolution are projected into the past (depicting them as resolutely "modern" and atypical for their time), cultural histories seek to show how the images of these men were *developed* into those we think of today.

Having discussed the general methodological approaches of both intellectual and cultural history and the impacts these approaches have on historical depictions of the Scientific Revolution, we can now turn to the example of Galileo Galilei. To illustrate how portrayals of Galileo have changed over time, the work of Alexandre Koyré and Mario Biagioli shall be highlighted presently.

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[43] Dogmatism "was pernicious because it disrupted the social relationships which could alone produce and sustain factual knowledge. – Ibid, pp. 138
[44] Ibid, pp. 139
[45] Fara, pp. 31
[46] Ibid, pp. 31
[47] Ibid, pp. 32
[48] Ibid, pp. 33
[49] Ibid, pp. 32
[50] Ibid, pp. 32

Alexander Koyré's monograph, *Galileo Studies*, is a dense work chronicling Galileo's progression as a natural philosopher.[51] Koyré proposes to "teach us something about the history – or the pre-history – of [Galileo's] thought" by analyzing the course of Galileo's thought developments as they evolve from Aristotelian physics to impetus physics and finally to a mathematical, experimental Archimedean/Galilean physics.[52] Koyré focuses on Galileo's anti-Aristotelian arguments about motion that occurred while he was at the University of Pisa. With his conceptions of motion instilled by force, which are discussed in great detail by Koyré, Galileo made it "impossible to accept that there could be a spontaneous acceleration of motion." Galileo's new conceptualization of motion effectively nullified the Aristotelian idea of motion having its own impetus.[53] In this discussion, Koyré also places Galileo in an intellectually elevated position by describing him as "the only one who dared to reject this phenomenon [the impetus of motion] as impossible while his predecessors and contemporaries limited themselves to trying to explain it."[54] Galileo is depicted as a man apart; a crusading intellectual who challenged the antiquated Aristotelian system and who swiftly imparted a radical new view of the nature of movement to the greater public. Further illustrations of the progression of Galileo's theories follow these initial discussions, with Koyré examining the minutiae of each theoretical development and describing the numerous thought experiments Galileo performed to confirm his theories. These narratives provide an in-depth look into Galileo's work as it developed into his final cosmological interpretation, but do little to show Galileo as anything other than a man of purely scientific endeavors. Contextualizing details are seemingly deemed superfluous, and Galileo becomes a figure defined solely by his theoretical work. In *Galileo Studies* one sees how Koyré's depiction of Galileo is in keeping with the interpretive style of intellectual histories – it focuses on the theoretical developments, publications and experiments without any recourse to the myriad factors that might have influenced Galileo's thoughts, or, indeed, his motives for addressing such issues. Furthermore, Galileo is depicted by Koyré as the pinnacle of thought during his era – he "systematized, codified and clarified" the theories of his predecessors and then used these new modes of thought to drastically alter the way in which people saw the world.[55] By painting Galileo in such a way that isolates him from his peers and aggrandizes his achievements, Koyré clearly lauds Galileo as one of the "Great Men" of history.

Koyré's discussion of Galileo's *Dialogue Concerning the Two Chief World Systems* focuses heavily on the theories discussed in the book. This focus might strike one as decidedly lacking in historical context, since discussions of Galileo's *Dialogue* usually engender some reference to the Catholic Church's reaction to the work and their subsequent decision to place Galileo under house arrest. However, Koyré is content to describe the rhetorical structure Galileo employs, the theories present in the book, and the experiments Galileo describes to illustrate his theories. The overwhelming focus on the intricacies of Galileo's discourse in the *Dialogue* without any consideration of factors that shaped the argument or of the social impacts the arguments made decontextualizes the work. Galileo's *Dialogue* is not treated as something that was extremely controversial during its time, but is instead

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[51] Alexander Koyré is a twentieth century historian of science whose works – *Etudes Galiléennes* (1939), *From the Closed World to the Infinite Universe* (1957), and *Newtonian Studies* (1965), for instance – shaped the development of investigations focusing on the history of scientific thought. According to Yehuda Elkana, these works on the history of scientific thought in the sixteenth and seventeenth centuries and on the "Scientific Revolution" became a "paradigm for the history of science as a history of disembodied ideas." - Yehuda Elkana, "Alexandre Koyré: Between the History of Ideas and Sociology of Knowledge," In *History and Technology 4* (1987), pp. 111

[52] Alexandre Koyré, *Galileo Studies*, Trans. John Mepham, (New Jersey: Humanities Press, 1978), pp. 3

