

Introduction

The rise of English Protestantism and the ultimate victory of Oliver Cromwell produced a curious phenomenon in early modern England: the silencing and eventual destruction of the pipe organ in cathedrals and parish churches across the land. In this dissertation I examine the complex social conditions that led to this state of affairs. It is my contention that in England during the course of the sixteenth and seventeenth centuries, this ecclesiastical instrument figuratively embodied and literally gave voice to the Roman Catholic Church. When the Protestant Reformation silenced the Catholic Mass, the pipe organ was silenced as well. Because this ancient technology was emblematic of much that was despised in Catholicism, it came under assault by the Anglicans, the Puritans, the Monarchy, the Parliament, Oliver Cromwell's army, and even the militant rabble-rouser in the street. Attackers ranged from the Acts of the English Parliament to the axe of the Parliamentary soldier. My hypothesis is that the symbolic role played by the pipe organ in early modern English society was responsible for causing this instrument to become the tangible target of wide-ranging aggression.

This hypothesis is further enhanced by an investigation of the events that immediately followed the Commonwealth Era in England. With the Restoration of the Monarchy came the restoration of the organ.¹ By the close of the seventeenth century, the King of Instruments had not merely survived; it had fully recovered and had begun to flourish in the wake of the devastation that had forced it to forsake its long-accustomed role in English society.

Using the English pipe organ to structure a detailed case study of technology in society, I will illustrate by example that modern theories of technology formulated around such notions as novelty, growth, progress, change, and revolution are too narrowly conceived to accommodate the complexity of the various relationships that existed between the pipe organ as a stable technology and the unstable society of early

¹ The terms "pipe organ" and "organ" are used synonymously throughout this work. Unless otherwise indicated in the context of the discussion, both terms refer to instruments made in England.

modern England.² Without question, these traditional explanatory categories have yielded fruitful results, but not, as it turns out, for the English pipe organ. My analysis of the nature of the antagonistic relationship between a long-established technology and the diverse social structures that attempted to annihilate it will show that we must include “technology as symbol” among our conceptual categories.

Overview of the Project

In order to place the pipe organ fully formed into sixteenth-century English society, I felt that it was necessary to review the history of the origin of this instrument. The ambience of the Alexandrian society that gave birth to this ancient technology contrasted sharply with the unsettled environment of early modern England. The pipe organ first made its appearance in Alexandria during the third century BCE. By that point in time, the foundations of Western philosophy, which included a theoretical understanding of music, were already well established. A premium was placed on scholarship. Engineering skills were valued in a social setting that was receptive to innovation. Political and religious institutions were relatively stable and the overall atmosphere was lively and festive. The newly invented organ was quickly accepted into the cultural life of the community.

In contrast, in early modern England this musical instrument was subjected to a lengthy period of religious upheaval and political dissent. One manifestation of the widespread discontent was an increasing antagonism toward the musical expression of the Italian Renaissance, which was closely identified with the Roman Catholic Church. During the Protestant Reformation, the pipe organ became a symbolic manifestation of Catholicism. At the same time, as the legitimacy of the use of this instrument in the service of Protestant worship was called into question, there was a growing reaction against its heathen ancestry.

² This is not to imply that historians, sociologists and philosophers of technology have neglected to address the diversity and complexity of relationships between technology and society, but rather to stress the point that the pipe organ was obviously not a recent innovation undergoing the initial stages of social negotiation in anticipation of its reception into English society. It had long since achieved the status of a normal, unremarkable, socially acceptable and essentially transparent technology.

My first chapter brings into focus the details of the organ's early history in order to draw attention to the intellectual background out of which this ancient technology emerged. It also provides an overview of the instrument as it appears in both ancient and modern histories of technology. Here I show that earlier historians of technology have left elaborate descriptions of the organ, but modern authors have either made a passing reference to this sophisticated mechanism or else have not mentioned it at all. I am convinced that this complex technology with a history spanning more than two thousand years deserves wider recognition in the field of Science and Technology Studies.

The main body of my dissertation consists of the second, third and fourth chapters. Beginning with the second and continuing with the third chapter, I examine a collection of primary source documents that pertain to the fate of the pipe organ as a symbol of Roman Catholicism and a victim of the English Reformation. The social disharmony that led to the destruction of the organ lasted from the early stages of the Reformation until the end of the Commonwealth Era. In the fourth chapter, I analyze the process of recovery that began with the Restoration of the Monarchy. My fifth chapter consists of a summary, conclusions, and suggestions for further research.

An overview of the early years of the English Reformation shows that after the separation between Henry VIII and the Roman Catholic Church, the Reformation movement spread quickly and achieved dominance during the Elizabethan Age. However, the overall transition from Catholicism to Anglicanism did not take place without great cost to society. As a result of England's severance from Rome and the subsequent dissolution of the monasteries, the church as a social, political and economic structure was significantly weakened. This institution lost the numerous benefits from the extended system of patronage that had previously been linked to the Roman Catholic ecclesiastical hierarchy. There is one outcome of the separation that has been overlooked by social, political and economic analysts, although it is a facet of the Reformation movement that has been duly noted by historians of music. This particular aspect of the split with Rome is the detrimental effect that it had on the ecclesiastical organ. Organ historian William Leslie Sumner summarizes the devastating consequences of the Puritan attitudes toward the organ that resulted from the close association of this instrument with the Roman Catholic Church:

After the Dissolution of the Monasteries in 1536 the organ was often identified with Roman Catholicism to such an extent that it had a very chequered history until it was completely disposed of by Cromwell in 1642, as far as its use in Christian worship was concerned, for a period of eighteen years. But for a hundred years before this, waves of “Puritanism” had gone far to cause the neglect or destruction of many instruments, notably in the London district during the reign of Elizabeth (Sumner 1962, p. 101).

As this passage indicates, the organ found itself more than once at a critical juncture in English history. The effect of each of these episodes will be covered in the course of my case study.

Ultimately, the organ fell victim to the violently destructive relationship that developed between militant Puritanism and the English Parliament, culminating with attacks on the instrument by Oliver Cromwell’s army. Ironically, at the same time that Puritan excess was forcing the pipe organ into a struggle for survival, the Puritan ethic was beginning to breath life into the Scientific Revolution.³

On the subject of science, I must add a note of explanation concerning the difficulty of working with certain vocabulary items. The first of these is the word “science,” which has customarily been used to refer to the investigation and acquisition of knowledge of the natural world from the earliest recorded history to the present day. However, the use of this word in the context of intellectual activity in Classical Greece and the Hellenistic age is problematic because “there is no single term in Greek that is exactly equivalent to our ‘science’” (Lloyd 1970, p. 125). Therefore, the umbrella phrase “Greek science” must be understood to have various interpretations. The Greeks, who introduced the diversity of theories that are customarily labeled in this manner today, considered themselves as “philosophers or *physikoi* or mathematicians or doctors or sophists” (Lloyd 1970, p. 125). Even among these subgroups there were distinctive differences.

The more recent terms “scientific,” “engineer” and “technology” can also be problematic in a dissertation that delves into Classical Antiquity and also spans the early

³ For a comprehensive discussion of the relationship between the Puritan ethic and the advancement of science, see Merton (1970).

modern era.⁴ The term “engineer” (with various meanings and spellings derived from the Romance languages) was incorporated into the English language as early as the 14th century. “Science” is derived from the Latin *scientia* (knowledge) and has also been in use in English since the 14th century. However, the term “scientific” did not appear in general usage until the late 16th century. The English word “technology” is derived from the Greek *technología*.⁵ In the 17th century, the term generally referred to a “discourse or treatise on an art or arts; the scientific study of the practical or industrial arts.”⁶ By the early 18th century it also meant the mechanical or the practical arts. The word “scientist” was not coined until the first half of the 19th century.⁷

Nevertheless, it seems awkward to write in the field of Science and Technology Studies without making use of the available modern vocabulary. These terms commonly appear in many of the works cited in this dissertation, especially in the first chapter. For the sake of clarity and consistency, I will occasionally make use of them as well.

Historiography of the Organ

In addition to the various selections from the history of technology that I review in the first chapter and the primary sources from which I derive the major segment of this dissertation, I also rely on a number of standard works in the field of music history and the history of the organ. My overview of these references begins with the classic work of Sir John Hawkins, which he entitled *A General History of the Science and Practice of Music* ([1776, 1853] 1963). A lawyer rather than a musician by profession, Hawkins thought that he might not be considered qualified to take on such a monumental task in a field not his own. His dedication to King George III expresses this concern:

⁴ Dates, definitions and examples of the earliest known usage of these words can be found in the *Oxford English Dictionary* at <<http://etext.virginia.edu/oed.html>>.

⁵ According to David Nye, Jacob Bigelow, who was a Harvard professor of medicine, formulated the word ‘technology’ in 1828. In his *Elements of Technology*, Bigelow “encouraged the fusion of science and art, which he felt was characteristic of industrial society” (Nye, 1994, p. 46).

⁶ <<http://etext.virginia.edu/oed.html>>.

⁷ “Upon the request of the poet Coleridge in 1833 Whewell invented the English word “scientist;” before this time the only terms in use were “natural philosopher” and “man of science.”” See Snyder, Laura J., “William Whewell”, *The Stanford Encyclopedia of Philosophy (Spring 2001 Edition)*, Edward N. Zalta (ed.), URL = <<http://plato.stanford.edu/archives/spr2001/entries/whewell/>>.

A History of Music by any but a professor of the science, may possibly be looked on as a bold undertaking; and it may appear not a little strange that one, who is perhaps better known to the world as occupying a public station than as a writer, should choose to be the author of a work of this kind, and for which the course of his studies can hardly be supposed to have in any degree qualified him (Hawkins [1776, 1853] 1963, vol.1, p. xix).⁸

Hawkins represents himself to the King as an amateur lover of music and an avid collector of materials. His history is a detailed encyclopædia based on original sources and anecdotes. For the 1853 edition, his anonymous biographer offers the following description of the ideal historian, noting that if this Renaissance man cannot be found, then task of writing the history of music should fall upon the student:

So the beau ideal of a historian of music would be found in a man who united in his own person the composer, performer, linguist, and philosopher, together with the leisure *and* studious habits of the man of letters. But if we cannot find this phœnix, if we must rest contented either with the artist or the student, the balance of qualification is highly in favour of the latter” (Hawkins [1776, 1853] 1963, p. xiv).⁹

Hawkins begins his history with an analysis of the music of the Greeks and proceeds chronologically to the year 1776. Much of his information about the organ is derived from *Harmonie Universelle*, published in Latin by Marinus Mersennus (Marin Mersenne) in 1648. Hawkins recounts the history of music in England after the restoration of Charles II in 1660, offering numerous facts and quotations related to the performance of choral and organ music. His work provides a contextual account of the organ in early modern England, at least to the extent that anecdotal and printed sources were available to him. Of particular interest for this study is his description of the work in music theory by John Wallis, a mathematician and member of the Royal Society. As Hawkins relates,

Dr. Wallis was one of those persons whose private meetings for the improvement of philosophy by experiments, gave occasion to the institution of the Royal Society; and after its establishment he was a constant attendant, and frequent correspondent of the society,

⁸ At this point Hawkins had spent sixteen years working on his project. He dedicated it to King George III and presented it “to His Majesty at Buckingham House, during a long audience granted for the purpose” (Hawkins [1776, 1853] 1963, xiii).

⁹ See also the “Life of Sir John Hawkins, Compiled from Original Sources” (Hawkins [1776, 1853] 1963, pp. ix-xviii). This anonymous essay serves as an introduction to the 1853 edition.

communicating from time to time his discoveries in various branches of natural philosophy and the mathematics, as appears by his publications in the *Philosophical Transactions* (Hawkins [1776, 1853] 1963, vol. 2, p. 739).

Hawkins briefly refers to a “sundry” paper that John Wallis published in the *Philosophical Transactions*. This paper was a treatise on the “imperfection of the organ” (Hawkins [1776, 1853] 1963, vol. 2, p.740). Missing from Hawkins’ account of Wallis’ publication is the fact that this document was originally a letter to Samuel Pepys, written in response to an inquiry from the organ builder Renatus Harris, who figures prominently in the fourth and fifth chapters of this dissertation.

A competitive publication is *A General History of Music* by Dr. Charles Burney. The original four volumes appeared during the years from 1776 to 1779. Much of Burney’s text is extracted and expanded from the work of his rival historian, Sir John Hawkins.¹⁰ As an example, Burney’s version of the “Battle of the Organs” between Bernard Smith and Renatus Harris closely follows the account given by Hawkins.¹¹ Although Burney has the reputation of occasionally being somewhat less than accurate in his details, this comprehensive work on music and musical instruments has been influential in the field of music history.

A Short Account of Organs Built in England from the Reign of King Charles the Second to the Present Time (Sutton [1847] 1979) was published anonymously, but this work has been attributed to Sir John Sutton (Bicknell [1996] 1998, p. xvii). It is based to a great extent on the personal knowledge of the author. Like Hawkins and Burney, Sutton has been widely quoted by subsequent historians of the organ.

In 1855, the monumental history entitled *The Organ, its History and Construction* was published in three volumes by Edward J. Hopkins and Edward F. Rimbault [1855, 1870, 1877] 1987).¹² This work takes into account a great number of primary source

¹⁰ Stephen Bicknell notes that Burney “rifled and expanded” Hawkins’ material (Bicknell [1996] 1998, p. xvi). Excerpts from Bicknell are reprinted with the permission of Cambridge University Press.

¹¹ For the story of the “Battle of the Organs” see Chapter 4 below.

¹² In his Preface to the first reprint edition (1965), William Leslie Sumner notes that Hopkins (1818-1901) was a child of the Chapel Royal whose entire life was devoted to the organ. He served as organist of the Temple Church in London from 1844 until 1898. Sumner describes Rimbault (1816-1876) as a scholarly lawyer, historian and musician.

materials. It also offers new evidence to alter some of the interpretations of the previous authors (see Bicknell [1996] 1998, p. xvii).

Rimbault observed the regrettable status of the organ in some ecclesiastical circles, noting that it is the responsibility of the musician to bring this instrument to light. “The rescue of this noble instrument from the ‘holes and corners’ to which modern ecclesiologists have oftentimes assigned it is part of the musician’s creed” (Hopkins and Rimbault [1855, 1870, 1877] 1987).¹³ Likewise, the rescue of this noble instrument from the nooks and crannies to which modern historians of technology seem to have assigned it should be part of the scholar’s creed.

Historical accounts of individual organs were being published in music journals from time to time; however, in 1921 “a new quarterly magazine *The Organ* provided for the first time a dedicated forum for serious scholarly articles” (Bicknell [1996] 1998, p. xvii). During the early years of publication, the most important contributor was the Reverend Andrew Freeman. William Leslie Sumner makes extensive use of Freeman’s collected materials in his publication on *The Organ: Its Evolution, Principles of Construction and Use* (1962). Freeman’s collection is housed at the British Organ Archives in the Birmingham (UK) Central Library (Bicknell [1996] 1998, p. xvii).

In 1963, Cecil Clutton and Austin Niland published *The British Organ* (Clutton and Niland [1963]). Commenting on Clutton’s writing style, Stephen Bicknell notes that this author

was a lively and charismatic man: trenchant, determined and always brief and to the point in prose. Thus in *The British Organ* his history of the organ in Britain is happily condensed into seventy-five pages (Bicknell [1996] 1998, p. xviii).

This text covers the early history of the organ and describes the various schools of organ building in Germany, France, Italy, Spain and Portugal as well as Britain. It also provides an account of the architectural history of the organ, complete with black and white plates of the organ casework.¹⁴ This volume also includes a Gazetteer that

¹³ See the “Preface to the First Edition” written in June of 1855. Rimbault also points out that the section of the book that describes the “Ancient Position of the Organ” is particularly interesting because at the time in which he is writing, “architects are anxiously looking for precedents.”

¹⁴ Niland offers the following description of organ casework: “An organ case is a wooden enclosure around the pipes and machinery of the instrument, the front of which is left open and filled with pipes and

identifies the casework and pipework of a large number of instruments, listing them by location, builder and date.

Speaking of the organ in England before 1800, historian Peter Williams claims in his work on *A New History of the Organ from the Greeks to the Present Day* that

because so few technical details of the English organ have ever been published and so few documents ever properly assembled, particularly as they deal with the two critical periods of 1660-90 and 1820-50, it could even be thought that no history of the English organ can yet be written, despite the attempts that have been made (Williams 1980, p. 131).¹⁵

There is some hope that Williams was mistakenly pessimistic in his thinking and that a comprehensive history of the English organ can, in fact, be written.

The work of Stephen Bicknell on *The History of the English Organ* ([1996] 1998) is an excellent example of this endeavor. Bicknell agrees with Williams that the English organ is relatively deficient in documented history, claiming that his native instrument is “one of the least understood of the various national and local organ-building types” (Bicknell [1996] 1998, p. xvi). He notes that his work “attempts to construct the first history of the English organ to tread a critical path between traditionally accepted accounts – some of them undoubtedly apocryphal – and modern understanding of documents and surviving instruments” (Bicknell [1996] 1998, p. xvi). More than any previous organ historian, Bicknell takes care to incorporate the social background into his discussion. He considers his text to be based on interpretation rather than on primary scholarship (Bicknell [1996] 1998, p. xix):

Today’s scholars in the field of organ history work increasingly on matters of detail and on individual builders or instruments: no one of these has drawn up a history which includes all the accumulated background knowledge. As one of the field-workers I have been acutely aware of the lack of a more general history providing pegs on which to hang the myriad details of new research (1998, p. xix).¹⁶

woodwork in various formal arrangements” (Clutton and Niland 1963, p. 45). The casework serves both a visual and a tonal purpose. It is traditionally designed to be attractive from an architectural point of view and it also serves in the production of sound in a manner similar to the sound board of a piano or the body of a violin.

¹⁵ “Peter Williams, who has made the most important and stimulating modern contributions to organ history in the English language, has not really found English instruments to his taste” (Bicknell [1996] 1998, p. xviii).

¹⁶ Steven Bicknell is an organ builder who says that he has been “directly involved with the design and construction of some of the most significant recent new instruments to be built in Britain.” See Bicknell’s web page at <<http://www.users.dircon.co.uk/~oneskull/2.1.htm>>. He claims that he is not an organ player.

While Bicknell's work covers the entire span of English organ history, it is his insight into the development of the organ in early modern England that provides important resource material for the present study. Bicknell has clearly identified a major deficiency in the standard repertoire, which is the fact that these earlier works fail to account for the vast amount of accumulated background knowledge. All of these previous volumes fall into the category of "internalist" organ history.¹⁷ The format of each of these histories relies extensively on the technique of adding one layer after another to the previous succession of publications.

However, this scholastic pattern began to change in 1978, when the British Institute of Organ Studies was founded for the purpose of promoting scholarly research on organ history and music. As an organization, BIOS has been instrumental in preserving archival material and has encouraged new avenues of scholarship. With the advent of an expanding collection of resources available for research, as Bicknell explains, "it is time for English organ history to be given a new platform" ([1996] 1998, p. xviii). He suggests several areas of interest for organ historians engaging these in new types of research, one of which involves further investigation on the two most important builders in England after 1660, Bernard Smith and Renatus Harris. He notes the importance of these two men:

In the period after the Civil War organ building was dominated by Bernard Smith and Renatus Harris, on whom later generations conferred a kind of joint sainthood; I have been concerned to use recent research to reassess their work and their position relative to each other (Bicknell [1996] 1998, p. xix).

In his own *History* Bicknell responds to this challenge with a fresh approach toward interpreting the activities of these men and their relative positions in Restoration England. He focuses on such technical issues as new tonal schemes, changes in pitch, and modifications to the old system of transposition. Bicknell also makes stylistic

As Bicknell modestly informs the reader, his work is "born out of need and opportunity, rather than from any certainty of being the right person to do it" (Bicknell [1996] 1998, p. xix).

¹⁷ Internalist history is focused on the artifact itself with little attention paid to the external influences of society. John Staudenmaier explains that internalist history reflects the "centuries-long tradition of interest, and indeed fascination, with the design characteristics of human mechanisms" (1985, p. 9).

comparisons between the two builders, but he finds this task difficult because so little of the work of these two men survives in its original condition:

The organs of Smith and Harris were built in different styles, reflecting their respective background and training. Judging the tonal qualities of their instruments is very difficult, for though considerable numbers of pipes survive in various places, only a handful are in original condition (Bicknell [1996] 1998, p. 128).

Like the biographer of Sir John Hawkins, Bicknell ponders the multiplicity of qualifications required of the ideal historian of the organ:

a perfect organ historian would have the skills of a musician, a craftsman, a palaeographer, and an archaeologist as well as having general interest in antiquarian, ecclesiological and architectural study (Bicknell [1996] 1998, p. xxi).

Bicknell's idealistic job description represents a daunting task for the student of organ history and technology. With his challenge in mind, in this dissertation I examine the historical record for evidence that goes beyond the traditional, internalist perspectives on music and organ history in order to illuminate the complex relationship between the pipe organ and the social systems of early modern England.

Chapter Synopsis

Chapter 1 provides an analysis of the ancient accounts of hydraulic and wind-powered organs from the time of their earliest documented appearance in the Hellenistic culture of Alexandria. This discussion is framed in the context of ambient technologies of antiquity. After the importance of the instrument as a complex technology in earlier civilizations has been established, this chapter offers a survey of the pipe organ as it appears in some of the more recent histories of technology. These works are examined in order to locate the perceived position of the instrument as a sophisticated technology in the modern mechanized world.

A comparison of data from the literature of both time periods shows that the early engineer-historians, notably Vitruvius (1962) and Hero of Alexandria ([1851] 1971) described the mechanics of the organ in rather elaborate detail. However, this ancient

artifact has received relatively little attention from modern historians of science and technology. As an everyday artifact of material culture in Western society, the organ has been perceived as neither experimental nor revolutionary. By the beginning of the early modern era, this two-thousand-year old instrument had evolved into a commonplace, essentially transparent technology that has since been taken for granted to the point of being generally overlooked by contemporary historians, sociologists, and philosophers in the field of science and technology.

Chapter 2 examines source documents that reveal the complex relationship between the pipe organ and the relevant social institutions of sixteenth-century England, including the Roman Catholic Church, the Anglican Church, and the Chapel Royal. This chapter opens with a short discussion of an important visual component of the ecclesiastical organ – its beautifully carved casework. Then the chapter describes certain aspects of the Protestant Reformation that reveal an atmosphere of growing hostility toward Catholic imagery, including stained-glass windows, saintly statues, the communion table and that detested “pagan icon of popery,” the pipe organ. The object is to bring to light the religious and political turmoil that adversely affected the organ and church music in Tudor England from the reign of Henry VIII until the end of the Elizabethan era. Knowledge of the symbolic role of the organ at the time these events took place is a necessary prerequisite to an understanding of the fate of the organ during the early decades of the seventeenth century.

Chapter 3 closely examines a number of original documents that reflect the complexity of the relationship between the pipe organ and society during the first four decades of seventeenth-century England. These records trace the changes in the social institutions that affected the church and court organs during the turbulent period from the death of Elizabeth I until the coronation of Charles II. During the Commonwealth Era, hardly any organ maker, composer, or performer in England could find work in his profession. As a result of social pressures and the lack of employment opportunities, most organ builders left the country, with the ultimate result that while they were living and working abroad, they had the opportunity to be exposed to innovative designs in organ building.

Chapter 4 opens with the Restoration of the Monarchy in 1660, which was followed shortly thereafter by a devastating fire in London in 1666. Ultimately, both of these events had a positive effect on the restoration of the organ. This chapter gives voice to a collection of contemporary inscriptions that illustrate the various roles of the organ in English society. These documents include the Diary of Samuel Pepys, the publications of the Royal Society, the records of the Chapel Royal, the minutes of the Temple Church, public advertisements, and a lengthy organ dedication sermon by the Reverend John Newte.

Chapter 4 also reveals the competitive relationship that developed between England's most important organ makers of the time. During the 1680s, the French-influenced Catholic organ builder Renatus Harris clashed in a famous "Battle of the Organs" with the highly respected and well-connected Protestant builder known as "Father" Smith. This episode merged the multifaceted aspects of social status, politics, religion and artistic talent into a prolonged public competition to win the contract for the installation of an organ in the Temple Church. This chapter concludes with the death of Renatus Harris in 1724. By this point the pipe organ no longer symbolized Roman Catholicism. It had emerged intact and had begun to make technological advances.

Chapter 5 provides a brief chronological review that links together the political, religious, military, legal, and economic events that had an effect on the pipe organ in sixteenth and seventeenth century English society. This chapter also provides a summary of my research, draws conclusions, and offers suggestions for further research.

Chapter 1 – The Organ in the Literature of Technology

The Origin of the Organ

The history of the pipe organ begins with a search for the instrument's pagan roots in the Greco-Roman civilization of Classical Antiquity. An awareness that the ancient hydraulis emerged out of a polytheistic society is a necessary prerequisite to an understanding of the destructive conflict between organ technology and Protestant theology in early modern England.¹⁸ The invention of the hydraulis was the final step in mechanizing the age-old process of the human blowing of a musical instrument.¹⁹ For the first time in history, a technical solution was found to the problem of providing a source of power that could furnish a steady wind supply.²⁰ Ancient writers are in agreement in giving credit for the invention of the first hydraulis, or water organ, to Ctesibius of Alexandria.²¹ While the writings of Ctesibius have not survived, his work is known today through the records of Vitruvius, Athenaeus, Philo of Byzantium, Proclus and Hero of Alexandria.

Ctesibius is thought to have lived around 285-222 BCE.²² An overview of the early history of Alexandria offers relevant insights into the receptive culture that gave birth to the ancient hydraulis. Founded by Alexander the Great in 332 BCE, the city was destined to replace Memphis as the capital of Egypt. After Alexander's death in 323, it continued to retain its Macedonian-Greek character. Political leadership passed to one of

¹⁸ "The early history of ancient musical instruments is surrounded by mystery and fable; their invention being usually attributed to the heathen deities" (Hopkins and Rimbault [1855, 1870, 1877] 1987, vol. 1, p.1). The hydraulic organ or hydraulis is an ancient musical instrument that derives its wind (pressurized air) from a manual lever mechanism that pumps water into a chamber and a valve and piston mechanism that forces the air from the chamber out through the various pipes in order to produce sounds.

¹⁹ The evolution from the early wind-blown pan-pipes to an artificially-blown instrument was undoubtedly a slow one (Sachs 1940, p. 143).

²⁰ Engineering design of the water organ made use of a new technology based on a piston-driven water compressor rather than a bellows made of leather.

²¹ This spelling is Latinized from the Greek name "Ktesibios."

²² See "Ancient Greek Scientists: Ctesibius of Alexandria," ©2001 Technology Museum of Thessaloniki; <http://www.tnmth.edu.gr/en/aet/1/31.html>>.

Alexander's generals, who assumed the divine title Soter, meaning "The Savior." The reign of Ptolemy I Soter (305-285 BCE) established the Ptolemaic dynasty that remained in power in Egypt until 145 BCE.²³ Within the span of a century, the port city of Alexandria became a magnet for scholars. It was the home of a museum of Hellenistic culture and the site of an extensive library collection.²⁴ Until 330 CE, when Constantinople was rebuilt by Constantine to be the new capital of the Roman Empire, Alexandria remained the most important city in the Mediterranean region.

Ptolemy I Soter introduced Egyptian society to the Greek anthropomorphic deity Sarapis (or Serapis in later Greek and Latin). The religious cult associated with Sarapis became increasingly popular and ultimately united the religious traditions of ancient Greece with the common beliefs of the Egyptian population. The name of the cult is thought to have originated from Osorapis, the god whose characteristics were in turn derived from the names of Osiris, husband and brother of Isis, and the god Apis, the sacred bull believed to have been transformed into Osiris after death. Osiris, who was also known as Dionysus to the Greeks, had been symbolically associated with phallicism, fertility, and immortality.

Ptolemy I Soter was succeeded by his son Ptolemy II (285-246 BCE), who was placed in a position of power three years before his father's death at the age of eighty-four. The transition apparently went smoothly and Ptolemy I was the only great Macedonian leader to die in bed of natural causes. After his death, Ptolemy I Soter came to be deified by the people. Ptolemy II and his revered sister/wife Arsinoë, a powerful woman in her own right, were both looked upon as gods even in their lifetime. Together they accomplished much to enhance the Hellenistic culture of the city, including the institution of a quadrennial festival to rival the Olympic games. The procession for the festival included elaborately decorated floats that displayed scenes of Greek religious figures. Alexandria continued to prosper. At this point in time, it was considered a Greek city, lying adjacent to Egypt but no longer a part of that country.

²³ For dates and further information on the influence of the prosperous Ptolemaic dynasty in Egypt, see Shaw (2000). A chronology of the Ptolemy dynasty can be found on page 482.

²⁴ Ptolemy I Soter is believed to have commissioned Demetrius with the task of founding the Library and the Mouseion at Alexandria around 295 BCE. Besides being "a brilliant politician," Demetrius was also "a most prolific writer." See <<http://www.greece.org/alexandria/library/library3.htm>>.

After the death of Ptolemy II at the age of sixty-three, the name “Philadelphus” (“brother-loving” and “sister-loving”) was bestowed upon both husband/brother and wife/sister. Their son and successor was Ptolemy III Euergetes (246-221 BCE), who assumed control two years before his father died. He was awarded the name Euergetes, meaning “The Benefactor,” because of his generous support of charitable causes and his patronage of the arts and scholarly pursuits. He is said to have provided books for the library by ordering that every book arriving with any traveler would be taken away, copied, and then deposited in the library. An officially certified copy would be given to the owner in return. The era of Ptolemy III is also known for impressive military victories, luxurious court buildings, and the construction of temples throughout Egypt.

These paragraphs have very briefly sketched the political, intellectual, artistic and religious climate of Alexandria during the time of Ctesibius. Several additional characteristics of the Ptolemaic dynasty reflect the existence of an extremely receptive environment for the newly invented water organ. First, there was an atmosphere of strong encouragement and support for science and technology, along with an active patronage for the arts. Within this favorable social context, the instrument emerged as an archetype of the successful integration of science, technology and the arts. As such it was a remarkable accomplishment in its own right. Second, there was a ready-made marketplace for the instrument in Alexandria, with palaces and temples, festivals and processions, sports and games, each of which offered a venue for the water organ to enhance religious and social activities. Third, implicit in the story of the city’s rise to prominence is the necessary role of an inventor such as Ctesibius. Without question, Alexandrian society placed a positive value on innovative technological achievements. Such was the contemporary cultural milieu that gave birth to this ancient musical artifact.

Another contributing factor to the success of the water organ was the influence of Greek music in Egyptian or Alexandrian society. A solid foundation for musical harmony was already in place. The early history of Western music is beyond the scope of this discussion; however, for historical perspective, it is worth noting that the mathematician and musician Pythagoras is believed to have traveled in Egypt, visiting temples and talking to priests, sometime around 535 BCE.²⁵ At the time when Ctesibius

²⁵ <<http://www-history.mcs.st-andrews.ac.uk/history/Mathematicians/Pythagoras.html>>.

was born, the rules of Greek theoretical and applied music were already well established and commonly accepted. As Vitruvius explained, “By the art of music, the notes of the organ are struck with manifold and varied modulation” (Vitruvius 1962, Book X, Chapter VIII). It was not necessary for the general populace to question the meaning of the phrase “the art of music.”

From this brief discussion, three points should be reiterated. The first and perhaps most important point with respect to subsequent developments in the turbulent history of the instrument is the fact that the organ has never completely cast off its heathen heritage. Even today, the instrument is shunned in some religious settings because of its very early association with pagan rites and rituals. The second point is that Ctesibius’ conception of the water organ exemplifies the integration of philosophy, technology and art in a society that placed a significant value on all three disciplines. Finally, this instrument was not only the most complex musical mechanism of the day; it was also one of the most intricately conceived technological achievements of antiquity. From the moment of its birth the organ has epitomized sophisticated technology. In 1855, Edward J. Hopkins described the pipe organ as “that most ingenious, complex, and noble of all musical instruments.”²⁶ And so it remains today.

²⁶ See “Preface to the First Edition” in Hopkins and Rimbault ([1855, 1870, 1877] 1987, vol. 1).

The Organ in Antiquity

The Story of the Organ, published by Charles Francis Abdy Williams in 1903, opens with an intriguing account of the early history of the instrument. Williams begins by acknowledging the mechanical aptitude of Ctesibius. He then provides the social context for the act of inspiration that resulted in the invention of the water organ:

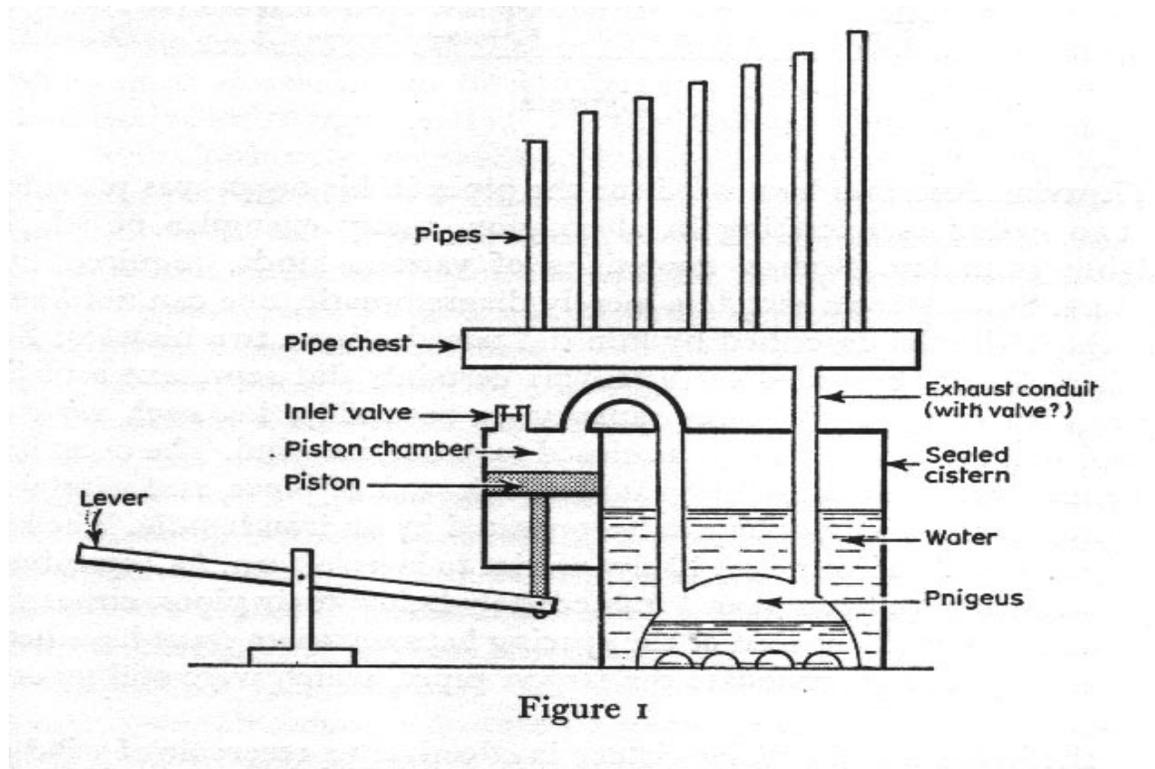
About B.C. 284 to 246 there lived at Alexandria, under Ptolemy Euergetes, a man named Ctesibius, who followed his father's trade of barber. Being of a mechanical turn of mind, he observed that the counterweight of a movable mirror, used for the purposes of his trade, produced a musical sound by the force with which it drove the air out of the tube in which it moved. Experimenting with the principle thus noticed, he succeeded in making a machine consisting of a hollow vase inverted, with an opening on the top, to which was attached a trumpet, and, on water being pumped into the vase the air was driven forcibly through the trumpet, producing a very powerful sound; and the machine caused so much admiration that it was consecrated in the temple of Venus (Williams [1903] 1972, pp. 1-2).

A full account of the organ's early history is found in Jean Perrot's work on *The Organ from its Invention in the Hellenistic Period to the End of the Thirteenth Century*. Perrot offers a generic definition of the instrument that applies to all pipe organs, from the ancient hydraulis to the great cathedral organ. From its inception, the organ has consisted of the following set of essential elements:

- (1) one or more ranks of sounding pipes;
- (2) a wind-chest to store air;
- (3) a mechanical blower, either a pump or a bellows;
- (4) a keyboard to direct the air into the various pipes (Perrot 1971, p. xix).

As a working definition, a pipe organ is essentially a musical instrument consisting of a mechanism that traps pressurized air in a wooden chest where the air is stored until the player causes it to be released by operating a sliding mechanism that allows the air to be forced into selected pipes, resulting in the sound being emitted from the pipes.

Figure 1 illustrates a water organ with a lever and piston pumping mechanism, a pnigeus (small water cistern) with conduits and valves, a pipe chest (windchest), and a rank of seven pipes.²⁷ The pnigeus is placed upside down in a barrel of water. The pumping mechanism forces the air into the pnigeus, which stored it under pressure until it is released through the exhaust conduit into the windchest. The mechanism that allows the air to enter the pipes is not shown in the figure.



According to Perrot, there is no confirming evidence to indicate that the first organ was anything other than the original work of a single individual. Perrot is convinced that “the invention forms a whole” and that furthermore, “not one piece of evidence, literary, historical, iconographical, or archaeological, points to the existence of the pipe organ prior to the Hellenistic period” (Perrot 1971, p. 5). Emphasizing the mechanical complexity of the organ and the subsequent continuity of organ technology from the time of its first appearance, Perrot concludes that “from the outset the instrument was also fitted with a wind-chest and a manual, a brilliant conception which has come down to posterity and on which the structure of the modern organ is still based” (Perrot 1971, p. 5).

²⁷ From <http://www.romanliturgy.net/organ_history.html>.

Organ historian George Audsley opens the first chapter of his monumental two-volume treatise on the “Science and Art of Organ-building” with the following assertion:

At the outset it must be clearly understood that the Organ, even in the crudest and simplest form with which we are acquainted, cannot be said to have been *invented*. The modern Organ is an evolution from what may be called, by way of comparison, a musical moneron – in other words, from the first single hollow reed pipe or whistle sounded by the breath of man (Audsley [1905] 1965, vol. I, p. 1).²⁸

Audsley finds that in the natural order of things the organ has developed over time from assorted reeds or whistles. He describes this gradual evolution:

The imaginative mind can easily follow the slow application of this discovery, until the syrinx, or so called “Pipe of Pan,” formed of a number of hollow reeds of different lengths, stopped at one end, and bound together, and yielding, when blown across their open ends, a more or less regular series of musical sounds, became the first mouth organ and the germ from which the modern Organ has grown, through a thousand progressive stages, to its present lofty position as the King of Instruments, and one of the greatest achievements of human ingenuity and skill (Audsley [1905] 1965, vol. I, pp. 1-2).

Unlike Audsley however, most historians of the organ, both ancient and modern, accept the concept of the unprecedented appearance of a revolutionary technology.²⁹ These writers have expressed an unquestioned faith in the creative genius of one person, Ctesibius (or Ktesibios). Perrot states this point clearly:

The invention of the organ was not a gradual process. The Alexandrian Greek Ktesibios, who discovered how to feed an enormous panpipe with an artificially contrived air stream at a constant pressure, and how to control each pipe by means of a keyboard with springs, was certainly the instrument’s true creator. There is no evidence in any known text that even a crude form of such a machine existed before his time (Perrot 1971, pp. v-vi).

²⁸ Audsley provides a comprehensive history of the instrument from antiquity, basing his discussion on extensive archaeological, iconographic and literary evidence. See the first page of his “Proem” for his use of the phrase “Science and Art of Organ-building.”

²⁹ For an exposition of the thesis that a radically new technology lacking a definitive linear technological antecedent can appear on the horizon, see Constant (1980). Even though some of the structural antecedents of the turbojet can be identified, Constant makes the point that “however central these prior technologies might have been to the turbojet revolution as it occurred or might be to its historical reconstruction, nowhere in that prior practice was the turbojet implicit, inherent, or inevitable” (Constant 1980, p. 98). It appears that the same principle holds for the origin of the water-powered pipe organ.

Recognizing that the genius theory of invention is difficult for some writers to accept, Perrot explains, “Great inventions are said never to be the work of one man, and for this reason people have refused to acknowledge that the organ might have been conceived and created by a single person” (Perrot 1971, p. 5).

On one hand, based on archaeological and literary evidence, both ancient and modern historians have concluded that Ctesibius alone was responsible for the original inspiration and successful implementation of his creation. The hydraulis made its sudden appearance as a novel, well-integrated machine. However, the various pre-existing artifacts comprising the elements of the first hydraulis did not emerge fully formed from a technological vacuum. A closer examination of Williams’ description reveals that at the design level, the components of Ctesibius’ new machine were readily at hand. The counterweight and tube were installed and functioning to adjust the movable mirror at the barbershop. The trumpet already had a long-established history. The new whistling bird was considered a toy; however, the design principle was applied to the hydraulis. Thus the significant innovation that Ctesibius brought to his invention was the use of water power instead of lead weights to force the air through the pipes.

While Williams has made a speculative beginning with his description of the origins of the organ in the barbershop, much work remains to be done toward identifying more accurately the instrument’s components and technological antecedents. Some of that effort has already been accomplished. Williams described a half-size working model built by the Reverend Francis W. Galpin around the turn of the twentieth century. Galpin’s design was based on a “careful study of all known representations of the Hydraulis on contorniates, pictures in ancient manuscripts, and a well-preserved model in pottery found at Carthage in 1885” (Williams [1903] 1972, pp. 210-213).³⁰ In addition to replications found on coins, manuscript illustrations and pottery, all of which were studied by Galpin in the course of his reconstruction of the hydraulis, there is also evidence for the early existence of the organ to be found in mosaic designs and terracotta replications.

³⁰ Twelve contorniate medallions struck with images of hydraulic organs are known to be in existence. These are described by Perrot (1971, pp. 89-94).

In assembling his instrument, Galpin followed the detailed technical explanations left by Hero of Alexandria and Vitruvius. Hero had said the springs should be constructed of “slips of horn, elastic and curved” (Hero of Alexandria 1971, p. 106). However, Vitruvius had described springs that were made of metal. Galpin chose to work with metal springs similar to those he had seen on ancient Roman brooches. The tuning scheme of his model gave the listener the rare opportunity to hear a reproduction of six ancient Greek modes, although the smaller size meant that the notes sounded an octave higher. According to Williams, “Mr Galpin is to be congratulated on his success in having constructed the first working model of this interesting instrument.” Based on photographic evidence, Perrot reports that Galpin’s hydraulic organ was carefully crafted and well received. “The instrument was mainly an object of curiosity, and in 1904, it was presented to the Musicians’ Company’s Exhibition, where, with the cithara, it was used to accompany the hymn to Nemesis and Calliope, ‘to the enthusiastic appreciation of a large audience’” (Perrot 1971, p. xiv).

Perrot reports on a number of other reproductions, mostly scale models, some of which were constructed for the sole purpose of replicating the mechanism of Ctesibius’ instrument in order to show that the pipes were actually able to produce sound. However, in the interest of “experimental research,” Perrot constructed a full-sized hydraulic organ:

My model was fundamentally different. I wished not only to confirm the fact that the mechanism worked satisfactorily but in addition to measure pressures, calculate the loss of air, and assess the volume of the sounds produced. I was also curious to discover how difficult it was to construct an instrument of this type (for this reason I used only those tools which a simple artisan might have possessed), and what disadvantages or shortcomings there were in its performance, in order to try to explain why it was discarded. It therefore seemed better to reconstruct a full-sized hydraulic organ such as is shown in the iconographic evidence, where the presence of human figures makes it possible to calculate the scale (Perrot 1971, p. xiii).

In reconstructing his hydraulic organ, Perrot follows the treatise of Vitruvius, since the instrument it describes is more sophisticated than the instrument of Hero of Alexandria. Vitruvius’ treatise serves as a technical manual. However, Hero’s text provides a better model for the keyboard, since his discussion of the spring mechanism is more complete. Perrot describes in some detail the difficult process of reconstructing this

“complicated piece of machinery.” He mentions that the hydraulic organ is a difficult instrument to build. Perrot also discusses his subsequent scientific experiments and describes the results of these experiments (Perrot 1971).³¹

On June 25, 2001, the Hellenic Foundation for Culture and the London Hellenic Society collaborated in the production of a lecture recital entitled “Hydraulis: An Ancient Greek Organ for the New Millennium.” According to the printed program notes for the evening’s concert, “The inspiration for this presentation was born some time ago in Oxford, when Professor Vassilis Karasmanis described the history, the discovery and the potential of the Hydraulis to Dr Anthony Kourakis, a friend of the London Hellenic Society.”³² This unique event marked the debut of the ancient hydraulis in the United Kingdom and introduced to London society an authentic replica of one of the oldest technologies of Western culture.

The first part of the program consisted of two lectures, “The Discovery of the Ancient Hydraulis” by Professor Demetrios Pandermalis and “The Ancient Hydraulis: History and Reconstruction” by Professor Karasmanis. Professor Pandermalis, an archaeologist responsible for directing excavations in Macedonia for Aristotle University of Thessaloniki, related to the audience his experiences working at the excavation site at Dion. According to the program notes, he “unearthed the upper part of an Hydraulis dating from the 1st century BC.” His remarkable find “consisted of a row of brass pipes in graduated sizes which were mounted vertically over the keys, and a horizontal decorated metallic support plate.” Further describing his discovery in a full-color brochure, Professor Pandermalis wrote:

With particular care, as if embracing a newborn baby, we swaddled our find together with the soil in which it was found and took it to our workshops. There, we were able to ascertain that it was a musical instrument, called a ‘hydraulis’ by the ancients.³³

Professor Karasmanis, a philosopher, a mathematician, an engineer and the Director of the European Cultural Centre of Delphi, supervised the five-year replication

³¹ For complete details on Perrot’s reconstruction of the hydraulis, see Perrot (1971, Chapter 8).