[53] Koyré, pp. 31-31

[54] Ibid, pp. 31

[55] Ibid, pp. 28

propped up as a text that was a victory for Galileo's Platonism; "his science is Plato's revenge."[56] By avoiding a discussion of social repercussions caused by the text, Koyré is attempting to conceal the somewhat unfavorable reception of the *Dialogue* and transform it into a symbol of the immediate triumphs of modern, rational science. Additionally, although Koyré does make mention that the *Dialogue* was written in "the vernacular, in Italian," which was "the language of the court and of the bourgeoisie," he fails to highlight the reasons Galileo might have chosen to write for this particular audience. According to Koyré, Galileo had the task of "persuading the gentleman reader and permitting them to understand the argument and accept the proofs." [57] But *why* Galileo wanted to persuade the gentleman reader is never discussed. Nothing is mentioned of Galileo's involvement in the patronage networks surrounding the court of the Medici, nor of the intellectual validation associated with having the backing of powerful patrons. Because Koyré's analysis focuses only on the scientific information contained within the pages of the *Dialogue*, it fails to illustrate any possible reasons Galileo may have had for writing for this gentlemanly audience. Galileo and his work are once more disassociated from the overall cultural milieu in which they are situated.

In *Galileo Courtier: The Practice of Science in the Culture of Absolutism*, Mario Biagioli offers a very different interpretation of Galileo's life and his reasons for espousing the scientific beliefs that he did.[58] Biagioli decentralizes scientific practice from his interpretation and instead brings Galileo's role in the Medicean patronage networks to the fore. He describes Galileo as someone whose "discourse, motivations, and intellectual choices were informed by the patronage culture in which he operated."[59] Thus, in Biagioli's illustrations, Galileo can be seen as more than just a man shaped by his scientific investigations; rather, he is someone who, concerned with the cultural prestige and validation of his work that came with associations to the Medici, was influenced by courtly dynamics. He fashioned a courtly identity for himself and cultivated a courtly audience to present his investigations to because that was the socially constructed way of establishing credibility.[60] Biagioli emphasizes that the Medicean court provided the social and cognitive legitimation for practitioners of science by giving them an arena in which to present their ideas.[61] This legitimation was especially important for a mathematician like Galileo, because mathematics was deemed academically subordinate to philosophy and theology. In the courtly milieu, however, no such hierarchy existed, and a mathematician was able to acquire "higher social status and credibility."[62] Galileo was able to make the cosmological claims that he did and garnered support for these claims precisely because of his elevated intellectual position in the Medicean court. Unlike Koyré, who disregards Galileo's relationship to the world around him, Biagioli adds historical context to the picture of Galileo by showing how he was situated within, and influenced by, the courtly world of the Medici.

On the subject of Galileo's Copernicanism, Biagioli discusses how much historiography has "limited itself to considering Galileo's statements about Copernicus in his books, manuscripts and letters," consequently developing "an unnecessarily narrow perspective of the issue."[63] This focus

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[56] Ibid, pp. 208
[57] Ibid, pp. 158
[58] Mario Biagioli is a Distinguished Professor of Law, History, and Science and Technology Studies at UC Davis. Some focal areas in his scholarship include: intellectual property in science, the history and philosophy of intellectual property, and the relationship between law and science. - "Mario Biagioli," Accessed on March 23, 2013, http://www.law.ucdavis.edu/faculty/biagioli/
[59] Mario Biagioli, *Galileo Courtier: The Practice of Science in the Culture of Absolutism*, (Chicago and London: The University of Chicago Press, 1994), pp. 4
[60] Biagioli, pp. 5
[61] Ibid, pp. 2
[62] Ibid, pp. 6
[63] Ibid, pp. 93-94

emphasizes Galileo's written works as symbols of his resolute belief in the Copernican cosmological model. However, Biagioli notes, "Galileo's drive to produce more discoveries" was not necessarily to explicitly prove the validity of the Copernican system, but "reflect his patronage concerns."[64] That is, Galileo felt the need to make discoveries to secure his position with the Medicis by dedicating his discoveries to his patron, rather than to explicitly verify the theories of Copernicus. Galileo did not have a fully formed belief in the Copernican system while at the Medici court, as many intellectual histories propose, nor was his support of this system based purely on observations and theorization. Rather, the *process* by which Galileo came to fully support Copernicus was based on the interactions between Galileo and his critics.[65] The focus on solely the developed theories fails to highlight "the structures of [Galileo's] daily activities and concerns," and "how these framed his scientific activities."[66] Thus, instead of depicting Galileo and his thoughts as a finished product, as many intellectual histories do, Biagioli shows how Galileo intellectual convictions were greatly influenced by the social world he was a part of; Galileo's beliefs were a result of a socially mediated, dialectical process.