³² George Rodopoulos, President, London Hellenic Society. Quoted from the welcoming message in the program notes for “Hydraulis: An Ancient Greek Organ for the New Millennium” presented in the Purcell Room, Queen Elizabeth Hall, Royal Festival Hall, London, on Monday, June 25, 2001.

³³ “The Water-Organ of Dion.” (Hellenic Foundation for Culture brochure.)

project. The new hydraulis was built between 1995 and 1999 in the workshop of George Parashos, who described the unprecedented impact of the original instrument as a technology. "In its time," he said, "the invention of the Hydraulis was equivalent to that of the first motor car which, even though it could scarcely reach 30 mph, was still a miracle."³⁴ The process of modern reconstruction required that the new instrument be manufactured only from materials that would have been available to Hellenic craftsmen. The result was a challenging technological achievement that recaptures the voice of antiquity for the contemporary listener.³⁵

³⁴ "Hydraulis: An Ancient Greek Organ for the New Millennium." Program notes.

³⁵ "Hydraulis: An Ancient Greek Organ for the New Millennium." Technical Description: "The instrument consists of a row of 24 pipes, which produce sound when air flows through them. The appropriate quantity of air is produced through a retrogressive air pump. The air passes upside down in the bottom of a water tank, the water covering the air chamber. The unidirectional airflow is achieved through the use of two one-way valves. Through the chamber air fills the space below the pipes. The air is directed into the pipes by drawer-like devices, controlled by the keys, which release or block the airflow to the individual pipes causing them to sound or remain silent."

The Organ in the Ancient History of Technology

Marcus Vitruvius Pollio was a Roman architect and engineer whose most famous literary work is the treatise *De architectura*.³⁶ He is thought to have been active during the time of both Julius Caesar (100-44 BCE) and Augustus Caesar (31 BCE-14 CE). In this monograph he addresses his emperor directly, but does not refer to him by name (White 1984, p. 185).³⁷ According to Vitruvius, the professional architect should possess a wide range of general knowledge. His own writing spans both the arts and the sciences. He provides explanations of the architectural orders, proposals for aesthetically designed public buildings, and engineering specifications for hydraulic instruments, time-keeping devices, and military engines. He is obviously familiar with astronomy, music, medicine and law. *De architectura* consists of ten books, the last two of which describe types of engines that are of particular interest to architects. In Book X, Vitruvius documents the various construction techniques for creating the elaborate machinery required for the immensely popular Roman sports and games. By way of justification for his literary efforts, Vitruvius apologetically explains in his dedicatory remarks that “it appeared to me, O Emperor, highly expedient, as in the foregoing books I have treated on buildings, to explain in this which closes the treatise, the principles upon which such machines are constructed.”³⁸

Since Vitruvius refers to the writings of Ctesibius on several occasions, it is clear that he knew of Ctesibius’ hydraulis. At the end of Book X, Chapter VII, he notes that some of the inventions, especially those “which are more for pleasure than utility, may be seen by the curious in the writings of Ctesibius.” One of the inventions described by Vitruvius is the hydraulic organ. In Book X, Chapter VIII, Vitruvius provides a brief interpretation of its principles of construction. First, he explains how the wooden frame of the instrument is built up in a manner resembling a scaffold. Then he describes the

³⁶ See http://www.ukans.edu/history/index/europe/ancient_rome/E/Roman/Texts/Vitruvius/10.html for the following quotations from Vitruvius, Book X.

³⁷ White claims that the dedication was written for Augustus Caesar.

³⁸ <http://www.ukans.edu/history/index/europe/ancient_rome/E/Roman/Texts/Vitruvius/10.html>.

technology of the pistons, which consist of “brass barrels with moveable bottoms, perfectly round, having iron rods fixed in their centers, and covered with leather and woolen, attached by pins to the levers.” A curious feature of Vitruvius’ water organ is the addition of “brazen dolphins with chains hanging from their mouths, which sustain the valves that descend below the holes of the barrels.” These symbolic brass miniatures are functional as well as decorative, serving as a counterweight for the inlet valves (Perrot 1971, pp. 39-40).³⁹

Vitruvius continues with a detailed description of the organ keyboard. He provides a rather complicated explanation of the linkage mechanism. The keys “communicate” with the channels in order to control the flow of compressed air from the pistons through the pipes. Translators differ on the exact technical interpretation of the keyboard mechanism. One translation calls for iron handles that require turning.⁴⁰ Another translation suggests iron finger-boards that are pressed down.⁴¹ In any case, based on the historical record, “it is unmistakably evident that the first musical instrument which was distinguished by the application of a Keyboard was the Organ” (Galpin [1910] 1965, p. 158.)⁴²

Even Vitruvius has some difficulty explaining this machine. The literary task he undertakes is not a simple one. He concludes Book X, Chapter VIII with an apology for his writing skills and a suggestion that an examination of the instrument itself is the most appropriate method for gaining knowledge of it:

I have striven to the best of my ability to describe clearly in writing a complicated machine. The task is not an easy one, nor accessible to the general understanding, except for those who have experience in matters of this kind. Yet if anyone grasps them imperfectly from my writings, a knowledge of the instrument will disclose the ingenuity and precision of its design.⁴³

³⁹ Perrot also notes that the dolphin was the symbolic representation of “the watery element” and was prized in antiquity for possessing “feelings of maternal love and philanthropy” (Perrot 1971, p. 40). The dolphin is also thought to have a taste for music.

⁴⁰ <<http://www.floraberlin.de/sbimages/vitruve.htm>>.

⁴¹ <http://www.ukans.edu/history/index/europe/ancient_rome/E/Roman/Texts/Vitruvius/10.html>

⁴² Galpin describes the keyboard as “a series of lever keys, which, when depressed by the fingers of the performer, pushed in the pierced slides and thus admitted the wind into the pipes placed immediately above them” (Galpin [1910] 1965, p. 158). See also Chapter XII, “Organs Portative and Positive.”

⁴³ <<http://www.floraberlin.de/sbimages/vitruve.htm>>.

The water organ that Vitruvius describes is indeed a complicated piece of machinery. In terms of material composition alone, building the instrument requires the knowledge and skill of the carpenter, the leather-worker and the wool-crafter. In addition, metal-workers are necessary for the brass and iron fittings. The builder must follow technical specifications requiring the pistons to be engineered to a degree of tolerance portrayed as “perfectly round.” Construction work involves accurate measurement according to stated dimensions. Careful alignment of the holes is necessary for the passage of air through an arrangement of tubing that “communicates” with the appropriate pipes. The moving parts are based on specialized technologies, which are assembled from levers, pivots, springs, valves, rings, pistons, rods, pin joints, linkages, keys and decorative but functional brass dolphins.

Vitruvius makes no reference to the performer, except in his description of the actual operation of the completed instrument:

Therefore when the keys are touched by the hands, they forthwith move the sliding bars backwards and forwards, closing some holes and opening others. By the art of music, the notes of the organ are struck with manifold and varied modulation.⁴⁴

Ultimately, for proper performance, both a philosophical understanding of the theory of music and a working knowledge of keyboard performance practices are essential components of the complex technological system that constitutes the water organ.

There is no indication that Hero of Alexandria was acquainted with the works of Vitruvius. The dates of Hero’s works have been the subject of much scholarly debate. It is assumed that he was living in 62 CE, based on his reference to a solar eclipse known to have occurred in that year. His writings, which became well known in the Islamic world, have been preserved only through Arabic translations. Marie Boas Hall’s “Introduction” to the reprint of the Woodcroft edition of Hero’s *Pneumatics* traces the series of further translations that made Hero’s works available to the Western world (Hero of Alexandria 1971, pp. x-xi).

As a result of these translations from the Arabic, Hero’s treatises were widely read and highly influential during the Renaissance. His *Pneumatica* is a most remarkable text for its time. His introduction invokes the traditions of the ancient philosophers, who

⁴⁴ <<http://www.floraberlin.de/sbimages/vitruve.htm>>.

had long debated the qualities of matter. In the fifth century BCE, Democritus had speculated that the fundamental components of the physical universe consisted of individual, indivisible atoms moving about among empty spaces, or voids. In contrast, Aristotelian theoretical physics denied the possibility of the void. Hero's work is designed to demonstrate from "sensible phenomena" the truth of Democritean mechanistic philosophy with respect to the properties of air:

The investigation of the properties of Atmospheric Air having been deemed worthy of close attention by the ancient philosophers and mechanists, the former deducing them theoretically, the latter from the action of sensible bodies, we also have thought proper to arrange in order what has been handed down by former writers, and to add thereto our own discoveries: a task from which much advantage will result to those who shall hereafter devote themselves to the study of mathematics (Hero of Alexandria 1971, p. 1).

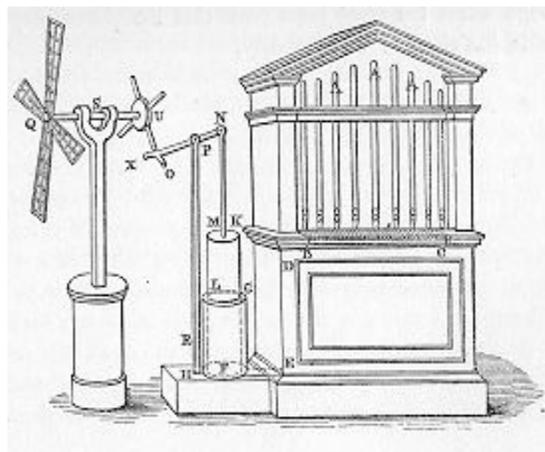
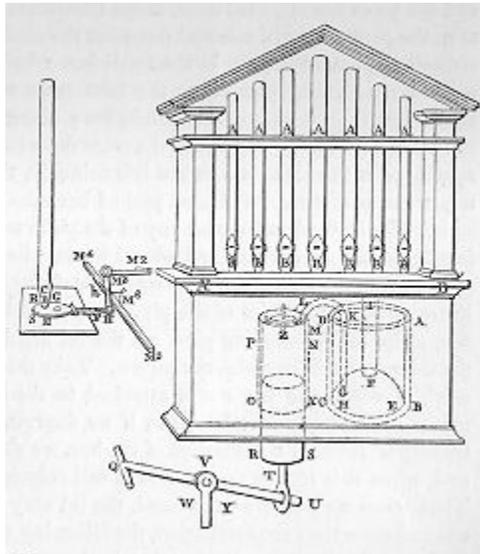
Hero describes two pipe organs in *Pneumatica*. Invention #76 is "An Altar Organ blown by manual Labour" and Invention #77 is "An Altar Organ blown by the agency of a Wind-mill" (Hero of Alexandria 1971, pp. 105-109). These two instruments are illustrated in Figure 2 on the following page.⁴⁵

⁴⁵ Hero's illustrations can be found at <<http://www.history.rochester.edu/steam/hero/section76.html>> and <<http://www.history.rochester.edu/steam/hero/section76.html>>.

Figure 2

Invention #76 An Altar Organ blown by manual Labour

Invention #77 An Altar Organ blown by the agency of a Wind-mill



The organ “blown by manual labour” is a hydraulic organ. The technical description of its power-producing mechanism shows that it is comprised of a lever with a handle for pumping up and down attached to one end, a pivot-base to support the lever in the middle, and a freely attached piston rod at the other end. The whole assembly seems to be similar to a children’s seesaw. The piston rod must be “of great strength.” The manually pumped piston forces air out the top through a tube into a “hollow hemisphere” that has been inverted to cover the bottom of “a small altar of bronze containing water.” The top of the piston has a rather intricate valve arrangement. After air is forced into the altar assembly by the piston, another tube leads the air out to the frame box that “communicates” with the pipes. The keyboard mechanism controls the flow of air into the pipes. It is a complicated assembly with a spring mechanism made from “slips of horn, curved and elastic.” In order for the pipes to sound, the corresponding keys are pressed with the fingers. Attached levers open the lids of the orifices of the air-filled box. Air is forced into the pipes. When the fingers are released, a string attached to the spring pulls the lids across the orifices to close off the wind.

The power supply for the wind-driven organ relies on the transfer of motion from the “broad arms like the sails of a wind-mill” to the piston mechanism. The arms are attached to one end of a rod, which is supported such that it turns freely. As the arms turn in the wind, the rod conveys a rotary motion to a gear-like pegged disk fitted tightly on the opposite end. The revolving pegs make contact with a lever attached by a pin to the piston rod, causing the piston to be raised as each peg engages the rod mechanism. When the peg advances beyond the lever, the lever is released and the piston descends in the cylinder. The falling piston compresses the air, forcing it out into the base of the cylinder, up through a connecting tube, and into the box on which the pipes stand. As the key mechanism is activated, air is released into the pipes, causing “the sound of a flute” to be produced. To assure a steady supply of air, the windmill frame can be turned directly into the prevailing wind.

Four of the component technologies that comprise these water organs are of particular interest. First, from a philosophical point of view, the piston mechanism involves a non-Aristotelian concept of compressed air. Hero specifies that the piston be “accurately fitted, that no air may enter by its side.” If in fact this mechanism was this

carefully constructed and was capable of performing according to these specifications, then the engineering tolerance of this instrument was quite remarkable.⁴⁶ Second, from a technological point of view, the wind-powered organ is the only known documented windmill type mechanism in antiquity. Wind power does not reappear in Western civilization until the twelfth century. Third, from an historical point of view, these instruments incorporate a manual keyboard, which as an artifact seems to be without precedent. Finally, the gear-like mechanism of the pegged disk attached to the windmill shaft is designed to transfer power from the rotating shaft to the reciprocating piston, thus converting circular to reciprocal motion. This wind-powered precursor to the human-powered crank violates the premise of Aristotelian cosmology that circular motion is the perfect movement of the heavenly bodies, while only reciprocating motion is natural on earth. Thus the wind-powered organ would seem to be not only a technological novelty but a philosophical anomaly as well.

⁴⁶ Robert Boyle and Robert Hooke's temperamental air-pump seems primitive by comparison. On the temperamental behavior of the seventeenth-century air-pump and the inconclusive results of the vacuum-pump experiments, see Shapin and Schaffer ([1985] 1989).

The Organ in the Modern History of Technology

Judging from the works of Vitruvius and Hero of Alexandria, it is clear that the hydraulic organ was a topic of interest to these ancient authors. However, except for music historians and organ historians, recent authors have had little to say on the subject of this ancient technology. There are a number of possible reasons for this lack of attention. First, the modern organ plays no social role as an agent of power or speed. Second, it is not perceived to serve society as a mechanism of economic production and growth. Third, it is not considered to be a scientific instrument or a marvel of engineering; therefore, it is not customarily associated with experimental work. Fourth, the organ has no meaningful relationship with contemporary philosophical notions of discovery, progress or revolution. Finally, and perhaps most significantly, in spite of its technological sophistication, it claims no historical status in society as an engine of change.⁴⁷

In short, the instrument exemplifies none of the qualities that excite historians of technology today. Yet according to *The New Grove Dictionary of Music and Musicians*, “The organ is, together with the clock, the most complex of all mechanical instruments developed before the Industrial Revolution.”⁴⁸ In the eloquent words of Dr. Charles Burney, “An organ is so operose, complicated, and comprehensive a piece of mechanism, that to render it complete in tone, touch, variety, and power, exclusive of the external beauty and majesty of its form and appearance, is perhaps one of the greatest efforts of human ingenuity and contrivance” (Burney [1776-1789, 1935] 1957, vol. II, pp. 343-4).

In 1885, Johann Julius Seidel sought to remedy the lack of available information concerning the construction and use of the instrument. He published a technical handbook for organists and builders, offering the following justification for his efforts: “The Organ is, undoubtedly, one of the most ingenious musical instruments, and being moreover designed for man’s most blissful vocation, viz., the worship of God, it surely

⁴⁷ For examples of ways that technologies have changed society, see Hindle and Lubar [1986] 1991).

⁴⁸ See *The New Grove Dictionary of Music and Musicians* (2001, 2nd ed., vol. 18, p. 565).

deserves our greatest attention” (Seidel [1855] 1982, p. v). Furthermore, Seidel claimed on behalf of the organ a permanent place amid humanity’s outstanding technical accomplishments:

Among the many inventions of the human mind, the organ undoubtedly occupies a high rank. It is the most perfect of all musical instruments, and so completely attains the end for which it was invented, that its position may very properly be deemed permanent (Seidel [1855] 1982, p. 9).

As an established artifact of technology in society, the organ has a long history of association with the multiplicity and diversity of cultural activities such as philosophy, religion, art, music, theater, politics, diplomacy and even sporting events that have occupied humanity throughout the centuries. Surprisingly, this complex mechanism, this outstanding technical accomplishment, this “most perfect of all musical instruments” has been largely overlooked by twentieth-century historians of technology. In order to support such a claim, it is necessary to examine a number of standard publications in the field. First, however, an interesting point of departure is a posthumous work by Robert Hooke, which serves as an introduction to the subsequent survey of twentieth-century literature concerned with history of technology.

Hooke held the title of “Curator of Experiments” for the Royal Society of London from 1662 until his death in 1703 (Espinasse 1956, p. 1). His intellectual curiosity was vast and his interest in mechanical inventions was boundless. In addition to his work in art and architecture, he also knew “a good deal” about music and is known to have engaged in discourse on the theory and orthography of music (Espinasse 1956, pp. 46, 110, 123). While he was at Westminster School during the period of the Commonwealth, Hooke even “learned to play 20 lessons on the organ” (Scholes 1962, p. 242).

It is reasonable to assume that with his well-documented interest in music, Hooke would not have overlooked the pipe organ. Indeed, this turns out to be the case. He addresses both the instrument and its builders in a treatise on *The Method of Improving Natural Philosophy* (Hooke [1705] 1969, pp. 24-26). In this text Hooke proposes a comprehensive scheme that will enhance the future development of natural philosophy.

In describing his project, Hooke is expanding the model for a new experimental method suggested by Francis Bacon in *The New Organon*.⁴⁹

Hooke's suggests a classification system that lists by topic first the Heads of Natural Histories and then the Heads of Artificial Histories. His intent is that a detailed history of each item on the list might ultimately be written. Hooke expresses his hope that the Natural Histories will "hugely facilitate all the other Inquiries in Philosophy." For the Artificial Histories, those that are concerned with technologies, he notes the categories that are to be included:

It will be requisite to take notice of, and enumerate all the Trades, Arts, Manufactures, and Operations, about which Men are employed, especially such as either contain some Physical Operation, or some extraordinary Mechanical Contrivance, for such as these will very much enrich a Philosophical Treasury.

Hooke enumerates sixteen categories, or Heads, "according to the various Materials about which they are conversant." Two of his proposed Histories are of particular interest. The first of these (Number 10 on the list) includes certain occupations that are "conversant" with tin, the main metallic component of organ pipes. Here is Hooke's complete grouping of tin-related trades:

10. The History of Latin-makers, and Tin-men, Type founders, Printers, of making Soder and Putte, Glass colours, Pewterers, Pipe or Worm-founders, Organ Pipe-makers.

In the right margin appears the notation "*To Tin belong these Trades, whose Histories should be collected.*" This category is immediately preceded by individual groupings for Minerals, Iron, and Lead. It is followed by a grouping for Copper and Brass, and then one for Gold and Silver.

The other History of interest here (Number 13) is quite broad. The list below includes only the last subcategory from the group of trades concerned with materials that

⁴⁹ *The New Organon* represents Division Two of the six divisions of the Great Instauration (Bacon [1620] 1960, p. xxxiii). Bacon's "Preparative Toward a Natural and Experimental History" includes a "Catalogue of Particular Histories by Titles." Proposed title #70 is a "History of Music." Several of his entries relate to the material components of the pipe organ. For example, wood, lead, leather, and "various Machines" are listed as titles that should be taken into account in a comprehensive natural and experimental history. However, he does not mention the pipe organ or other specific manifestations of the mechanical arts. Bacon suggests a reason for this omission: "For I care little about the mechanical arts themselves: only about those things which they contribute to the equipment of philosophy" (Bacon [1620] 1960, p. 292).

are derived from vegetable products. Musical instrument makers and organ makers fall into this category, along with other tradesmen who depend on wood for a living:

13. The History of Sawyers and Saw-mills, Carpenters, Shipwrights, Mill-wrights, Pump-makers, Joiners, Cabinet-makers, Screw-makers, Musical Instrument-makers, Organ-makers, Carvers, Turners, Fletchers, Bowyers, Archers, Buttonmold-makers, Coopers, Gagers, Basket-makers, Box makers, Comb-makers, Last and Heel makers, Broom and Mop-makers, Bellows makers, Hoop-makers, Lath-makers.

The margin notation for this category is simply “*Vegetables.*” It is followed by proposed histories for items and occupations associated with Animals, then Parts of Animals, and last of all, Man.

With the completion of his classification system, Hooke has outlined the subject matter for the task ahead. He then proceeds to describe the major goals of his proposed project:

In the writing of all which Histories there may be two things design'd, either a Description of the things themselves, whereby Inquisitive Persons that are ignorant of them, may come to a more perfect Knowledge of them; in order to some other Design as for Curiosity, or Discourse, or Profit, and Gain, or the like: Or such a Description of them as is only in order to the Use of Philosophical Inquiry, for the Invention of Causes, and for the finding out the ways and means Nature uses, and the Laws by which she is restrain'd in producing divers Effects.

Hooke has conceived a monumental assignment that will require future natural philosophers and historians to provide designs or descriptions relevant to material artifacts and their associated occupations. This is his dream for the enhancement of “Philosophical Inquiry.”

With Hooke’s research program in mind, the object now is to discover, on behalf of the pipe organ, how well Hooke’s proposal has been fulfilled in the literature of science and technology. It is true that scholars of music history and musicology have achieved much success in bringing the story of the organ to the attention of the academic community of musicians. Organ historians have been particularly diligent in their research, producing a number of comprehensive volumes covering every aspect of

internalist organ history.⁵⁰ However, this project calls for an investigation of the literary contributions toward Hooke's research program by historians of science and technology.

While most of this discussion focuses on works concerned specifically with technology, an exception is George Sarton's 1927 *Introduction to the History of Science* (Sarton [1927] 1975, vol. 1). Sarton's goal is to explain scientific progress. His intent is to offer an explanation for "the development of one essential phase of human civilization that has not yet received sufficient attention – the development of science, that is of *systematized positive knowledge*" (Sarton [1927] 1975, vol. 1, p. 3). While he recognizes the significance of the history of art, his introductory disclaimer points out that he is not considering the fine arts in these volumes. He specifically excludes the aesthetic aspects of music from consideration, but of necessity, the scientific legacy of music is included in his work:

Indeed, the theory of music was considered a part of mathematics almost until modern times. It was one of the main divisions of the quadrivium which dominated mediaeval education (Sarton [1927] 1975, vol. 1, p. 7).

For this reason, the importance of music and the close association between music and mathematics in the history of science cannot be overlooked. Religion has also been an important influence in the history of science, so the contributions of theologians are included as well. But physicians, engineers and teachers are mentioned only when their work is of special significance to scientific progress. Among the diversity of categories he has chosen to consider, does he find a place for the pipe organ?

Sarton's first chapter begins with a discussion of the literature attributed to Homer. The significance of the *Iliad* and the *Odyssey* as monuments of Western culture hardly requires further discussion here. For the purpose at hand, it is enough to say that these epic poems provide a rich source of information on craftsmanship and raw materials. Sarton notes that Homer describes simple tools and speaks of the smith, the carpenter, and the leather-worker. Metals known to be available at the time, besides gold and silver, are those from which the earliest pipe organs were built: iron, copper and tin. Thus the Homeric poems show that the necessary raw materials and the appropriate

⁵⁰ The relatively recent work of Stephen Bicknell ([1996] 1998) is an outstanding exception to the internalist genre. His research includes a strong component of contextual interpretation.

craftsmen were readily available for organ construction long before the first instrument was built.

Sarton also offers a very brief overview of the history of music theory, beginning with Terpander of Lesbos (fl. c. 710 to 670 BCE), who founded the first European music school at Sparta. He is considered the father of Greek music (Sarton [1927] 1975, vol. 1, p. 61). He implemented innovations in the structure of the musical scale, composed hymns, and possibly developed two-part compositions. Sarton also notes that during the time of Aristotle (384-323 BCE), Aristoxenos was one of greatest music theorists of antiquity (Sarton [1927] 1975, vol. 1, p. 126). Aristotle himself was concerned with problems of music theory. Sarton shows that the material, technical and intellectual environments of Greece were all well prepared for the arrival of the first pipe organ. With this background in place, Sarton tells the reader: “The greatest technician of that period (if he really belongs to it) was Ctesibios of Alexandria, who invented various mechanical and hydraulical contrivances” (Sarton [1927] 1975, vol. 1, p. 178). In the context of a later discussion of physics and technology, Sarton has a little more to say about Ctesibius. He notes that his dates are uncertain and his writings are lost. Sarton credits him with the invention of the “hydraulic clock, hydraulic organ (with keyboard?) and force-pump” (Sarton [1927] 1975, vol. 1, p. 184). It is curious that either Sarton is not sure whether the instrument had a keyboard at all, or he is unconvinced that Ctesibius was responsible for its invention.

In the category concerned with “Hellenistic and Chinese Mathematics,” Sarton ascribes to Hero (Heron) the invention of a “fountain, fire engine, aeolipile, water-organ, thermoscope, various presses, contrivances using the force of steam, “penny-in-the-slot,” and other automatic machines” (Sarton [1927] 1975, vol. 1, p. 208).⁵¹ Sarton also places Hero of Alexandria in the category of “Hellenistic Physics and Technology.” As Sarton reports, “Heron continued the mechanical tradition of Alexandria and invented (or described) many very ingenious devices” (Sarton [1927] 1975, vol. 1, p. 202). Sarton believes that “Heron lived after Archimedes and Apollonios and before Pappos; it is very

⁵¹ The aeolipile is considered to be the first working model of a steam engine and boiler. It is also considered to be an artifactual precursor to the jet engine.

probable that he lived after Hipparchos and that his writings appeared too late to be used by Vitruvius” (Sarton [1927] 1975, vol. 1, p. 209). Later historians have also commented that Vitruvius apparently did not have access to Hero’s work. Sarton gives no further information about Hero’s inventions or technical descriptions (in fact, historians are still not sure which is which). He does not mention the water organ again. It is reasonable to assume that Sarton did not perceive the organ to be either historically influential or in any way associated with scientific or technological progress.

In Volumes VII and VIII of a comprehensive work on *A History of Magic and Experimental Science*, Lynn Thorndike addresses the relevant literature of the seventeenth century (Thorndike [1929] 1958). Comparing this corpus to the documents of the previous centuries, Thorndike finds it a “pleasing feature” that unlike the writers of the Renaissance, especially Leonardo da Vinci, these authors are less concerned with “engines of war and destruction” (Thorndike [1929] 1958, vol. VII, p. 620). But Thorndike’s major interest is to examine the close relationship between magic and experimental science and to look at the period of transition from one to the other. With this theme in the foreground, it is not surprising that he finds little to say about pipe organ technology of the time. For the most part, his short references to the instrument and to music in general are taken from his survey of literary sources. He summarizes a few bits of historical information, adding little in the way of interpretation.

In Thorndike’s opinion, Marin Mersenne “made little positive contribution to science except perhaps in music and mathematics” (Thorndike [1929] 1958, vol. VII, p. 428). Following a brief summary of some of Mersenne’s writings, including his *Questions on Genesis*, Thorndike passes over Mersenne’s extensive experimental work in acoustics and his substantial legacy as a musicologist with a single statement: “After discussion of mechanical and liberal arts, and much on music, we come back again to man the microcosm but to a denial of astrological chiromancy” (Thorndike [1929] 1958, vol. VII, p. 435). He mentions that Mersenne moves on to speak of Robert Fludd, whom Thorndike suggests Mersenne thought was “mildly insane.” Meanwhile, Thorndike moves on to speak of other matters. In the context of magic, Mersenne’s experimental music has no place.

Nor does machinery mesh with magic. Thorndike's chapter on "Artificial Magic and Technology" summarizes the works of several seventeenth-century authors who have written on the subject of mechanical devices. Among these are manuscripts by Athanasius Kircher and Salomon de Caus, both of whom describe numerous curious, amusing and ordinary artifacts, including pipe organs. Beyond this, however, Thorndike has nothing more to say about the instrument. It seems to be not worth mentioning when the context is magic and the object is a machine. By the seventeenth century, the organ has become a transparent technology. There is nothing mysterious about it. Thorndike concludes this chapter with the observation that "we must admit that machinery and magic do not go together. Magic may employ sleight-of-hand, but not the monotonous regularity of impersonal mechanics, which is the very antithesis of magic" (Thorndike [1929] 1958, vol. VII, p. 621). For Thorndike, the "monotonous regularity" of the pipe organ remains external to the mysterious realm of magic.

There is another inconsequential reference to the organ in Thorndike's chapter called "Other Exponents of Experimentation." Thorndike shows his lack of concern for Mersenne's extensive experimental work in music by neglecting to include it in his overview of early works, but he does mention the organ in his description of the books on philosophy and experiment written by Johann Kestler, who was a disciple of Athanasius Kircher:

The sixth book deals with the mechanics of the ancient Egyptians, including water clocks. The seventh book is chiefly pyrotechnic but has a chapter on iatro-chemical practice and ends with a pipe-organ (Thorndike [1929] 1958, vol. VIII, p. 227).

Again, Thorndike has nothing further to say on the subject of philosophy and experiment relative to the history of the pipe organ.

Abbott Payson Usher's work on *A History of Mechanical Inventions* was first published in 1929 (Usher [1929] 1970). In his 1954 "Preface to the Revised Edition," Usher provides a more formal framework for the original chapters, which are essentially narratives. Usher's philosophical commitment leans toward an empiricist approach, consistent with the period during which he is working. He admits, however, that empirical verification is difficult to achieve in historical reconstruction. It is a task that requires "more knowledge of the broad features of social and intellectual history than we

now possess” (Usher [1929] 1970, p. vi). His comments are particularly valid in the case of the ancient organ, since so little of the desired data is available.

Usher is influenced not only by three decades of philosophical progress in empiricism, but also by contemporary achievements in the field of genetics. For Usher, drawing an analogy from biology, the use of a classification system such as Hooke’s is helpful, but it is not sufficient as a tool of analysis. Genetic considerations related to evolutionary theory are necessary components of historical work. He is especially concerned with developing an analysis of innovation, claiming that we should seek “the precise nature of the continuities and discontinuities in the systems of events which constitute our history” (Usher [1929] 1970, p. vi). For Usher, these “systems of events” constitute the appropriate unit of analysis for historical study.

Usher’s approach to mechanical invention requires an understanding of the emergence of novelty. He develops this idea at some length, basing his discussion on his interpretation of acts of insight. He builds his theory of innovation on a “genetic sequence” consisting of four steps (Usher [1929] 1970, p. 65).

1. The problem (or incomplete pattern) is perceived.
2. The stage is set for a solution.
3. Experimentation yields an act of insight resulting in a solution.
4. Understanding and critical revision take place, or in modern terminology, assessment feedback occurs.⁵²

For Usher, insight is prepared insight and invention is a cumulative process. He finds that much of what is known about mechanical principles has grown out of smaller elements of knowledge based on previously existing mechanisms. He offers the following example of technological evolution in engineering:

The mechanical devices of Philo and Hero, made for entertainment or for the mystification of temple worshipers, afford important insight into their knowledge of principles. The clock and watch makers laid the foundations for the analysis and design of geared mechanisms. The history of their achievements is thus an integral part of the history of engineering. The history of invention is a study of the circumstances that have converted the simple but relatively inefficient mechanisms of early periods into the complex and more effective mechanisms of today (Usher [1929] 1970, p. 117).

⁵² For a recent model of technology as an input/output transformation process, see Pitt (2000), pp. 14-15.

It is interesting to note that Usher cites the clock and watch as precursors to geared mechanisms. But what account does he give of the organ? There is no mention of the instrument here. However, in a previous passage, following a discussion of Greek treatises on the principles of statics and dynamics, he refers to certain treatises on mechanics that constitute “descriptions of particular machines, such as the water clock, the organ, and the various mechanical devices used in temples” (Usher [1929] 1970, pp. 86-87).

Usher includes the organ simply as an item in the list. He considers this descriptive set of Hero’s treatises to be less important than the treatises on pneumatics. These are the writings that provide evidence for the use of experimental methods. In reference to the treatises on pneumatics, Usher has more to say about the origins of the organ:

The organ has a long history in antiquity, beginning with a small apparatus that is hardly more than a bagpipe. Its real career begins, however, with the appearance of a device blown by one or two leather bellows. In antiquity, this form soon gave place to the so-called “water organ,” ... The invention of this type of organ is commonly ascribed to Ctesibius. No descriptions are available earlier than the treatises of Vitruvius and Hero, though some vague representations in archaeological fragments are available from the pre-Christian period (Usher [1929] 1970, p. 136).

Although Jean Perrot finds no prior evidence for the existence of the organ before its first documented appearance as a water-powered machine, Usher is hesitant to accept the possibility that its origin could be attributed to spontaneous generation. He agrees that no historical records predating the reports of Vitruvius and Hero of Alexandria have surfaced. Nevertheless, based on “some vague archaeological fragments,” he believes that a primitive “bagpipe” organ existed before Ctesibius. He also argues that the two styles co-existed for a period of time. His implication seems to be that this non-hydraulic instrument continued to develop, but he offers no further description of its evolutionary path.

In addition to these brief references, Usher also includes a summary of Hero’s description of the water organ (Usher [1929] 1970, pp. 137-140). He mentions three devices used in the construction of the instrument. First, Usher calls attention to an

apparatus that involves a windmill-type mechanism. He points out that Hero's account is the only known reference to this type of artifact in antiquity and comments that he is unsure of the date that the windmill was first used as a source of power. Next, Usher discusses the key action, noting that both Hero and Vitruvius describe a spring mechanism for releasing the key after it has been pushed. A string attached to a simple spring constructed from animal horn returns the key to its original position. Beyond this, he has nothing more to say about the key mechanism.

Finally, Usher shows a special interest in the trip hammer associated with the wind-driven water organ, claiming that there is a lengthy time span between the use of this device for motion and its use for power production. "This apparatus," he says, "is perhaps one of the most striking demonstrations of the distinctions between the production of motion and the production of power, for this little device embodies two notable arrangements that ultimately appear in heavy-duty machinery (Usher [1929] 1970, p. 140)." Usher draws no conclusions about the possible influence of these mechanisms on later technologies.

Another volume published in 1929 is Stuart Chase's *Men and Machines*. Chase is also concerned with the history of inventions and the effects of machines on society. Early in the book, as he struggles to find a satisfactory definition of machines, Chase asks the question: "What are they actually doing to craftsmanship, skill, quality of output, art, architecture and recreation?" (Chase [1929] 1935, p. 20). Ultimately, however, he has little to say in response to this question. Instead, except for some curious diversions, he focuses his efforts for the most part on machines that perform some kind of work.

In making his selection from among the diversity of mechanisms that date from the Middle Ages, Chase finds it intriguing to account for an assortment of instruments of torture, such as the thumb screw and "the wheel – on which a man was strapped and broken." He is further impressed by reports of an "admirable engine of those days" known as the "girdle of chastity." He even extends his list to include a particular religious technology of Tibet, the Buddhist Praying Wheel. Chase adds an amusing comment relevant to an artifact of similar (and perhaps more familiar) construction: "Less holy supplicants still worship with such engines at Monte Carlo" (Chase [1929] 1935, pp. 55-57).

Among these fascinating curiosities, it turns out that the medieval pipe organ, a machine that surely embodies Chase's desire for "craftsmanship, skill, quality of output, art, architecture and recreation," is entirely missing from the list. A clue to the possible reason for its omission appears in his chapter on James Watt. Here Chase provides a glimpse of his own level of concern for the topic:

Young Watt was an exceptionally gifted tinkerer. By trade a maker of mathematical instruments, he could turn his hand to anything, repair all sorts of mechanisms. As a musician he hardly knew one note from another, but if an organ was out of kilter, he could not only make it play again, but play better than before. Once, for a whim, he made a very fine guitar. All of which proves once more that musical instruments and steam engines have much besides noise in common (Chase [1929] 1935, p. 65).

It appears from the tone of this passage that Chase has limited musical interests. From his perspective, at least in this context, the organ is a noisemaker that tends to get out of kilter. Apparently, it has neither musical nor technical appeal for him. In any case, Chase is aware of the common heritage that organs and steam engines share. He is well acquainted with the work of Vitruvius and Hero of Alexandria and even describes a number of Hero's technologies (Chase [1929] 1935, pp. 53-55). This would have been a good opportunity for him to place the ancient organ in its historical context.

The passage on Watt is not the only reference Chase makes to this instrument. He brings it up again in a discussion of machine-made, automated, repetitive habits. This time his context is religion:

We go to church (in diminishing numbers it is true) in a motor, rather than a horse and buggy; the organ is furnished wind by a motor instead of by a perspiring organ boy; sermons by radio are multiplying; the parson has an adding machine in his sanctum, or wishes he were in a position to have one – but by and large it is the same religion, accompanied by the same hymns, nor have we, in a century and a half of machinery, caught up with the Buddhists and invented a praying wheel. If we had really cared about speeding up religion we might have had a turbine (Chase [1929] 1935, p. 121).

Chase does recognize the organ as a standard fixture in the church. But even now that it has a motor, it fares no better from a technological perspective than it did as a human-powered noisemaker. Chase, an accountant and economist by trade, gives the organ about the same degree of consideration that he gives to the parson's adding

machine. Chase's image of a perspiring organ boy reinforces the assumption that the instrument itself is of little concern to him. Much more appealing in this passage is his fascination with the prayer wheel, a technology that in fact does resemble a turbine, and if only it would spin a little faster ...

That unfinished thought is best left to the historical imagination. Chronologically, the next source in which to search for the technological role of the pipe organ is Lewis Mumford's *Technics and Civilization*, first published in 1934 (Mumford [1934] 1963). In his "Introduction" to the 1963 reprint edition, Mumford recalls that the publication of this book created an important break from the "traditional neglect of technology." He was the first to integrate the "social milieu" with technological achievements. The characteristics of the various cultural phases of technology throughout history provide a structural theme for his work.

Mumford is especially concerned with machines, by which he means individual objects with specialized functions. His generalized use of the phrase "the machine" refers to "the entire technological complex" (Mumford [1934] 1963, p. 12).⁵³ As Mumford tells his readers, "*Technics and Civilization* heralds a change of attitude among scholars both toward the history of technics as an element in human culture and, to a lesser degree, toward evaluating its social and cultural results; and it possibly helped to generate this new interest, or at least to create the audience that made such books possible" (Mumford [1934] 1963).⁵⁴

In tracing the path of the machine from the ancient world to the Middle Ages, Mumford emphasizes the role of the monastery in preserving social order. He observes that by the seventh century, monastery bells were rung seven times in a twenty-four-hour period to mark the canonical hours. Accurate tracking of time was required, so the need for a timekeeping device became evident. Mumford tells the story of the monastery clock as the tale has been handed down through legend:

According to a now discredited legend, the first modern mechanical clock, worked by falling weights, was invented by the monk named Gerbert, who afterwards became Pope Sylvester II near the close of the tenth century.

⁵³ Here Mumford includes industrial knowledge, arts, skills and relationships as well as the various tools and machines associated with the new technics.

⁵⁴ Mumford's work served as an inspiration to scholars and helped to create an audience for histories of technology.

This clock was probably only a water clock, one of those bequests of the ancient world either left over directly from the days of the Romans, like the water-wheel itself, or coming back again into the West through the Arabs. But the legend, as so often happens, is accurate in its implications if not in its facts (Mumford [1934] 1963, p. 13).

Regardless of the accuracy of the legend of the clock, the tradition of the pipe organ in the monastery rests on firm historical grounds. As Perrot points out, during the eighth through the tenth centuries “the monks were virtually the only group of people competent to make the pipes the correct size, and tune them, since both these operations called for a certain degree of instruction in arithmetic and acoustics” (Perrot 1971, p. 218). Mumford has nothing at all to say about the presence of the organ in the monastery.

There is, however, a passing reference to the organ in his discussion of various agents of mechanization that were built for the purpose of amusement:

Certainly the part played by toys and non-utilitarian instruments in fostering important inventions cannot be lightly ignored. The first “use” of the steam engine, as suggested by Hero, was to create magical effects in the temple to awe the populace: and steam appears as an agent of work in the tenth century, when used by Sylvester II to operate an organ (Mumford [1934] 1963, p. 101).

Mumford is correct in claiming that mechanical devices such as twittering birds and clocks with moving figures were essentially devoted to entertainment. These intricate kinds of playthings served as forerunners to later generations of utilitarian machines. But at the time of Sylvester II, the organ was not a toy. In any case, regardless of whether it was powered by steam or by heated air, Mumford implicitly believes the organ to be a true ancestor to the steam engine. It seems odd that he has so little to say about the possible role of this machine as a precursor to steam-powered technologies.

During the years between 1000 and 1750 CE, there were a number of innovations and discoveries that profoundly affected the cultural traditions of Western Europe. Mumford enumerates the primary inventions of the era: “mechanical clocks, the telescope, cheap paper, print, the printing-press, the magnetic compass, the scientific method, inventions which were the means to fresh inventions, knowledge that was the

center of expanding knowledge” (Mumford [1934] 1963, p. 141).⁵⁵ He notes that few of the required inventions, the lathe and the loom for instance, were already in place. These new material artifacts were the mechanical colleagues of the old-fashioned organ. Each was influential in history, but with the possible exception of the clock, none was as technologically sophisticated.

The organ’s mechanical family tree acquired an interesting technological descendent during the inventive era of the Renaissance. Mumford provides a list of Leonardo da Vinci’s contributions to warfare, including such curious artifacts as “the steam cannon, the organ gun, the submarine, and various detailed improvements upon the common devices of his time ...” (Mumford [1934] 1963, p. 141).⁵⁶ Leonardo’s own notes illustrate three types of multi-barreled machine guns. One of his models consists of three tiers, each constructed with a rank of twelve barrels. The guns were to be fired one tier at a time, with the second to be reloaded and the third allowed to cool after it was fired (Hart [1962] 1977, pp. 292-293).⁵⁷ The three tiers of barrels very much resemble three ranks of organ pipes. Leonardo himself calls the weapons *spingarde a organi*.⁵⁸ Leonardo designed a number of military artifacts, but this one in particular represents an extraordinary “technological complex” of warfare and the Church.

In his discussion of the demise of medieval economy and the rise of public and private luxury, Mumford misses an even more significant opportunity to take the organ into account. Recalling the extravagance and ornate décor of the Baroque era, he writes:

The great art of the Baroque period is in the country houses and the town palaces: when churches and monasteries were built, they were done in the same style: abstractly, one could hardly tell the difference between the nave of one and the ballroom of the other. One acquired riches in order to

⁵⁵ Mumford compares these fundamental inventions to a breach in the line, though which a whole army rapidly followed (Mumford [1934] 1963, p. 141).

⁵⁶ Mumford notes that the “persistent warfare between the engineer and the artist” was an issue in Leonardo’s life (1452-1519) (Mumford [1934] 1963, p. 141).

⁵⁷ The machine gun held a particular fascination for Leonardo. On the influences in Leonardo’s life and his technical background, Ivor Hart notes that the greater stimulus was the military, followed in second place by the Church. The technologies of warfare required mining and metalwork for the production of munitions and weapons. The Church needed wood carvers, masons and carpenters, lead-glass and precious metal craftsmen, organ builders, bell casters, chalice makers, etc. “The directing minds for these activities were the medieval equivalents of the architects and the engineers of today” (Hart [1962] 1977, p. 164).

⁵⁸ See photographs of reconstructed models of Leonardo’s organ guns at <http://www.museoscienza.org>. One of these reproductions is designed with thirty-three barrels; the other model has eight barrels.

consume goods according to the standards of the court: to “live like a prince” became a byword (Mumford [1934] 1963, p. 99).

Here Mumford lists such luxuries as fine china, elegant fabrics, precious stones, perfumed baths and private gardens, all of which contributed to an economy of opulence. Yet anyone who has ever seen and heard what is surely one of the most elaborately conceived technological artifacts of the Baroque era must wonder how this author could have disregarded the pipe organ. William Leslie Sumner describes its significance to civic pride during the lifetime of Johann Sebastian Bach (1685-1750):

The proving and testing of organs was quite a feature of church life during the Baroque period. The erection of a new instrument was a matter of great interest and pride in any German or Dutch town. Experts from distant places were paid to come from distant towns to test every small part of an organ, and the process sometimes took a week. J. S. Bach was himself in great demand as an organ-prover (Sumner 1962, p. 96).⁵⁹

In this era of artistic extravagance, the size of the instrument and the skill of the performer were objects of intense rivalry between European churches and towns. Mumford traveled in Europe. According to Williams, his trip was one of a sequence of events that led him to focus his “Form and Personality” project more directly on machinery. Rosalind Williams describes this crucial journey:

Mumford discovered books, museums, cities, and colleagues – discoveries that, in his words, ‘altered the scope and scale of the entire work’ (Williams 2002, p. 41).

Given this set of cultural discoveries, it seems strange that the elegant sight and superb sound of that magnificent technological and artistic achievement, the European Baroque organ, escaped his attention.