From the preceding discussions of the methodologies of both cultural history and intellectual history, it should be apparent that the two approaches produce drastically different accounts of what went on during the Scientific Revolution. Intellectual histories give detailed accounts of the inventions, theoretical developments, and influential men – giving the reader an idea of these topics in isolation – but do little to show how scientific thought was influenced by the overall cultural/social setting in which these ideas and men were situated. One is presented with the science itself, but not the life going on outside the science. Cultural histories, on the other hand, generally strive to show the interconnectedness of historical events and characters so as to provide a more contextualized, nuanced picture of the Scientific Revolution. The cultural-historical narrative picture does not just depict scientific and developmental aspects of the Scientific Revolution as isolated, independent entities, but shows how other – non-intellectual – factors could have exercised influence on the construction of ideas. Admittedly, my stance in this essay has been somewhat biased in favor of a cultural historical approach to the study of the Scientific Revolution. This bias exists because I have had a greater exposure to cultural histories throughout my academic career, which has informed my discursive opinion to view this style of historical narrative more favorably. It is, however, inimical to promote one method as more *valid* than the other, as both intellectual and cultural histories have their merits for studying different parts of the Scientific Revolution; each simply presents an *alternative* interpretation of what changes occurred during the Scientific Revolution and how these changes were fomented. There is no 'master narrative' of a historical event or personage that must be followed; rather, there are multitudes of ways in which history can be interpreted. One should, thus, be mindful of the multiple narratives that can be found in a historical period depending on what aspects the historian highlights and for what purposes the history might have been written.

Works Cited

Electronic Resources:

[64] Ibid, pp. 94
[65] These interactions were framed by patronage dynamics. - Ibid, pp. 94
[66] Ibid, pp. 3

UC Davis. "Mario Biagioli." Accessed on March 23, 2013. http://www.law.ucdavis.edu/faculty/biagioli/

Printed Resources:

Biagioli, Mario. *Galileo Courtier: The Practice of Science in the Culture of Absolutism*. Chicago and London: The University of Chicago Press. 1994.

Butterfield, Herbert. *The Origins of Modern Science: 1300-1800, New Edition: Revised and Enlarged*. London: Lowe and Brydone Printers, Limited. 1968.

Carroll, William E. "Creation and Intertia: The Scientific Revolution and Discourse on Science-and-Religion." In *Science and Faith within Reason*. Edited by Jaume Navarro. Surrey: Ashgate Publishing Limited. 2011.

Coudert, Allison P. *Religion, Magic, and Science in Early Modern Europe and America*. Santa Barbara, CA: ABC-CLIO. 2011.

Drake, Stillman. "Early Science and the Printed Book: The Spread of Science Beyond the Universities." In *Essays on Galileo and the History and Philosophy of Science, Vol. 3*, Edited by Noel M. Swerdlow and Trevor Harvey Levere. 118 – 130. Toronto: University of Toronto Press. 1999.

Drake, Stillman. "Literacy and Scientific Notations." In *Essays on Galileo and the History and Philosophy of Science, Vol. 3*. Edited by Noel M. Swerdlow and Trevor Harvey Levere. 345 – 363. Toronto: University of Toronto Press. 1999.

Elkana, Yehuda "Alexandre Koyré: Between the History of Ideas and Sociology of Knowledge." In *History and Technology 4* (1987): 111-144.

Fara, Patricia. *Newton: The Making of Genius*. New York: Columbia University Press. 2004.

Koyré, Alexandre. *Galileo Studies*. Translated by John Mepham. New Jersey: Humanities Press. 1978.

MacLachlan, James. "Stillman Drake (1910-1993)." In *The Journal for the History of Astronomy 25* (1994): 73-75.

Ritschel, Daniel. "The Politics of the Whig Interpretation of History." Review of *Herbert Butterfield: Historian as Dissenter*, by C.T. MacIntire. H-Albion, H-Net Reviews. December 2005. Accessed at: http://www.h-net.org/reviews/showrev.php?id=11043.

Shapin, Steven. *The Scientific Revolution*. Chicago and London: The University of Chicago Press. 1998.

Shapin, Steven and Simon Schaffer. *The Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*. Princeton: Princeton University Press. 2011.

White, Hayden. *Metahistory: The Historical Imagination in 19th-Century Europe*. USA: John Hopkins University Press. 1973.