In light of this oversight, it is ironic that Mumford brings *Technics and Civilization* to a close by drawing on musical imagery as his concluding metaphor. To summarize his work, he portrays civilization as an evolving orchestra. His symphony emerged out of the “scraping and tuning” of tenth-century instruments. These were ultimately joined by seventeenth-century fiddles and woodwinds that provided shrill notes for the prelude to “the great opera of mechanical science and invention,” next by

⁵⁹ Judging from this passage, it would seem that the church served as a laboratory in which the Baroque organ was subjected to extensive experimental trials.

eighteenth-century brasses that rang out with “metals predominating over wood,” and finally by nineteenth-century human voices that “timidly sounded through the systematic dissonances of the score, at the very moment that imposing instruments of percussion were being introduced” (Mumford [1934] 1963, p. 434).⁶⁰ Even in this final movement of his much acclaimed opus, Mumford orchestrates no part for the most majestic musical technology of them all, the pipe organ.

As a final coda, perhaps it would be appropriate to suggest that if Mumford had chosen to analyze more closely the complexity of relationships between the instrument, the composer, the performer, the listener and the architectural and social spaces that join all of these components together, he would have found a greater measure of the harmony he sought between technics and cultural patterns.

A comprehensive resource is *A History of Science, Technology and Philosophy in the 16th and 17th Centuries* by Abraham Wolf. In his Preface, written at the University of London in 1934, Wolf explains that the primary aim of his work “to give a reasonably full account of the achievements of the sixteenth and seventeenth centuries in the whole field of ‘natural’ knowledge” (Wolf [1935, 1950] 1959, vol. I, p. xiv). He provides a record of the scientific, technological and philosophical achievements of the early modern era. As Wolf reminds the reader, “modern science, in its early stages, was helped by treatises transmitted from ancient times, and most of all perhaps by the mechanical treatises of Archimedes and the technological works of Hero of Alexandria and Vitruvius” (Wolf [1935, 1950] 1959, vol. I, p. 2). He reviews the history of the steam engine, dating it back to the time of Hero. He lists a number of Hero’s descriptions and inventions, pointing out as most historians do that Hero did not distinguish those he created himself from those that others had built. As a technological antecedent, Wolf refers to the Aeolipile, a kind of steam turbine, but he suggests that it was probably “little more than a toy” (Wolf [1935, 1950] 1959, vol. II, p. 543). Wolf’s only concern with the organ seems to be in reference to an instrument that was reportedly constructed in

⁶⁰ For Mumford, writing in the 1930s, everything so far had been only a rehearsal. Science and technics had fallen far short of society’s expectations. Nevertheless, in spite of his pessimism, there remained one lesson to be learned: “Nothing is impossible” (Mumford [1934] 1963, p. 434).

Rheims in 1125 by Gerbert (Wolf [1935, 1950] 1959, vol. II, p. 543).⁶¹ This instrument was blown by air that was compressed by means of heated water. Knowledge of steam power was available in the twelfth century. On this subject Wolf draws a weak but plausible technological link from Hero's treatises to the steam technologies of the Middle Ages. But he has nothing further to say about the pipe organ.

Wolf advances the argument that the Christian Church had been detrimental to the advancement of learning:⁶²

The chief obstacle in the path of science during the Middle Ages was the Christian Church. Concerned mainly with the lowly, disdainful of the world and the flesh, and believing itself in proud possession of divinely revealed truth concerning all that mattered, the Church was at first contemptuous and then hostile towards all those who sought knowledge of Nature by the independent light of reason (Wolf [1935, 1950] 1959, vol. I, p. 8).

In spite of Wolf's support for the perceived conflict between religion and science, on the matter of the relationship between religion and technology, he missed this opportunity to credit the institutional structure of the Christian Church, especially the monasteries, with assuming responsibility for preserving and enhancing pipe organ technology throughout the Middle Ages.

Aage Gerhardt Drachmann published *Ktesibios Philon and Heron: A Study in Ancient Pneumatics* in 1948. Here he addresses the problem of classifying Ktesibios' profession:

But we know from Vitruvius on the authority of Ktesibios himself, that he was both a barber and an engineer. The whole trouble seems to me to arise from a snobbish idea that a great inventor could not possibly have begun his life as a barber. But the special talent for mechanical inventions which distinguished Ktesibios is certainly not confined to the upper classes (Drachmann 1948, pp. 2-3).

From his research, Drachmann concludes that the inventor was "a barber's son and probably originally a barber himself," that he lived from about 300 to 230 BCE, and that he was "one of the great inventive talents of all time" (Drachmann 1948, p. 3).

⁶¹ Wolf cites his source as "R. Stuart's *History and Descriptive Anecdotes of Steam Engines*, Vol. I, p. 15." The date given here is inconsistent with other sources. Gerbert was appointed pope in 999 CE, taking the name Sylvester II. He died in 1003. See <<http://www.ku.edu/kansas/medieval/108/lectures/gerbert.html>>.

⁶² For two early interpretations of the argument that science and religion were long at war with each other, see White (1897) and Draper ([1902] 1925).

Drachmann laments the choices that Vitruvius made in selecting which of Ktesibios' inventions to include in his history. For those Vitruvius omitted, he refers his readers to Ktesibios' own book, now lost, for information about his less necessary inventions. Drachmann admits that Vitruvius was "at liberty to decide for himself what he wanted to write and what not," but he has an additional observation to make on the topic of making choices:

When an inventive genius finds a brand new natural force to explore, it seems to me natural that he should explore it to the uttermost, without regard to the practical use of his invention. I fail to see that it was better to invent catapults – which never came into practical use – than singing black-birds, which led to the invention of the organ, and of which we still find a descendant in the cuckoo clock. So even by the standards of the critic the black-birds have proved the better invention (Drachmann 1948, p. 3).

Drachmann explains Vitruvius' water organ in detail, but observes that since there is no drawing of this instrument, "his description is not easy to follow by itself" (Drachmann 1948, p. 7). Fortunately, he explains, the differences between the descriptions of the water organs of Vitruvius and Heron are slight, and Heron's is more helpful. He also notes that Heron's water organ probably had its prototype in Philon's, but because Philon's book is lost, there is no way to compare the two descriptions (Drachmann 1948, p. 100). In comparing the history of the organ with the history of the piano, Drachmann observes that "no one knows the name of the first man to play on strings with hammers and keys; but we know the name of the inventor of the organ: Ktesibios" (Drachmann 1948, p. 16).

Historians of science and technology have often struggled to account for the relative roles of science and technology. Is technology dependent on science, or vice versa? In response to this question, Charles Singer observed in the mid-fifties:

In our own time technology has become almost synonymous with the application of scientific knowledge to practical ends. To us it seems that science is the source, the parent, of technology (Singer, Holmyard, Hall and Williams, eds. [1956] 1972, vol. II, p. 774).

Singer was working on *A History of Technology* during the post-war era, when the idea that technology equated to "applied science" was a sign of the times. Since then, of course, attitudes have changed. More recent scholarship in the history and philosophy of

technology has shown that the interrelationship is much more complex and the range of viewpoints has expanded. Joseph Pitt, for example, argues in *Thinking about Technology* that there is not just one definitive relation, “there are many,” he says, “and that is the way it ought to be” (Pitt 2000, p. 138).

A search for evidence of the pipe organ in *A History of Technology* yields little information that would shed light on the science-technology question. A short reference to the wind-organ as described by Hero of Alexandria appears in the chapter on “Power,” written by R. J. Forbes (Singer, Holmyard, Hall and Williams, eds. [1956] 1972, vol. II, pp. 614-615). The text shows an illustration of Hero’s instrument, but this figure is based on a sixteenth-century reconstruction of Hero’s description. Forbes’ brief explanation focuses on the Greek word *anemourion*. This is a term that is translated to mean “wind-vane,” but this author notes that it occurs only in Hero’s text and again in the work of a bishop who lived in the twelfth century. The later copies of Hero’s manuscripts were produced at a time when the windmill was already known, so the drawings reflect contemporary technologies and lack historical accuracy. Forbes concludes that there is no reason to believe the windmill was known in Hero’s time. However, speaking of the windmill as a prime-mover, he does speculate that “it is just possible that this idea finally emerged in the western windmill”(Singer, Holmyard, Hall and Williams, eds. [1956] 1972, vol. II, p. 616). It is tempting to stretch Forbes’ conjecture into a claim that the wind-organ was in fact an instrument of change, but to do so would be historically premature. At present, this conjecture requires more extensive research and documentation.

In different context, *A History of Technology* provides one additional reference to the organ. In the chapter entitled “Leather,” John W. Waterer writes about the uses of this common material in daily life. He mentions that organ makers have been working with leather, using alum as a preservative, since the very early days of organ building:

Music has uses for leather. Whether syrinx or bagpipe came first is arguable; but it is not too fanciful perhaps to regard the ‘windy organs’ as a combination of the two. In quite early times organs employed alumed sheepskin for bushings and seatings for pipes, and for the gussets of bellows”(Singer, Holmyard, Hall and Williams, eds. [1956] 1972, vol. II, pp. 180-182).

From these scant references, it is clear that except for a remotely possible influence on the technology of the medieval windmill, the pipe organ is not perceived as an instrument of change by the authors and editors of *A History of Technology*.

A Short History of Technology from the Earliest Times to A.D. 1900 was published in 1961. While earlier works on the history of technology had a tendency to reflect little more in terms of social context than political and economic environments, the stories of technological development in this text are woven into a broader cultural fabric. The authors' use of the word "development" is significant in that it implies historical interest in other kinds of technologies besides those that merely engender progress and change. Acknowledging this diversity in the world of technology, Thomas Derry and Trevor Williams hope that their choice of subjects will turn out to be "an acceptable blend of those branches of technology that have decisively changed the course of history with homelier crafts of greater human interest but lesser consequence" (Derry and Williams 1961, p. vii).⁶³ Not only the revolutionary technologies but also the "homelier crafts" are worthy the historian's consideration. Such a willingness to take into account these not-so-influential technologies reflects an unusually inclusive attitude on the part of these authors. As an example, in the context of the discussion on metal-working in the Middle Ages, Derry and Williams call attention to the building of church organs with copper or bronze pipes as one of the two most interesting uses of metals in medieval times. The other noteworthy instance of medieval metal-working is the casting of bronze church bells.

The history of the medieval organ can be traced to the influence of Christianity at the time of Charlemagne (442-814 CE). Derry and Williams provide a brief historical overview of the organ. Because the authors refer to several technical aspects of the instrument, and because their summary is both concise and comprehensive, the passage is worth quoting in full:

The organ had been well known in the ancient world: the problem of providing an even wind-pressure by mechanical means had engaged the attention of both the great Alexandrian mechanics, Ctesibius and Heron. Its use in Christian services appears to have begun at Constantinople in the fourth century, and St Jerome tells of an organ at

⁶³ The authors note that it is the intent of this work to associate the history of a technology with the historical context of the age.

Jerusalem, with two elephant-skins for a wind-chest, which was audible a mile away. The Franks received their first as a gift from the Byzantine emperor in 757, and by the tenth century organs were fairly common in England as well as in France and Germany: St Dunstan, for instance, installed two, and there was one in Winchester cathedral said to be furnished with 400 bronze pipes and 26 bellows. The pipes were at first operated by pulling rods, but a keyboard was employed at Magdeburg cathedral before 1100; the pedals were added before the end of the Middle Ages. By the time of Samuel Pepys, who longed to buy one, small organs were a not unusual amenity in private houses.⁶⁴

It is clear from this description that the medieval organ of western Christendom was a sophisticated technological artifact. Its construction and operation required the individual efforts of numerous skilled workers and craftsmen. Miners extracted ore from the ground. Metal-workers shaped and soldered pipes. Hunters killed elephants, skimmers removed the skins, and tanners processed hides. Leather-workers fashioned leather into wind-chests. Wood and metal craftsmen designed and constructed keyboards and added the pedals. Organ-builders assembled all of these components. Tuners voiced the pipes in accordance with prevailing music theory. Composers composed, bellows-blowers blew, performers performed, and audiences listened. It was said that the sound of the organ could be heard from a mile away.

The organ spread across Europe and even served as an instrument of diplomacy between the west and the east. It was included in the Christian church service at least as far back as the fourth century. By 1100 CE, the instrument had found its place in the cathedral. But the medieval organ has not been perceived by historians of technology as an artifact that arouses intellectual interest in associating cause with effect. For this reason, it has received little attention from historians such as Lynn White, for whom technological progress and social change are the primary selection criteria.

White's groundbreaking work on *Medieval Technology and Social Change*, published in 1962, is concerned with change and improvement brought about by various technologies in European society during the Middle Ages (White [1962] 1964).⁶⁵ White

⁶⁴ As much as Pepys admired the organ, he decided the model he was considering was too big for his house and that the "fashion" did not suit him. Instead, he purchased a small espinette, or spinet, as it was called in England.

⁶⁵ Lynn White examines a wide range of historical sources in order to investigate the relationship between technology and social change in Europe during the Middle Ages.

examines the archaeological, iconographical, and etymological evidence in search of answers when there are no answers to be found in the contemporary written record. One of his areas of concern is to trace medieval sources of power, examining the exploitation of mechanical devices and machine design in the latter part of the Middle Ages. White is particularly interested in the development of water and wind-powered machinery from antiquity. The ancient organ qualifies in both respects, but he finds it of little interest as an instrument of social change.

One of White's brief references to the organ is buried in a complex description of the development of machine design. Quoting Louis Mumford on the topic of the transfer of motion, White makes the claim that "the technical advance that characterizes specifically the modern age is that from reciprocating motions to rotary motions" (White [1962] 1964, p. 114).⁶⁶ Mumford's original statement appears in the context of an explanation of the wheel-and-axle as an agent of mechanization, where he credits Franz Reuleaux and others with prior recognition of its importance (Mumford 1963, p. 80).⁶⁷ According to Mumford, the most significant application of the wheel-and-axle is the lathe, which he considers to be the most important machine tool. "Without a machine for accurately turning cylinders, screws, pistons, boring instruments, it would be impossible to create further instruments of precision: the machine-tool makes the modern machine possible" (Mumford 1963, p. 80).⁶⁸

In this discussion White is searching for a reason that would account for the long technological delay in the implementation of rotary motion. He finds the answer in the philosophical and physical explanation that reciprocating motion is the only legitimate movement native to the organic world, and in this case to the human body in particular, whereas circular motion belongs exclusively to the heavens. "To use a crank, our

⁶⁶ White quotes from Mumford (1963, p. 80).

⁶⁷ Mumford claims that "Reuleaux and others have even said that the technical advance that characterizes specifically the modern age is that from reciprocating motions to rotary motions" (Mumford 1963, p. 80). The idea is that without rotary motion, the mechanical precision of the machine age would be impossible to achieve.

⁶⁸ Mumford also notes that the foot-treadle gave James Watt the necessary model for transferring a reciprocating motion to a rotary motion for his steam engine.

tendons and muscles must relate themselves to the motion of galaxies and electrons. From this inhuman adventure our race long recoiled” (White [1962] 1964, p. 115).⁶⁹

Once the crank was finally in place, both reciprocal and circular movements were joined together into one mechanism that provided continuous rotary motion. Closely associated with the innovation of the crank was the development of the treadle. As White explains, “There is no evidence that Antiquity knew the treadle in any form, save in China, where it was used on looms by the middle of the second century of our era” (White [1962] 1964, p. 117). White has found archaeological and iconographical evidence for the treadle connected to looms and lathes in the late twelfth and early thirteenth century. Because the technology of the treadle is closely associated with the mechanism of the pedal keyboard, he had assumed that the medieval organ would seem to be an obvious place to look for a treadle-like application. What White found in the course of his research surprised him. He quotes from Charles W. Pearce in *The Evolution of the Pedal Organ*:

It is strange, in view of all this, that the treadle does not seem to have been applied to the pipe-organ (the most complex engine used by the Middle Ages) in the form of a pedal keyboard until c.1418 (White [1962] 1964, p. 117).⁷⁰

Certainly it is reasonable for White to find it “strange” that the pedal keyboard was so late appearing, since the instrument itself was “the most complex engine” of the day, and furthermore, foot-powered mechanisms were already well established. That is to say, it would have been “strange” if in fact the historical events had taken place in the manner that White relates them here. However, White seems to have misinterpreted Pearce’s findings. What Pearce is describing at this point is the earliest known *documented* appearance of the pedal keyboard, not the earliest implementation. The claim Pearce actually makes is that “Historians seem to agree that the earliest authentic record of Continental pedals dates back to the beginning of the fifteenth century” (Pearce 1927, p. 1). Pearce notes that the year is established because “the date 1418 was found

⁶⁹ The explanation is to be found in nature. “Continuous rotary motion is typical of inorganic matter, whereas reciprocating motion is the sole form of movement found in living things. The crank connects these two kinds of motion; therefore we who are organic find that crank motion does not come easily to us” (White [1962] 1964 p. 115).

⁷⁰ White’s source for this statement is Pearce (1927, p. 1).

engraved on the inner side of the KERN (or LANGUID) of two large pipes which the builders considered could never have belonged to the manual” (Pearce 1927, p. 1).⁷¹ Expressing skepticism that this particular instrument would have been the first on the European Continent to have pedal keys, Pearce concludes, “But it is more probable that, long before the year 1418, there were organs on the Continent to which were attached both pedal keys and pipes” (Pearce 1927, p. 2). Thus it appears that the application of treadle action to the pipe organ was not as late as White had surmised.

The only other reference White makes to the organ occurs in his discussion of medieval sources of power, where he writes, “Our present concern is ... to examine the new exploratory attitude towards the forces of nature which enabled medieval Europe to discover and to try to harness other sources of power which have been culturally effective chiefly in modern times” (Pearce 1927, p. 89). He relates a tale from sixth-century Byzantium in which the architect of Hagia Sophia, who was a mathematician and apparently a practical joker as well, produced a simulated earthquake with the use of steam-pressure. What is especially significant about this story is that it helps to demonstrate White’s belief that “the cultures of the eastern hemisphere were far more osmotic than most of us have believed” (White [1962] 1964, p. v).⁷² White has left this investigative task to a future historian. There is still much work to be done in tracing the route of the organ as it traveled to the orient and returned again to Western culture. Meanwhile, it seems very strange that White has paid so little attention to the instrument that he calls the most complex engine of the Middle Ages.

In 1963, Drachmann published *The Mechanical Technology of Greek and Roman Antiquity* (Drachmann 1963). This book translates, examines, interprets and illustrates a selection of literary sources that describe the mechanical technologies of ancient Greece and Rome. Some of the information Drachmann provides on the inventions of Ctesibius comes directly from the Latin manuscripts left by Vitruvius. He believes this material to be authentic because Vitruvius himself based it on a book by Ctesibius that is no longer

⁷¹ This instrument was being rebuilt at Beestow, five miles from Frankfort-on-the-Oder (Pearce 1927, p. 1). The kern (or languid) is a circular metal plate placed horizontally inside a pipe at the opening (the mouth) between the tapered lower section (the foot) and the upper body of the pipe. A narrow slit at the edge of this plate allows the air to pass through the pipe. These pipes, inscribed with the date 1418, were too large to have been played from a manual keyboard, and must have been played with pedals.

⁷² White suggests that a better understanding of medieval Europe requires an examination of the historical sources of the non-western world (White [1962] 1964, p. v).

extant. He credits Ctesibius with inventing the “cylinder and plunger,” which led to the invention of the force pump, the water organ, and a catapult that worked by means of compressed air (Drachmann 1963, p. 10).⁷³ Drachmann is complimentary of the classical technical writers in spite of certain linguistic inadequacies in their work. One of his more amusing observations is that Vitruvius “writes an atrocious Latin, but he knows his business” (Drachmann 1963, p. 12).

Drachmann describes in careful detail the mechanical engineering aspects of Vitruvius’ array of inventions. He also provides a number of his own illustrations, including sketches of the crane, the water-drum, the Archimedean water-snail (a device that would move water uphill by rotation of the screw), and the fire pump. He recalls that the “cylinder and plunger were invented by Ctesibius, who used them first of all for pumping air for his water-organ and other pneumatic devices” (Drachmann 1963, p. 156).⁷⁴ After mentioning that three bronze pumps from antiquity can be found in the British Museum, he lets the reader know that the next chapter in Vitruvius’ work “deals with the water-organ, which lies outside the scope of this book; but we take up the thread with ch. 9” (Drachmann 1963, p. 157).

Since Drachmann has already analyzed Hero’s *Pneumatics*, most of his attention in this book is devoted to an analysis of the *Mechanics*. According to Drachmann, Hero of Alexandria was “a man who knew his business thoroughly, who was acquainted with the whole field of mathematics, astronomy and mechanics of his time, and who was quite a skilful inventor” (Drachmann 1963, p. 19). Claiming that the *Pneumatics* is a collection of notes, part of a larger project rather than a finished work, Drachmann defends the writer against critics who have judged it harshly, adding that Hero might not have understood the inventions he was describing. Drachmann finds Hero’s work clearly written and easy to understand. As he explains, “A man who is always able to present his subject in such a way that it is readily understood, is a man who understands it himself, and he is certainly not a fool or a bungler” (Drachmann 1963, p. 19).⁷⁵

⁷³ Drachmann also relates the story of Ctesibius in the barbershop and mentions some of his other inventions (Drachmann 1963, p. 10).

⁷⁴ Here Drachmann gives a comparative explanation of Vitruvius’ air and water pumps (Drachmann 1963, p. 156).

⁷⁵ Drachmann provides a history of the translations of Hero’s work (Drachmann 1963, p. 19).

Because Hero's description of the water organ is found in the *Pneumatics* rather than in the *Mechanics*, Drachmann is spared from having to attend to it in the major part of his book. However, he apparently has second thoughts about including this instrument. Following his analysis of ancient engines of war, he adds a penultimate chapter called "Sundries" (Drachmann 1963, pp. 192-196). Here he includes a description based on the treatises of Vitruvius. His account is essentially a replication of the original text, with a few suggestions regarding translation issues. Drachmann comments that Ctesibius had to construct a keyboard for his invention. Drachmann's work is particularly important for this discussion because he provides a context that includes other ancient artifacts that coexisted with the water organ.

Another author of medieval history is Jean Gimpel, whose study of *The Medieval Machine* (1976) omits the technology that Pearce calls "most complex engine used by the Middle Ages" (Pearce 1927, p. 1). Gimpel is chiefly concerned to show that this period was not a time of stagnation, as it had been characterized in Renaissance thought, but that it was instead "one of the great inventive eras of mankind" (Gimpel 1976, p. viii).⁷⁶ In his discussion of medieval industries, he observes: "Tin was used in the Middle Ages not only with copper to make bronze – for church bells, and later for cannons – but also, alloyed with lead, in the manufacture of pewter mugs and plates, an important English export industry of the time (Gimpel 1976, p. viii).⁷⁷ Perhaps because the pipe organ was neither a medieval innovation nor an export commodity, Gimpel simply takes it for granted. In any case, he does not include the organ workshop in his list of medieval industries that provided a customer base for the English stannary during the Middle Ages.

Gimpel's chapter on Villard de Honnecourt and medieval architecture would have been an ideal context in which to provide an account of the changing role of the organ. In the Middle Ages this artifact of medieval machinery found a new niche as it branched out from the isolated confines of the monastery into the public space of the medieval church. In contrast to Gimpel, Jean Perrot is well aware that organ builders responded to an expanding thirteenth-century marketplace. He recognizes the transition of organ

⁷⁶ Gimpel also maintains that the Middle Ages should be considered the first European Industrial Revolution (Gimpel 1976, p. viii).

⁷⁷ Gimpel notes that the demand and production of tin, an important component of organ pipes, fluctuated widely (Gimpel 1976, p. 97).

technology from the monasteries into the churches and cathedrals. Perrot even provides a detailed site list of new or upgraded instruments, which he prefaces with the explanatory remark that “most of the European churches were vying with each other to acquire or enlarge their organs” (Perrot 1971, p. 272).⁷⁸ Perrot speculates on the process by which “the once pagan organ from Alexandria finally conquered the Church, to become its liturgical instrument *par excellence*.” The following comprehensive passage clearly illustrates his perspective on the evolution of the old positive organ, a small instrument, into the new cathedral organ:

It is likely that the development of the instrument was not unrelated to the architectural transformation of Western churches. Towards the middle of the twelfth century the style today improperly called ‘Gothic’ was beginning to replace the Romanesque style of building, solid and heavy, with a new concept of balance which enabled men to build high naves and huge windows of stained glass. In the new cathedrals the limited power of the small positive organ was no longer adequate to accompany the growing congregations of worshippers or to alternate with the choirs. Organ-builders were therefore forced to devise instruments that were more complex, more sonorous, and consequently larger. This evolution was to lead gradually to a decisive transformation in the transmission mechanisms, and from the fourteenth century we find the ingenious ‘coupling’ device. This meant that the wind-chest could be vastly enlarged to take a very great number of pipes, while the manual was kept to a compact size, so that from then on the instrument was played by only one organist (Perrot 1971, p. 273).

Given Perrot’s argument for a direct relationship between a newly emerging Gothic architectural style and the resulting stimulus to the development of organ technology, Gimpel might also have included the organ in his discussion of the medieval cathedral.

In his 1978 publication on *Engineering in the Ancient World*, John Landels combines his engineering experience with an extensive collection of literary and archaeological resources (Landels 1978). Written in the style of an accessible technical manual for the general reader, this book provides an analysis of the Greek and Roman limited technologies of power. Specifically, the power sources available were men, animals, water, wind and steam. However, as Landels explains, only man-power and water-power were predominant in classical antiquity. “The theoretical possibilities of

⁷⁸ Perrot notes that a number of large towns, including those in England, “were already endowed with instruments” (Perrot 1971, p. 272).

steam power, hot air expansion and windmills were known, but apparently never exploited except on a very small scale, and not in useful or practical applications” (Landels 1978, p. 9).⁷⁹

Landels remarks that the Greeks and Romans used wind as a source of power for their sailing vessels, but there is no evidence that they developed rotary windmill technology. A thought occurs to him: “This is strange, and no satisfactory reason has yet been offered” (Landels 1978, p. 26). He finds the lack of technological influence odd because it is clear that the Greeks and Romans understood relative motion and the cause and effect relationship between the set of the sails, the angle of the wind, and the direction of the ship. It would seem that they might easily have applied the same power principle to some kind of milling machinery. In Landels’ words:

They were perfectly well aware that by adjusting the set of the sail a boat could be made to travel at an angle to the direction of the wind, and a very slight development of this idea could have led to the type of sail-mill to be seen nowadays on Mykonos and in Crete. But we have no evidence for any such machine in classical antiquity (Landels 1978, p. 26).⁸⁰

Landels takes a particular interest in the “one and only mention” from classical antiquity of harnessing wind power to do work. The wind-driven water organ described by Hero of Alexandria in *Pneumatica* is truly a unique artifact. According to Landels, it was “unparalleled” in its day. While other historians have expressed skepticism over the validity of Hero’s description, Landels finds no valid reason to doubt the textual authenticity of the historical record. Even though the “device was clearly a toy,” still the question remains, “why did nobody (apparently) see its potential as a power source?” (Landels 1978, p. 27).⁸¹ As a possible answer, he suggests that the wind-powered water organ was built to such a small scale that it did not lend itself to further development. Even so, the question remains “very puzzling.”

In the same spirit as Landels, Kenneth D. White takes seriously the task of integrating the study of technology with the cultural environment from which it emerged. In his 1984 survey of *Greek and Roman Technology*, he examines the relationship

⁷⁹ Landels notes that water power was used to a certain extent, but it was probably not common before the first century BCE (Landels 1978, p. 9).

⁸⁰ On the other hand, Landels argues that there is nothing in the literary sources that would serve as evidence against the existence of such a machine (Landels 1978, p. 26).

⁸¹ Landels suggests perhaps no one thought of experimenting with a larger windmill (Landels 1978, p. 27).

between developing technologies and the kinds of power sources available in ancient Greece and Rome (White 1984). He is concerned with all aspects of the social and cultural context of technology, although his work reflects a particular interest in examining the economic picture. White acknowledges his historical indebtedness to Landels, who had taken steps to break free from disciplinary constraints and to interpret technology as a process in history as well as a product in society (White 1984).⁸²

White stresses the necessity for a careful examination of both the literary and the archaeological record. He stresses that when the literary record is incomplete, historians must depend on conjecture and speculation. In such cases, an examination of the archaeological record is crucial (White 1984, pp. 172-173). White sees the historical record of the water organ as an outstanding example of the success achieved from merging literary and archaeological evidence. He proposed the notion that this ancient technology represents “applied scientific knowledge” whereby “a specific machine was produced by means of a combination of a number of principles” (White 1984, p.173).⁸³

Kenneth White notes that there has been a “fashionable tendency” among historians of medieval technology to downplay the significance of technical accomplishments from classical antiquity. Citing *Medieval Technology and Social Change*, he places some of the blame for this lack of appropriate recognition on the pattern set by Lynn White, whose “attractive style and bold, sweeping assertions, supported by an impressive array of footnote references, not all of which are germane to the argument, have given this book an influence that far exceeds its intrinsic and undeniable merits” (White 1984, p.173). Kenneth White is especially critical of historians who use only the yardstick of invention to measure the progress of technological productivity. He rightly claims that if invention were the only standard of measurement, it would appear that little was accomplished during the lengthy period of time between the early Greek and the late Roman civilizations. Few historians of technology make the claim, as White does here, that such a limited measure for success

⁸² White reiterates the idea “that technology is woven into the fabric of a society, and that it cannot be profitably studied in isolation (White 1984, p. 8).

⁸³ White also claims that in the case of the water organ, this application of scientific knowledge is “outstanding” in the historical record (White 1984, p.173).

ignores other important criteria. Certainly in the case of a well-established technology such as the pipe organ, success can be measured by very long-term continuity.

Besides the use of invention as a critical gauge for technological productivity, some modern writers have latched onto another measuring stick, one not considered by Kenneth White. As is evidenced by the title of Lynn White's frequently cited study, this selection criterion is based on the relative impact of a technology on social change. The decision on whether to incorporate a specific technology into the historical record often seems to depend on the historian's perception of the manner in which that technology has changed society and how much progress it has spawned. This tendency means that historians have often failed to claim success for a technology that emerges and develops without assuming a noticeably influential role on the progress of another technology or on social change. The oversight of the pipe organ on the part of mainstream historians of technology is a case in point.

Kenneth White argues that economic and social historians have long recognized the need for a contemporary account of the technical accomplishments of classical antiquity, but that classical historians have placed a low priority on technology (White 1984, pp. 6-7).⁸⁴ At the same time, historians of technology have been overly concerned with the *products* of invention, to the exclusion of the *process* out of which an invention emerges and the context in which it is developed. Furthermore, in his opinion, historians have tended to place a much higher priority on science, with the result that technology is left in a subservient position. White makes it clear in his concluding statement that much research remains to be done in all of these areas. His work makes a contribution toward the gradually emerging historical picture of the technical achievements of antiquity.

H. Floris Cohen, in his article on "Beats and the Origins of Early Modern Science," describes the position that he believes the church organ ought to hold in historical accounts of technology:

Let it be clear right from the start that the church organ, with its ingenious bellows, wind chests, pipework, tracker systems, keyboards, and so on, is among the peaks of medieval technology. Regrettably, walls between separate academic disciplines are so high, and the history of organ

⁸⁴ White observes that scientists like Archimedes and engineers like Hero of Alexandria were concerned with cultural aspects of applied technology, but historians have had difficulty incorporating Greek technological practice into their studies of Greek science (White 1984, pp. 6-7).

building, which is known in great and fascinating detail, has been so compartmentalized within the domain of musicology, that it has apparently never occurred to anyone to study the pre-baroque church organ as one, incredibly sophisticated, specimen of medieval technology. Yet that is where it belongs, too, on a par with the mechanical clock, with gothic architecture, the compass, the printing press, the stirrup, and all those other inventions which, whether or not they originated on West European soil, already in the Middle Ages lent to the cultivation of technology in Western Europe an unmistakably distinct character (Coelho, ed. 1992, pp. 21-22).

Cohen makes this claim on behalf of the organ as a sophisticated medieval technology, regardless of whether all of the inventions in his list originated during the Middle Ages.

Long before medieval times, the pipe organ was a masterpiece of problem solving techniques. For example, even from the early days of the emergence of the instrument in Alexandria, the use of the bellows had quite adequately solved the problem of amplifying human wind power. Following the fall of the Roman Empire, the art of organ making was preserved by the Byzantine civilization.

An artistic representation of the Byzantine instrument can be found on the fourth-century obelisk of Theodosius. This carving is shown in Figure 3. The organ has eight pipes of graduated lengths. Two men are shown playing the instrument while two others are standing on the bellows pumping the air.



Figure 3

Figure 4 represents an artist's conception of a sixth-century double hydraulic organ. This illustration is found in the Utrecht Psalter. Two organists are shown with four men pumping the bellows, using with long levers to force air into the receivers that trap the air under water pressure.

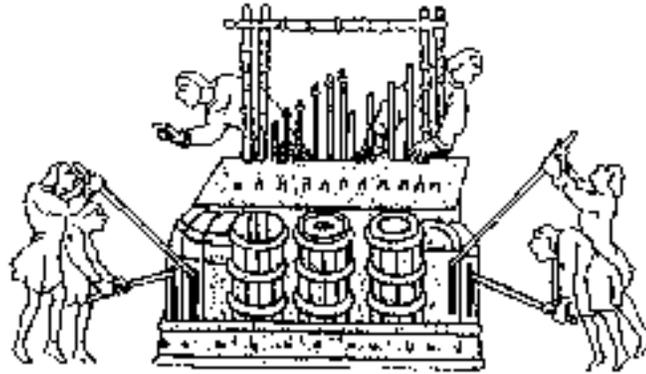


Figure 4

Cohen's acknowledgment of the organ as a technological achievement is the kind of recognition of the instrument that rarely appears in histories of technology. Coelho briefly alludes to the need for more attention to the instrument maker's craft tradition in his "Preface" to *Music and Science in the Age of Galileo*, where he mentions that

historians of science clearly acknowledged the contributions of the unwritten craft tradition, and many historians of science have dug up the roots of the scientific revolution in the craftsman's field. (The contribution of instrument makers – certainly, the "craftsmen" of music – is a history that cries out to be recognized in musicology.)" (Coelho, ed. 1992, p. xi).

On this point, Coelho is certainly correct, although musicology is not the only field where this history belongs. As this overview of the position of the pipe organ in the standard literature in the field of history of technology has shown, the history of the contributions to society that have been made by organ craftsman for over two thousand years is a history that "cries out to be recognized" in the field of Science and Technology Studies. One of the episodes in this history is the story of the restoration of the organ by the craftsmen of seventeenth-century English society. This is the story that unfolds in the following chapters.

Chapter 2 – The Organ in Reformation England

The fate of the pipe organ in early modern England echoes the inharmonious history of sixteenth-century English society. In the age of the Protestant Reformation, the pipe organ was perceived to be a symbol of the Roman Catholic Church. Like the communion table, the saintly figure and the stained glass window, the church organ was tinged with suspicious elements of “popery.” These visual and aural representations of Catholicism had become the fundamental physical components of European religious life and artistic culture. The Reformation sought to remove them, one and all.

In his comprehensive volume on *Art and the Reformation*, George Coulton traces the growth and decay of medieval art and iconography during the periods of the Reformation and the Renaissance (Coulton 1928). His major interest lies with Romanesque and Gothic architecture and related arts. Although Coulton specifically excludes from his discussion all references to music, and by extension all references to musical instruments as well, even a cursory examination of the musical arts would have enhanced his work. Instead, with an apologetic note, he admits that the topic of music lies outside the area of his expertise.⁸⁵

Coulton might have described the pipe organ as a common subsidiary of church architecture, envisioning the beautifully crafted casework of cathedral and parish church organs as noteworthy works of art.⁸⁶ Examples would have been readily available to him. For instance, in a volume dating from 1883, Arthur George Hill explains his purpose for providing the reader with a book containing his own drawings of organ cases:

It is the special province of this book to illustrate the manner in which that most important of musical instruments, the organ, has received decorative

⁸⁵ “Music no doubt has a real importance of its own; but I do not think it would materially affect the problem, and I cannot speak of it with knowledge” (Coulton 1928, p. 1).

⁸⁶ For descriptions of early English organ cases, see the monograph attributed to Sir John Sutton ([1847] 1979). Sutton was writing to provide an inventory of existing organs and to encourage their preservation. See also the beautifully illustrated work by Hill ([1883] 1966). For a later account, see Chapter III, “The Cases” in *Father Smith otherwise Bernard Schmidt, being an Account of a Seventeenth Century Organ Maker*, (Freeman 1926). See also the photographs of casework in the section on “Architectural History” in Clutton and Niland ([1963] 1982).

treatment during the epochs of the Middle Ages and Renaissance, and to show how beautiful, and often magnificent, are the designs of the cases which enclosed the organs constructed by the ingenuity of our forefathers (Hill 1966, p. 11).

Some of these old instruments and many newer organs that have been constructed using the old cases can still be seen on the European Continent (Peeters and Vente 1971, p. 13).⁸⁷ In England, unfortunately, little evidence of these earlier instruments has survived. As Hill explains, “It certainly does not reflect much credit upon churchwardens, organists, and others who have had the charge of organs during the last century, when we are compelled to acknowledge that there is scarcely an instrument in the country, except those which have been built during the last few years, which has not been altered very considerably from its original state (Hill 1966, p. 15).” Hill can only speculate on the unique beauty of the decorative English organs of the Middle Ages:

The cathedrals and churches of this country must have contained, before the religious struggles of the sixteenth century, very many beautiful organs, which would have been remarkable more on account of their decoration than by reason of their musical resources. English organs have always been widely distinct from the continental instruments (Hill 1966, p. 23).

In 1923, Sidney Harvey noted that the documented history of the organs of Canterbury Cathedral dates back further than that of any other cathedral or parish church in the Kingdom. “We owe to Theodorus (669-690) that noble instrument which, with modern improvements, is now regarded as almost a necessary article of church furniture, and of which our church was in possession before any other church in Western Europe” (Harvey 1923, p. 1).⁸⁸

In spite of Coulton’s oversight in the matter of this almost obligatory item of church furniture, his chapter entitled “The Puritan Revolt” traces the history of some of the events and arguments concerning the use of ecclesiastical images in the church that

⁸⁷ This volume contains a beautiful set of color prints reproduced from photographs of the Gothic, Renaissance and Baroque cases of the Netherlands.

⁸⁸ Harvey quotes from Dr. Hook, *Lives of the Archbishops of Canterbury*, Vol. I, p. 199. The first recorded organ builder in Britain was St. Dunstan, who was appointed Archbishop of Canterbury in 959 and died in 988. He provided organs for several abbey churches and is believed to have been responsible for placing an organ in his own Cathedral Church. The chronicles of Canterbury Cathedral span some twelve hundred years.

would also pertain to the welfare of the organ (Coulton 1928, 371 ff).⁸⁹ For example, Coulton observes that complaints against pagan superstitions had begun to surface among the worshippers at St. Peter's and that objections were being brought against the practice of encouraging common folk and sinners to touch the sacred images. Using the term "puritan" in a broadly defined sense, Coulton explains that heretics with a puritan perspective toward religious art had "gone further, and repudiated the whole system of ecclesiastical imagery" (Coulton 1928, p. 381).⁹⁰ Ultimately, it became necessary for the criticisms that emerged during the course of the Reformation to be acknowledged and addressed by the Roman Catholic Church at the Council of Trent.

Meanwhile, for dedicated Protestant Reformers, the escalating aura of discontent encompassed not only the despised images of sainthood and other detested monuments of superstition or idolatry, but also that pagan icon of popery, the pipe organ. The social and religious environment easily accommodated these emerging superstitions. During the course of the Reformation, there was an increased demand that all Christians learn the doctrinal and liturgical the elements of the true Christian faith.

One of the main purposes of this instruction was to purify the faith by eradicating superstitious beliefs and practices, eliminating vestiges of paganism, and suppressing magic (the great rival of true religion) in all its forms. The activities that came under attack included simple popular blessings and exorcisms that were modeled on medieval liturgical practice, the use of holy water, charms and amulets to protect oneself and one's possessions from evil power, and the practice of healing, divination and love magic, all of which could involve incantations and the recitation of prayers (Levack [1987] 1995, p. 109).

In their sermons and other writings, Protestant pastors campaigned against popular beliefs in paganism, superstition, witchcraft, demonology and magic.⁹¹

As the Reformation spread, the Catholic and the Protestant alike increasingly envisioned the other as the "outsider." It was a normal state in the society of sixteenth-

⁸⁹ By *puritan*, Coulton means that human spirit which protests against the necessity to separate art from moral values, but when called upon to do so, would choose morality.

⁹⁰ As Coulton notes here, "the leaders of the Counter-Reformation, the fathers of the Council of Trent, had to deal with the acknowledged abuses of images, while they insisted on their use."

⁹¹ For a discussion of the complex relationship between witch-hunting and the Reformation, see Chapter 4 on "The Impact of the Reformation" in Levack ([1987] 1995).

century England that outsiders were alleged to be evil, immoral, and depraved.⁹² The most obvious examples, and surely the most frightening to the common people, were “the Turk, the Jew, and the witch” (Burke 1978, p. 165). The wicked witch was perceived as “the traitor within the gates, blaspheming against Christianity by insulting the cross and the host, doing harm to her neighbours, eating children and engaging in sex orgies with demons” (Burke 1978, p. 165). Witches and demons had been a part of the popular culture since the Middle Ages, but two other “popular villains” emerged during the conflict of the Reformation: “the Catholic stereotype of the wicked Protestant and the Protestant stereotype of the wicked ‘Papist’” (Burke 1978, p. 168). Protestants were especially keen to characterize the Roman Catholics as supporters in league with the devil (Burke 1978, p. 169). All manner of superstitious ritual associated with popery and even the pope himself epitomized this evil-worship.

Another avenue of evil, the popular fear of witches and what they might do, escalated to the point of violence toward the end of the sixteenth century. Attitudes toward witches and witchcraft reflected problems that had long been present within the culture.⁹³ People would naturally be expected to use these old, familiar images when speaking or writing of matters concerning the relations among God, Satan and the witch. A similar aura of evil images characterized the rhetoric associated with the sixteenth-century pipe organ, the wicked witch, the prince of darkness, and the polyphony of papal Rome. Over time, each of these figures conjured up a vision of the outsider.⁹⁴

⁹² In his chapter on “Heroes, Villains and Fools” Peter Burke says, “No image of society can be complete if it does not include the outsiders” (Burke 1978, p. 165.)

⁹³ John Teall (1962) has investigated a multiplicity of reasons for “witchcraft mania” in Elizabethan England. He has also examined the conclusions of historians who have been concerned to show how Calvinism contributed to the hysteria over witchcraft in the latter part of the sixteenth century.

⁹⁴ Weld notes that even “past the middle of the seventeenth century, men calling themselves philosophers, and so styled by the multitude, yet cherished a belief in witchcraft, which, supported by Royal authority (James I himself wrote on the subject of demonology), and countenanced by Bacon, was almost universally adopted by the people” (Weld [1848] 1975, vol. I, p. 87). Weld quotes from James VI, who writes in his *Dæmonology* of “The fearfull abounding at this time in this country of these detestable slaues of the Dieul, the witches or enchanters ...” (Weld [1848] 1975, vol. I, p. 87, Note 20). He also informs the reader that even Francis Bacon “had still too much of the mortal about him to shake off all the superstitions of the times” (Weld [1848] 1975, vol. I, p. 87, Note 21). The first Charter of the Royal Society states that the institution was founded for the improvement of *Natural Knowledge*. Quoting from Dr. J. A. Paris, *The Life of Sir Humphry Davy* (1831), Weld explains that, “At the period of the establishment of the Society, the arts of witchcraft and divinations were very extensively encouraged; and the word natural was therefore introduced in contradistinction to supernatural” (Weld [1848] 1975, vol. I, p. 126). The English witchcraft statute of 1604 was repealed by Parliament in 1736 (Levack ([1987] 1995, p. 250).

In this social milieu of suspicion and mistrust, growing attitudes of antagonism toward the musical styles of the Roman Catholic Church played a significant role in the history of the pipe organ during the course of the Reformation. In terms of vocal style, there was an increasing insistence that simple melodies be composed on the principle of correspondence between distinct syllable and one single note, so that the text of the music could be clearly understood. In terms of instrumental music, the organ was increasingly criticized for interfering with the comprehension of the text.

Desiderius Erasmus (1469-1536) was an influential opponent of the contemporary musical style, in particular the Gregorian chant (Shannon 1978, p. 29).⁹⁵ After visiting Cambridge in 1516, he criticized the unintelligibility of the musical text in a commentary on the New Testament:

Modern church music is so constructed that the congregation cannot hear one distinct word. The choristers themselves do not understand what they are singing, yet according to priests and monks it constitutes the whole of religion (Le Huray 1967, p. 11.)⁹⁶

It was not only the monophonic style of the Gregorian chant that offended the Protestant critics. Disapproval was also growing against the customary manner of adding embellishments to choral polyphony and to the use of Latin text. Contemporary music such as Erasmus had heard at Cambridge was responsible for alienating the congregation “three times removed” (Temperley 1979, vol. 1, p. 10). First of all, the text was in Latin, a language foreign to the ears of the English-speaking congregation. In the second place, the musical ornamentation overpowered the text to such an extent that the words could not be followed at all. After complaining about the time spent on extraneous organ music, Erasmus remarked:

And they consume almost as much time in those melismas sung at length on a single verse. It would be better not to extend the solemn rite into tediousness with such gratuitous additions.⁹⁷

⁹⁵ There is a sense in which a role had to be created for the organ in the service of the Roman Catholic Church. Elaboration upon the simplicity of the Gregorian chant helped to provide a “vital liturgical function” for the organ in the worship service (Shannon 1978, p. 29).

⁹⁶ Le Huray has adapted this passage from J. A. Froude, *Life and Letters of Erasmus* (1894), p. 115.

⁹⁷ See *On Restoring the Harmony of the Church* by Desiderius Erasmus, reprinted in Strunk (1998, p. 364). The term “melisma” refers to a musical phrase in which several notes are sung on a single syllable of the text.

Finally, the melody itself was so elaborate that it did nothing to encourage vocal participation by the congregation. This issue continued to vex Erasmus over the years. He felt that too much time was being wasted on nonessential music during the service, with nearly an hour being spent on the sequence, while the Creed was shortened and the Lord's Prayer was omitted. "Whoever dislikes the sequences," he wrote in 1533, "especially the inept ones, may omit them; the Roman Church does not recognize any sequences."⁹⁸

Concern over the intelligibility of the musical text was widespread and long lasting. In England, a response to the problem of indistinct syllables appeared in an official injunction to the Dean and Chapter of York Minster. Archbishop Holgate declared in 1552 that

we will and command that there be none other note sung or used ... saving square note plain, so that every syllable may be plainly and distinctly pronounced, and without any reports or repeating which may induce any obscureness to the hearers (Morehen 1995, pp. 80-81).

Changing attitudes toward religious music spread rapidly under the influence of Protestant Reformers Martin Luther (1483-1546), Ulrich Zwingli (1484-1531), and John Calvin (1509-1564). Luther, who played the lute (a popular instrument in his day), believed strongly in the significance of music in religious life and thought. In his moderate approach to musical reform, he retained some of the hymns of the Latin liturgy, but added German hymn texts to the service. In 1524, he prepared a German Mass for use by clergy untutored in Latin. He also wrote, translated, and arranged texts suitable for either Latin or German services. Luther drew inspiration from the prophets and kings of the Old Testament, who praised God with the singing of hymns and the playing of stringed instruments. He believed that the singing of psalms and spiritual songs was a way of praising God and recognized that singing as a form of worship had been practiced since the days of early Christianity.⁹⁹ A brief quotation, attributed to Luther, offers a glimpse of his feelings toward the power of music to appease the troubled spirit:

⁹⁸ Sequences were types of hymns with non-Biblical text. They originated as interpolations between sections of the mass. The use of these musical sequences was later restricted by the Council of Trent. See *On Restoring the Harmony of the Church* by Desiderius Erasmus, reprinted in Strunk (1998, pp. 363-64).

⁹⁹ From Martin Luther's Foreword to *Wittenberg Gesangbuch* (1524) in Strunk (1998, p. 361).

Next to the Word of God, music deserves the highest praise. She is a mistress and governess of those human emotions ... which control men or more often overwhelm them ... Whether you wish to comfort the sad, to subdue frivolity, to encourage the despairing, to humble the proud, to calm the passionate, or to appease those full of hate ... what more effective means than music could you find?¹⁰⁰

In 1524, Zwingli had seen to the removal of all Catholic images from the churches in Zurich. He had even “smashed the organ in the Zurich cathedral ...” (Knappen [1939] 1963, p. 427).¹⁰¹ These popish furnishings were not restored after his death on the battlefield in 1531. John Calvin did not condone the use of the organ at all. Neither did he allow the singing of harmonized versions of the hymn tunes. Calvin permitted Scripture-based hymns to be sung, but strongly encouraged the use of the psalms alone (Temperley 1979, vol. 1, p. 22). In the Dutch Republic, Calvinist attitudes prevailed and were met with less opposition than in England, although in the Dutch and German Reformed churches the pipe organ was played to accompany the singing of psalms, often with elaborate polyphonic settings. The organ was permitted to remain in the Dutch church, so long as only appropriate music was played on it, but the “synod of Edam (1586) forbade the use of church bells and organs to play ‘thoughtless and worldly song’” (Burke 1978, p. 219).

Meanwhile, in France the organ was less threatened. “There can be little question that the genius of the French psalm tunes contributed much to the popularity of the Reformed religion” (Temperley 1979, vol. 1, p. 22). But this was not the case in England, where both the pipe organ and the polyphonic style it so beautifully enhanced struggled for survival. A few of the French psalm tunes found their way into the English parish churches, but for the most part, only metrical psalms were sung, and only in unison without choral leadership or instrumental accompaniment.

Luther wrote his well-known hymn “A Mighty Fortress is Our God” in 1529, twelve years after he had posted his famous ninety-five theses for debate on the door of

¹⁰⁰ This quotation is taken from <<http://www.gospelcom.net/chi/GLIMPSEF/Glimpses/glimps065.shtml>>. Unfortunately, it is not further documented.

¹⁰¹ “Zwingli had taken an ascetic line from the start, possibly because he, as a former keeper of a concubine, was reacting from precisely the opposite kind of early career.” For one account of Zwingli’s role in the Reformation, see Knappen ([1939] 1963), p. 427).

the Castle Church in Wittenberg.¹⁰² The text of this “Battle Hymn of the Reformation” pledged to Christian believers that the devils of the world could not prevail over the truth of the word of God:

And though this world, with devils filled,
Should threaten to undo us,
We will not fear, for God hath willed
His truth to triumph through us.
The prince of darkness grim,
We tremble not for him;
His rage we can endure,
For lo! his doom is sure,
One little word shall fell him.¹⁰³

The hymn text is based on Psalm 46, which begins with the assurance that “God is our refuge and strength, a very present help in trouble.” The Psalmist’s reference to the power of the Lord over the raging heathen has extraordinary relevance to the turbulent times in which Luther lived. The whole Reformation movement found strength and comfort from the presence of God and drew hope and courage from the promise that: “He maketh wars to cease unto the end of the earth.”¹⁰⁴

Although Psalm 46 makes no explicit mention of the devil himself, these verses express the Psalmist’s awareness of the strong presence of evil in the world. This sense of malevolence was pervasive. Erasmus is alleged to have claimed that organ pipes sounded solely through the agency of the devil. Clearly no congregation could be expected to derive spiritual benefit from an instrument of Satan. An accusation that the devil played a role in producing the sound from the organ pipes would have been no idle allegation.

During the age of the Reformation, Europeans increased their awareness of the Devil’s presence in the world and became more determined to wage war against him. One of the main sources of this heightened consciousness of, and militance against, diabolical power was the thinking of the great Protestant reformers Martin Luther and Jean Calvin (Levack [1987] 1995, p. 103).

¹⁰² The date was October 31, 1517, on the Eve of All Saints’ Day. For a biographical account of the life and work of Martin Luther, see Bainton (1950).

¹⁰³ This text is the 3rd verse from *The Presbyterian Hymnal: Hymns, Psalms, and Spiritual Songs* (1990, p. 260), translated from the German by Frederick Henry Hedge in 1852.

¹⁰⁴ The quoted passages are found in the King James Version of the Old Testament, Psalm 46.

In Reformation theology the devil was perceived to have a very real and active earthly presence. Belief in the devil was pervasive and an awareness of his existence was enduring. Three and a half centuries after Martin Luther composed his famous Reformation hymn, Henry Wadsworth Longfellow published a trilogy called “Christus: A Mystery.”¹⁰⁵ This lengthy poem is intended to relate the history of Christianity. At the end of Part II, there is a “Second Interlude,” which Longfellow entitled “Martin Luther.” The poem adapts stanzas from Luther’s hymn and verses from Psalm 46, using them in counterpoint to his own passages of interpretative imagery. This Interlude reflects upon and reaffirms Luther’s belief in the remarkable power of music to calm human emotions, reminding the reader that from the days of the Old Testament, at a time when the Prophet David first played upon the strings of his harp, the art of music has been recognized as a marvelous Gift of God:

Yea, music is the Prophet's art;
Among the gifts that God hath sent,
One of the most magnificent!

The message that the text of “A Mighty Fortress is Our God” proclaims to the Christian world is the promise that the devil’s doom is sure and certain, for he will be felled by one little word. That word is “Christus.” Longfellow took Luther’s text and further embellished it, calling on the choir and the organ to “trouble and repel” the devil:

Nothing can vex the Devil more
Than the name of him whom we adore.
Therefore doth it delight me best
To stand in the choir among the rest,
With the great organ trumpeting
Through its metallic tubes, and sing:
Et verbum caro factum est!

What better way to proclaim the word of God than to stand in the choir with the pipes of the great organ trumpeting and to sing out loudly in unison that the word is made flesh.

¹⁰⁵ Henry Wadsworth Longfellow’s lengthy poem “Christus: A Mystery” is a trilogy that tells the story of Christianity from the beginning. It was first published in 1871. These quotations are taken from the end of Part II, “Second Interlude: Martin Luther.” The complete text of the trilogy can be found online at <http://www.everypoet.com/archive/poetry/Henry_Wadsworth_Longfellow/longfellow_christus_p2_second_interlude.htm>.

Denouncing both Satan and the Roman Pope who was perceived to be his devoted disciple, Longfellow also takes his stand at Luther's side to rail against the loathsome Erasmus:

But ah! Erasmus of Rotterdam,
He is the vilest miscreant
That ever walked this world below ...

Under Longfellow's pen, the humanist scoundrel not only goes about mocking Papists and Protestants alike; he also scoffs at St. John and St. Paul, and even at God and Man. Yet the poet knows that these derisive sneers are hollow and false; therefore, whenever he prays, he prays for a curse to fall upon "Erasmus, the Insincere."

Longfellow's work reflects the feelings of many sixteenth-century contemporaries of Erasmus that the humanist philosopher remained an "outsider" to the Reformation movement. In spite of Longfellow's prayerful expectations concerning the ultimate fate of Erasmus, the legacy of Erasmus in the context of Renaissance humanism has been immensely influential.¹⁰⁶ Luther, who was in many ways the nemesis of Erasmus, was of course the "insider" whose contributions to the Reformation and to Reformation music need no further elaboration here. To delve more deeply into the sources of religious and personal conflict and agreement between these two men would lie well beyond the scope of this discussion.¹⁰⁷

It is, however, necessary to examine the relationship between certain political and religious aspects of the English Reformation that directly affected the role of music and the organ in the church. While it is difficult to choose a place to begin, a possible starting point is the year 1524, when William Tyndale left London for Germany with the intention of translating the Bible into English. In setting out on this journey, Tyndale was acting in defiance of ecclesiastical regulations.¹⁰⁸ Without the approval of his bishop, he was prohibited from issuing a translation of the Bible (Knappen [1939] 1963, p. 3).

¹⁰⁶ Erasmus assumed a moderate stance in the Reformation movement, causing opposite ends of the religious spectrum to perceive him as an enemy. As a linguistic style, he preferred humanist rhetoric to scholastic logic.

¹⁰⁷ For a discussion of the intellectual relationship between Luther and Erasmus, see Bainton (1950, pp. 125-128).

¹⁰⁸ In 1408 the English clergy had passed the "Constitutions of Oxford." These laws banned the reading and translation of the Scriptures into the English vernacular without the permission of the bishop and declared the English translation of the Bible to be illegal. They remained in effect until 1537.

Nevertheless, he persevered in his task and accomplished the printing of the first English language edition of the New Testament in 1525-6.¹⁰⁹ Sir Thomas More, then the Bishop of London, condemned Tyndale for his work. Ultimately, Tyndale was hunted down, imprisoned, sentenced for execution, strangled by the hangman, and burned at stake for heresy in the year 1536. Meanwhile, the Reformation was gathering momentum across Western Europe.

As it turned out, the Reformation came to England not as a direct result of Tyndale's martyrdom nor even because of the rapidly spreading influence of Luther, Zwingli and Calvin. Instead it arrived by fiat, the result of an act of state.¹¹⁰ King Henry VIII (1509-1547) was intent on resolving his matrimonial difficulties. In first year of his reign he had married his brother's widow, Catherine of Aragon, to whom he had been betrothed at the age of eleven. At first he found her "quite congenial," but he became increasingly concerned about her inability to provide him with a male heir to the throne (Cannon and Griffiths 1988, pp. 235-36, 326). Their only surviving child of this marriage was Princess Mary, born in 1516. Henry began to contemplate divorce. Finding himself unable to procure the blessings of the Church of Rome in this matter, he garnered support from the anti-clerical majority of the members of the House of Commons and proceeded to break England's ties with the Roman Catholic Church. The coronation of his new Queen, Anne Boleyn, was held in May of 1533 (Cannon and Griffiths 1988, pp. 319-20).¹¹¹ The King was promptly excommunicated from the Roman Catholic Church.

The Act of Supremacy of November 1534 recognized Henry VIII and his heirs and successors as the only Supreme Head in earth of the Church of England. It was this statute, a document more political than religious in both nature and intent, which entirely dispensed with the supremacy of the Pope. It also provided Henry with a power greater

¹⁰⁹ Johann Gutenberg had produced the Gutenberg Bible in Latin. Printed in Mainz in 1455, it was his first book to be printed with moveable type. Tyndale's assistants Myles Coverdale and John Rogers completed the translation of the Old Testament and produced the first complete Bible in English in 1535. See <<http://www.williamtyndale.com/0biblehistory.htm>>.

¹¹⁰ For a full historical account and economic interpretation of English Puritanism and the events of the English Revolution, written from an English Marxist perspective, see Hill [1958] 1967).

¹¹¹ Archbishop Cranmer had declared Henry's marriage invalid. Support for the declaration came from the text of Leviticus 20:21, which prohibited marriage to a deceased brother's wife (Cannon and Griffiths 1988, pp. 319-20). Meanwhile, Anne Boleyn, whose secret marriage to Henry was recognized by the Archbishop, was anticipating the birth of their child, Elizabeth.

than the authority held by any previous monarch. Furthermore, “the King was quick to use it” (Le Huray 1967, p. 1).

Henry VIII decided to strengthen his personal political supremacy by abolishing the potentially rival monastic orders. In doing so, he effectively eliminated an economic and social foundation that had provided for the construction, maintenance and preservation of pipe organs for many centuries. This bleak episode in organ history is told through the words of Stephen Bicknell:

It is unlikely that Henry VIII foresaw the eventual effects of the closure of the religious houses on arts and music. It was not just that the church was a wealthy patron commissioning works of every kind; the monastic houses provided economic and intellectual support for training craftsmen, whether from amongst their own members or laymen; they helped maintain continuity from one generation to the next. They may also have provided a network of intellectual communication that encouraged visits from foreign craftsmen. The closure of no less than 800 houses would have affected not just the flow of new work but the whole economic and social base on which the craft of organ building was founded (Bicknell [1996] 1998, p. 41)¹¹²

The dissolution of the monasteries was begun in 1536 and carried out under the guidance and direction of Thomas Cranmer, who had become Archbishop of Canterbury in 1533. In the process, many monastery records were lost. As a result, very little information concerning the tradition of monastery organs has been preserved. However, a number of documents relating to the use of organs in the cathedral have survived. For example, at Canterbury, the Cathedral Statutes of 1540 stipulate that the organist shall be “of good character, of upright life, and skilled in singing and playing of the Organ,” he shall play “at proper times upon the Organ,” and he shall also “apply himself to the teaching and instructing of the Choristers” (Huitson 2001, pp. 3-4). A comparison of the salary of the organist at Canterbury Cathedral to the amount earned by the other employees provides an indication of his relative professional status. In 1540, he received a salary of £5 7s, which was five times a chorister’s salary but only a fifth of the amount paid to the minister (Huitson 2001, p. 4).¹¹³

¹¹² Bicknell provides descriptions of the talents of some of these monks, one of whom was gifted in the “seven liberal sciences” and the “making of organs” (Bicknell [1996] 1998, p. 41).

¹¹³ The earliest known compositions by an organist at Canterbury Cathedral date from this period.

In 1539, Henry VIII authorized a new version of an English Bible based on Tyndale's translations.¹¹⁴ It was made available for public use. The Book of the Holy Scriptures was now in the hands of the common people, who were encouraged to read it. This was an important step in the Reformation movement, since all who were literate were free to arrive at their own interpretations. As the next step in the process, an English Litany, or English Procession, as it came to be called, was published in 1544. In early summer of that year, England was at war with both Scotland and France. The King, desiring divine assistance in this difficult matter, wrote to Archbishop Cranmer. He requested the reestablishment of the custom of holding religious processions. Henry VIII required that the Litany for the various kinds of processions be composed in English. "He had evidently accepted by then the basic principle that was to be the mainspring of the English liturgical reformation, namely that the laity should fully understand and take part in public worship" (Le Huray 1967, p. 5).

Cranmer worked on the project of formulating English versions of the Latin liturgical text, adding some plainsong compositions of his own. He made the decision to keep these tunes simple in order that the text, now that it was to be sung in English rather than in Latin, could be clearly understood. In a letter written to the King on October 7, 1544 Cranmer expressed his opinion that: "the song that shall be made thereunto would not be full of notes, but, as near as may be, for every syllable a note; so that it may be sung distinctly and devoutly" (Le Huray 1967, pp. 6-7). He apologized to the King for the lack of grace and facility of his English verses and expressed his hope that the King might cause others to improve upon them. Perhaps Cranmer was suggesting that Henry VIII might write something even better than he had written, since the King himself was a composer.¹¹⁵ During the reign of Henry VIII and under his supervision, the music of the court was held in high regard (Compton-Rickett 1909, p. 147).

As Cranmer had hoped, other composers did begin to improve upon the music of the church. For the performance of new compositions, numerous church organs were available at the time. Wealthy parishioners often endowed the organs in small churches,

¹¹⁴ Thomas Cranmer was responsible for engaging Myles Coverdale to oversee the printing of this "Great Bible" at the request of Henry VIII.

¹¹⁵ An anthem composed by Henry VIII, 'O Lorde, the Maker of all Thyngs' has been "warmly praised" in the musical world (Compton-Rickett 1909, p. 147).

especially in prosperous areas. A great organ was customarily placed on the rood loft, which was an elaborate structure that separated the nave and the chancel or choir of the church.¹¹⁶ Acoustically, this was the most advantageous position. Playing the great organ was a demanding task for the organist, requiring much physical exertion, so this instrument was commonly used to accompany plainsong at the unison. Some churches had more than one organ. Often, a secondary or portative organ was placed in the Lady Chapel (dedicated to the Virgin Mary) or in another side chapel. This smaller and more versatile instrument was less difficult to play and better suited for the performance of polyphonic music than the great organ (Temperley 1979, Vol. 1, pp. 7-8).¹¹⁷

Although Cranmer had additional projects in mind for musical reform, the English procession, including some of his own plainsong tunes, was the only form of service in the vernacular to be approved during the reign of Henry VIII (Le Huray 1967, pp. 5-7). The whole congregation was never permitted to sing music of its own making in the worship service during his lifetime. The Lutheran hymns that had become so popular on the European Continent must have been familiar to the English authorities, but these hymns were not to be admitted into the corporate worship of the subjects of the kingdom (Temperley 1979, vol. 1, p. 13).

Such was the broad context of political, religious and social upheaval and reform in Tudor England when the Council of Trent was first convened on December 13, 1545 under the Sovereign Pontiff, Paul III (1534-49). The gathering of this ecumenical body had been necessitated by the fact that "the unity of the Christian name was rent and well-nigh torn asunder by schisms, dissensions, heresies" (Roman Catholic Church 1848). It was becoming imperative that the council meet to formulate a response to the rapidly spreading Protestant Reformation movement, which challenged papal authority. At the same time, it was essential for the Council to address an increasing number of accusations of abuse, both external and internal, which were being levied against the Roman Catholic Church.

¹¹⁶ The archaic definition of "rood" refers to the cross on which Christ died. In the church, the rood is the large crucifix or cross usually placed at the entrance to the choir or chancel. The ecclesiastical function of the rood loft is to support the cross. It also serves the practical purpose of supporting the organ and is sometimes used as a gallery for the singers. A decorative rood screen attached to the loft enhances the beauty of the architecture.

¹¹⁷ Temperley also mentions that the small portable reed-organ, known as the regal organ, grew in popularity in the 1540s.

The initial session opened with the following charge to the bishops, cardinals and prominent theologians of the council:

Doth it please you, -- the praise and glory of the holy and undivided Trinity, Father, and Son, and Holy Ghost; for the increase and exaltation of the Christian faith and religion; for the extirpation of heresies; for the peace and union of the Church; for the reformation of the Clergy and Christian people; for the depression and extinction of the enemies of the Christian name, -- to decree and declare that the sacred and general council of Trent do begin, and hath begun? They answered: It pleaseth us (Roman Catholic Church 1848, p. 5).

Thus with this formal response to extensive criticisms, internal schisms, external heresies and widespread dissension, the Counter-Reformation of the Catholic Church had officially begun.¹¹⁸

After the death of Henry VIII on January 28, 1547, the successor to the throne was a nine-year-old boy, Edward VI (1547-53). The formal doctrine of the English Reformation began to take shape by statutory steps. Liturgical reformation continued under the administration of the Lord Protector Somerset. “Within six months of Edward’s coronation a Royal Visitation was in progress to ensure the end of ‘popish’ practices and ceremonies (Le Huray 1967, p. 8).

The official Royal Visitors appear to have been meticulous in carrying out their charter. They “carried out their work with great thoroughness and, as they visited each cathedral in turn, they enquired minutely into details of routine and organization” (Le Huray 1967, p. 8). These details included close attention to musical matters. In the Lincoln Cathedral Injunctions of April 14, 1548, for example, the Visitors decreed that “no anthems of our Lady or other Saints, but only anthems of our Lord” were to be sung, and these were not to be sung in Latin (Le Huray 1967, p. 9). Instructions to the choir required that translations be made. The members of the choir were informed that after selecting “the best and most sounding to Christian religion they shall turn the same into English, setting thereunto a plain and distinct note for every syllable one they shall sing them and none other” (Le Huray 1967, p. 9). Traditional polyphony was not acceptable.

In the matter of polyphony, the incomprehensibility of the Biblical text was not the only problem. Reaction was intense against the typically polyphonic music of the

¹¹⁸ Some historians prefer to use the expression Catholic Reformation rather than Counter-Reformation.

Italian Renaissance because of its popish (and therefore supernatural and evil) association with the Church of Rome. Strict Reformers demanded that even polyphony had to be performed in a simple note-against-note manner, devoid of embellishment. Thus within a prevailing atmosphere of fear and superstition, Cranmer's musical innovation had far-reaching effects on the appropriate composition styles in church music and on the proper accompanying role of the ecclesiastical organ. For many years to come that evil Italian outsider, polyphony, would be prohibited from competing in the worship service against the Biblical text of the Protestant hymn.

During the short reign of Edward VI, a landmark Reformation document appeared. It was entitled "The Book of the Common Prayer and Administration of the Sacraments, and other Rites and Ceremonies of the Church, after the Use of the Church of England." Hardly more than a translation of the Ordinary of the Mass, the text retained most of the Catholic tradition from the Latin worship service. Of particular significance to the Reformation movement was the fact that this document was composed in English. For organists, however, the text was of little help, since it "contained not a note of music, and its rubrics gave musicians little guidance as to what was expected of them" (Le Huray 1967, p. 19).

The First Act of Uniformity, ratified by parliament on January 21, 1549, required the use of "The Book of Common Prayer" throughout the land. For organists, an immediate result of this publication was that organ playing "was frowned on in advanced circles" (Bicknell [1996] 1998, p. 43). Le Huray relates that on some occasions, financial provision was made for organists who were deprived of their positions.¹¹⁹ A set of Injunctions issued to the Dean and Chapter at St. George's Chapel, Windsor on October 26, 1550 included the order that two organists, John Merbeck and George Thaxton, would be entitled to "enjoy their several fees during their lives if they continue in the College, in as large and ample manner, as if organ playing had still continued in the Church" (Le Huray 1967, p. 25). Another option for retaining employment was to sing with the choir. Two years later, a set of Injunctions issued to the Dean and Chapter at York Minster ordered that the "playing of the organs ought and must be ceased," and the

¹¹⁹ An act of parliament in 1547 had put a stop to the chantries (endowments for singing or saying a mass for the patron). This act effectively ended the careers of many musicians.

organist and Master of the Choristers was commanded that he would “for the time being help to sing Divine Service to the uttermost of his power within the quire of the Church of York ...” (Le Huray 1967, pp. 25-26). It appears that these reassignments were not unusual circumstances. Over the next few years, organs in most of the churches were either dismantled or sold (Temperley 1979, vol. 1, p. 13). The organs at St. Paul’s Cathedral were silenced in 1552.

Not only did church music suffer radical revision; ecclesiastical attire experienced disdainful scrutiny as well. “At this point in the movement away from Rome the question of vestments first became an issue” (McGinn 1949, p. 7).¹²⁰ Reformers who had spent time away from England returned strongly influenced by Genevan practices and beliefs. For these Reformers, ecclesiastical attire portrayed an unacceptable image of Romish popery in the church service. Fundamentally, the argument over vestments stemmed from a close examination of the Scriptures, which were found to provide no authorization for ceremonial garments. Symbolically, the dispute became “the prelude to the Puritanical demand that the church in all its ceremonies must be guided by the Bible” (McGinn 1949, p. 7).¹²¹ Theologically, the demand that the church return to its former primitive state, based solely on the Scriptures, essentially defined the meaning of Puritanism. Meanwhile, as church property continued to be secularized, a large number of important church, collegiate, abbey, cathedral and even hospital choirs were disbanded.

The first Book of Common Prayer had not satisfied reformers. In April of 1552, a second Act of Uniformity was passed by Parliament. This new statute was entitled “An Act for the Uniformity of Service and Administration of Sacraments throughout the Realm.” As a result, the Book of Common Prayer was radically revised, bringing the Communion Service “very close to a Zwinglian or Calvinist interpretation of the Sacraments” (Le Huray 1967, p. 28). The Communion Service was no longer referred to as a sacrifice, but rather as a commemoration. The title was changed from “The Supper of the Lord and the Holy Communion, Commonly called the Mass” to “The Order for the

¹²⁰ According to McGinn (1949, p. 7), “The chief antagonist to vestments in Edward’s reign was John Hooper, who under Henry had fled to Zurich where he had encountered the influence of the extreme reformers opposed to retaining any of the old rites in the church.”

¹²¹ A more complicated version of the same argument was made both *for* and *against* the use of organs in the worship service, since references to the instrument appear in the Scriptures.

Administration of the Lord's Supper or Holy Communion" (McGinn 1949, pp. 7-8.) In order "to take away the superstition," Luther's controversial doctrine of consubstantiation was denied by Parliamentary decree:

And to take away the supersticion, whiche any person hathe, or myghte have in the bread and wyne, it shall suffyse that the bread bee such, as is usuall to bee eaten at the Table wyth other meates, but the best and purest wheate bread, that conveniently maye be gotten. And yf any of the bread or wine remayne, the Curate shal have it to hys owne use.¹²²

Thus the doctrine of the Real Presence was eliminated from the Service of Holy Communion.¹²³ Henceforth, only common, ordinary, everyday bread and wine were to be served at the Communion Table. By official decree, the communicant's consumption of the body and blood of the Lord Jesus Christ became transformed into a symbolic act. The mystery and superstition were swept away.

There were further modifications to make the service less popish. With respect to the pipe organ, a lasting result of the second Book of Common Prayer turned out to be that the use of music, "possibly the most mystical of all liturgical ornaments, was severely pruned ..." (Le Huray 1967, p. 28). Yet another Edwardian revision became increasingly important during the course of the Reformation: "all albs, copes, and vestments were forbidden throughout England" (McGinn 1949, pp. 7-9.)¹²⁴ Enforcing this requirement throughout the country was to prove extremely difficult. In addition, attendance at a parish church had to be actively enforced. The wayward parishioner who remained at home did so under pain of punishment. Furthermore, all who participated in an unapproved form of common prayer or administration of the sacraments were subject to imprisonment. A number of other directions were taken at this point in the journey from Catholicism to Protestantism, including the path that led the church away from the requirement of clerical celibacy. "Parliament declared the marriages of the clergy, if performed according to the Service Book, good and valid" (McGinn 1949, p. 9).

¹²² For the text of this decree see <http://justus.anglican.org/resources/bcp/BCP_1552.htm>. [This text reads "hothe" in the first line.]

¹²³ Luther had rejected the Catholic doctrine of transubstantiation, maintaining instead that the substance of Christ's body and blood is present *with* the substance of the bread and wine.

¹²⁴ McGinn finds this to be the most startling change, noting that all references to vestments were deleted in the directions concerning deacons, priests, and bishops.

Following the death of Edward VI on July 6, 1553 and a nine-day reign by Lady Jane Grey, Queen Mary (1553-58) acceded to the throne. The Act of Uniformity was repealed, reversing all antipapal legislation from the previous two reigns. Formal reconciliation between Church and Rome occurred on November 30, 1554, and papal supremacy was restored (Temperley 1979, vol. 1, p. 27.)¹²⁵ Meanwhile, as a direct result,

the restoration of the old religion went on vigorously. The altars were set up again, the married clergy were deprived, High Mass was sung at St. Paul's, and new bishops were consecrated according to the ancient ritual. In Mary's second Parliament the title of supreme head was formally abrogated, and an attempt was made to re-enact the statutes against heresy, but was defeated by the resistance of the Lords. ... In less than four years 277 persons were burned to death.¹²⁶

Upon Mary's accession, the singing of Latin ecclesiastical polyphony was resumed and the vestments, rood screens, and crucifixes were returned to the service. Archival documents from Canterbury Cathedral show that in 1553-4, money was expended to repair the bellows of the great organ. Additional work was done on the cathedral organs in 1556-7. However, this respite from sectarian assault was short-lived (Huitson 2001, p. 4).¹²⁷

By the time of Mary's death in 1558, very little evidence remained of the Edwardian Reformation. A number of important leaders, including Archbishop Thomas Cranmer, had been burned at the stake. Some of the reformers had gone into exile, finding it expedient to flee to Strasbourg, Zurich, Frankfurt, and other European cities (McGinn 1949, p. 9).¹²⁸ In contrast, for the pipe organ, Mary's reign had brought about a restoration of Latin services, a return to elaborate music, and a resurrection of organs in those churches that had sufficiently adequate financial and professional resources to

¹²⁵ As Temperley points out, the vast holdings of the church that had been confiscated by Henry VIII and Edward VI were never returned.

¹²⁶ For a Catholic perspective on Queen Mary's reign, see the article on "Mary Tudor" in *The Catholic Encyclopedia*, Volume IX (Copyright © 1910 by Robert Appleton Company, Online Edition Copyright © 1999 by Kevin Knight, Nihil Obstat, October 1, 1910, Remy Lafort, Censor, Imprimatur +John M. Farley, Archbishop of New York). <<http://www.newadvent.org/cathen/09766a.htm>>.

¹²⁷ With the accession of Elizabeth I to the throne of England, "the liturgical pendulum quickly swung back towards more Protestant observance with its emphasis on textual authority as opposed to ceremony" (Huitson 2001, p. 4).

¹²⁸ According to McGinn, most of those who were fortunate enough to escape went to Frankfurt. An alternative view is that the exodus of hundreds of Protestants during Mary's reign was not "a hurried flight from persecution," but rather a premeditated plan to establish an English Protestant colony on the European Continent (Temperley 1979, p. 26).

rebuild their instruments and return them to use. The inverse power relationship between Puritanism and the presence of the ecclesiastical organ was now firmly established in England.

During the reign of Queen Elizabeth (1558-1603), music, drama, poetry and the fine arts flourished in a society relatively free from political turmoil. Elizabeth herself was quite fond of music and the arts. She was a talented musician, accomplished on the virginal and lute (Price 1981, p. 16).¹²⁹ She was also politically astute, finding it necessary to strike a delicate balance in the matter of music and the church:

At first it seemed as if the Queen might be thinking of liturgical reforms on the lines of those approved by her father during the last few years of his reign. Some small changes were made almost immediately at the Chapel Royal, including the substitution of Cranmer's English Litany for the Latin forms of procession; and, within a month, similar changes had been authorized by royal proclamation for use throughout the country (Le Huray 1967, p. 31).

In the beginning, the liturgy maintained the Latin tradition that had been reestablished during reign of Queen Mary. Even Elizabeth's coronation service at Westminster Abbey on January 15, 1559, closely followed the ceremonial traditions of the past. However, the Queen favored the use of the vernacular and instructed that services in the Chapel Royal should follow the Book of Common Prayer.

When Parliament opened on January 25, 1559, the Queen through her Lord Keeper encouraged the Lords and Commons to do everything possible to avoid contentiousness. She then appointed a committee to review Edward's liturgy to see whether changes might be in order. "Sympathetic with her more conservative subjects, she herself had no taste for reform but to the disgust of the extremists preferred to retain crucifixes, vocal and instrumental music, and vestments – all of which they abhorred ..."¹³⁰ (McGinn 1949, p. 12). In April of 1559, new Acts of Supremacy and Uniformity further strengthened the position of the Anglican (or Episcopal) Church. This Parliamentary statute repealed Mary's previous repeal, effectively restoring the Act of

¹²⁹ The atmosphere of the Courts of both Henry VIII and Elizabeth I played an important role in the spread of musical literacy in England. This courtly influence continued into the reign of James I.

¹³⁰ The full quotation reads " – all of which they abhorred as the 'leauinges off Popishe dregges,' to borrow Calvin's phrase from his letter to Knox and Whittingham at Frankfurt."

Uniformity from the reign of Edward VI and approving the second Edwardian Book of Common Prayer.

Although Elizabeth retained the altar and the crucifix in the Chapel Royal, she ordered the destruction of popish trappings elsewhere. At St. Paul's Cathedral, for example, the high altar was demolished; an ordinary table for the sacrament stood in its place (Orlin 2000, p. 296 *ff*).¹³¹ Following the Edwardian pattern, she arranged for the appointment of Royal Visitors who were charged with going out and enforcing the use of the Book of Common Prayer in the colleges and churches. These Royal Visitors, armed with the necessary injunctions, zealously exceeded their commissions. "With the assistance of mobs they tore down roods and crucifixes, burned vestments, altarcloths, books, and banners, and destroyed stained-glass windows" (McGinn 1949, p. 14). Unfortunately, the rood screens had become "hated symbols of Papal authority; and their destruction, one of the most common iconoclastic acts of the Puritan element of the Reformation" (Shannon 1978, p. 133). Because little distinction was made between the rood screens and the organs they supported, even from an architectural standpoint the organ was perceived to be a detested symbol of Rome. All across the land, as Puritanism rose, pipe organs fell, especially in the parish churches. Those instruments fortunate enough to be spared from abuse suffered greatly from neglect.

Royal Injunctions, similar to those from the Edwardian era, were rewritten and expanded to address current concerns. One of these included a somewhat lengthy passage concerning music that was undoubtedly tailored to avert criticism from Puritan exiles returning from abroad. A clause in the passage reflected a tone of political compromise in the ongoing conflict between interesting music and intelligible text. Cautiously penned, the text permitted at some appropriate point in the service the addition of a "Hymn, or such like song, to the praise of Almighty God, in the best sort of melody and music that may be conveniently devised, having respect that the sentence of the Hymn may be understood and perceived ..." (Le Huray 1967, pp. 32-33.). This proposed modification to the approved Anglican liturgy sought to retain the requirement

¹³¹ "Though Elizabeth I attended services in the cathedral several times and donated to its repair, the building gently declined." The cathedral spire was struck by lightning and burned in 1561. After the fire it was removed and not replaced. See John Schofield on "The Topography and Buildings of London, ca. 1600" (Orlin 2000, pp. 296 *ff*).

that the hymn text be recognizable, while at the same time it encouraged advancement in the quality of the music. In fact, the addition of a hymn as part of the liturgy “was never authorized by parliament, and until the end of the eighteenth century was generally regarded as illegal” (Temperley 1972, vol. 1, p. 2). In spite of the conciliatory tone of the passage, it was later cited frequently as the basis of authority in support of arguments on opposing sides of the controversy.

Regardless of Elizabeth’s spirited efforts to achieve a compromise, opposition to music in religious settings continued to grow. Adversaries were attempting to dispense with it altogether. Intellectual claims based on the authority of the Scriptures lent support to the negative side of the argument. In 1562, a substantial majority in the Lower House of Convocation in the Province of Canterbury rejected a seven-point reform program that included a proposal to abolish “all curious singing and playing of the organs” (Le Huray 1967, p. 35). Among those in favor of the proposal was Dean Nowell of St. Paul’s Cathedral. When a less radical program was presented for a vote on February 13, 1562 the sixth and final point was a proposal requiring that “the use of organs be removed” (Le Huray 1967, p. 36). On this occasion Puritan sentiment almost prevailed, but the proposals were defeated by a one-vote margin of fifty-nine to fifty-eight.

Meanwhile, following the death of Paul III in 1549, the Council of Trent had fallen under the successive supervision of Julius III (1550-55), Marcellus II (1555), Paul IV (1555-59) and Pius IV (1559-65). On September 17, 1562, the twenty-second session of the council was assembled under Pius IV. During this meeting the council formulated a “Decree Concerning the Things to be Observed, and to be Avoided, in the Celebration of Mass.” Particular consideration was given to the expectation of proper and dignified behavior during the service. To assure the avoidance of irreverence, it was forbidden for any “wandering or unknown priest” to celebrate mass. Furthermore, all in attendance had to show that they were present at the service “not in body only, but also in mind and devout affection of heart.”

The Council decreed that an additional responsibility was to be placed upon the ordinary bishops of each diocese: “They shall also banish from churches all those kinds of music, in which, whether by the organ, or in the singing, there is mixed up any thing lascivious or impure; as also all secular actions; vain and therefore profane conversations,

all walking about, noise, and clamour, that so the house of God may be seen to be, and may be called, truly a house of prayer” (Roman Catholic Church 1848, p. 161). While the council banned only *inappropriate* music from the celebration of the mass, the church was officially put on notice that the possibility of the banishment of organ music was not only a very real threat; such punishment was in fact *required* if the instrument failed to behave itself in a seemly manner. After surviving the leadership of five popes (along with a significant disruption caused by the plague), the Council of Trent was finally brought to a successful conclusion in 1563. So long as it remained pure, the pipe organ was permitted to retain its position in the Catholic Church.

In Protestant England, the churches and colleges were expected to adhere to the established liturgy of the Anglican Church. However, in matters of worship and music, Elizabeth permitted more flexibility in the services at home, where her personal taste demanded popish ritual and polyphony. The Roman Catholic style and appearance of the services and especially the elaborate vestments still being worn at the Chapel Royal continued to offend a growing number of Puritan critics. When grave concern in this matter was raised during a sermon given at court by Dean Nowell of St. Paul’s, the Queen responded sharply with a pun: “Leave that, it has nothing to do with your subject, and the matter is now threadbare” (Le Huray 1967, p. 34).¹³² It seems that the Queen had heard quite enough on the subject of vestments and was growing weary of argument.

If perchance Her Royal Majesty had believed or even dared to hope that she might be able to dismiss this emerging controversy over vestments by pronouncing the matter “threadbare,” she was seriously mistaken. The debate resurfaced in 1563 and became popularly known as the “Vestiarian Controversy.” Radical Puritans strongly opposed the custom that required clergymen to don cap and gown for daily wear and surplices for worship services. The arguments stemming from this controversy escalated during the 1570s and 1580s, with the result that “much outspoken criticism of Anglican church music found its way into print” (Le Huray 1967, p. 36).¹³³ The ensuing literary exchanges between the Puritans and the Episcopalians came to be called the “Admonition

¹³² Le Huray also quotes a passage describing the controversial vestments of red and gold that were worn in the Chapel processions on St. George’s Day in April of 1562.

¹³³ By this point the vestiarian controversy had become an attack upon the Anglican or Episcopalian institutional system.

Controversy.” The published tracts associated with this controversy “serve as a sort of glossary for most of the pamphlet literature of the sixteenth century” (McGinn 1949, p. vii).¹³⁴

In 1572, an anonymous pamphlet appeared with the title *Admonition to the Parliament A View of Popish Abuses*. The editors of this tract argue that the publication “marks the point at which Puritanism began to be a hostile force, determined to do away with the existing system of polity and worship in the English Church.”¹³⁵ Intent on drawing public attention to the abuses in England’s religious establishments, the authors of the tract admonish the members of Parliament to be aware of the conditions of the cathedral churches, as these are the “dens”

of all loitering lubbers, where ... the chief cantor, singingmen – special favourers of religion – squeaking choiristers, organ players, Gospellers, Epistolers, Pensioners, Readers, Vergers, etc. live in great idleness and have their abiding. If you would know whence all these came we can easily answer you that they came from the Pope, as out of the Trojan horse’s belly, to the destruction of God’s kingdom (McGinn 1949, p. 39).

The argument was taken up and continued at length by the Episcopalian defendant John Whitgift, who later became Archbishop of Canterbury, and the Puritan proponent Thomas Cartwright, Professor of Divinity at Cambridge. The terms of this debate carved out ecclesiastical polity for both the Episcopalians and the Puritans. “The Admonition Controversy holds a unique place in the history of English Protestantism in that it marks the first systematic non-conformist attack on the government of the Established Church” (McGinn 1949, p. 134).¹³⁶ Cartwright’s ideas further solidified the Puritan appeal for the return to a “primitive church” stripped of all accouterments of Roman Catholicism.

The arguments were extensive, touching on all aspects of the controversy. In support of piping and singing and the wearing of vestments during the administration of the sacraments, Whitgift presented his case:

¹³⁴ See McGinn (1949) for an analysis of the arguments and a reproduction of the significant literary texts associated with this controversy.

¹³⁵ The editors are thought to have been John Field and Thomas Wilcox, who were ministers of city churches in London (McGinn 1949, p. 25).

¹³⁶ McGinn adds, “The *Admonition to the Parliament* and Cartwright’s three *Replies* contain the complete plans for the reorganization of the Church as a Presbyterian institution. Whitgift’s *Answer* and his *Defense of the Answer*, in turn, establish the *via media* that has become the mark of distinction of the Anglican Church.”

I think that there was nothing in the pomp of the celebration “that doth in any respect contaminate it or make it unpure.” As for piping, it is not prescribed to be used at the communion by any rule that I know. Singing I am sure you do not disallow, being used in all reformed churches and an art allowed in the Scriptures and used in praising of God by David ... (McGinn 1949, p. 243).

Crucial to Whitgift’s argument was the fact that on the matter of the selection and use of service music, the rubric of the liturgy remained silent. “Nor does it either authorise or forbid the introduction of instrumental music before, after, or during the service” (Temperley 1979, vol. 1, p. 3).¹³⁷ The sound of piping was acceptable to Whitgift on the grounds that it was an optional addition, neither mandated nor banned by the liturgy. Therefore, it remained pure and untainted by popery. Congregational singing was deemed appropriate on the basis that it had already been established in reformed churches. Most importantly for Whitgift, Old Testament Scripture sanctioned the use of music.

Cartwright argued to the contrary that only the singing of two unembellished psalms was admissible. Piping and organs could not be defended. Furthermore, he countenanced “no other singing than is used in the reformed churches, which is in the singing of two psalms, one in the beginning and another in the ending, in a plain tune, easy both to be sung of those which have no art in singing and understood of those which because they cannot read cannot sing with the rest of the church ...” (McGinn, 1949, p. 243). For Cartwright, there could be no additional “Hymn, or such like song, to the praise of Almighty God ...” which the Elizabethan Injunctions had specifically allowed and had even encouraged (Temperley 1979, vol. 1, p. 42). The music itself had to be simple and plain; it should never be an impediment to those who could neither read nor follow a tune.

And so the controversy continued. Although it never reached the point of a satisfactory conclusion, it eventually settled into a workable arrangement. “As far as music was concerned, the Anglican ideal prevailed in cathedrals, while in parish churches the Puritan pattern of congregational metrical psalm singing was allowed to establish itself” (Temperley 1979, vol. 1, p. 42). During the early years of Elizabeth’s reign, the

¹³⁷ Temperley argues that the parish churches had more, not less, individual freedom of expression in musical matters because of the lack of specific direction in the liturgy.

parish churches had retained a small choir and had used the organ for accompaniment, and records show that London church organs were kept in repair until around 1571. After that time it appears that organ maintenance ceased. In many parish churches around the country, the use of organs had come to a standstill (Temperley 1979, vol. 1, p. 43).¹³⁸

In the Queen's court, however, the organ remained securely established at the Chapel Royal. As an institution, the Chapel Royal is a body of clergy and musicians serving the spiritual needs of the English sovereign.¹³⁹ Although the name has been used to refer to any one of a number of several specific buildings that have served as chapels for the royal family, it originally referred to the clerical and musical establishment of the court (Harley 1968, p. 78). Responsibility for the Chapel Royal falls directly upon the Monarch. The fact that it has always been exempt from ecclesiastical jurisdiction is especially significant. During the troubled times of the Reformation, the Chapel Royal served the function of a well-funded and relatively unrestrained environment that fostered the growth and development of English music. In the earlier part of the sixteenth century, it was "the fount of all patronage and dual employment in the musical service of the Court, and the Chapel Royal was the final ambition of all literate musicians" (Price 1981, p. xv). From the time of Henry VIII until the reign of William and Mary, the Chapel Royal was physically connected with the Palace at Whitehall, the principal

¹³⁸ Payments to choir members in many London churches also seem to have ceased around the same time. Temperley's information comes from Alan Smith, *The practice of music in English cathedrals and churches, and at the court, during the reign of Elizabeth I.* (Ph.D. diss., University of Birmingham, 1967). Smith attributes the disuse of organs after 1571 to the death of John Howe, who had kept the instruments in repair until he died during that year.

¹³⁹ Music historians have customarily relied on two publications for insight into the activities of the Chapel Royal. One is *The Old Cheque-Book*, a volume edited by Edward Rimbault (Rimbault [1872] 1966). This work contains a collection of entries dated from 1561 to 1744, except for a gap spanning the two decades of the Interregnum, 1640 to 1660. The original *Cheque-Book* was "a large, commonplace ledger into which the secretary, or Clerk of the Check as he was called, entered the business of the Chapel appointments, resignations, decisions taken at 'Vestry' meetings, special forms of service, rates of pay, and so on" (Le Huray 1967, p. 57). A second ledger, dated from 1661, is similar to the first, but adds information on internal accounts, fees and wages, and travel allowances. The other book is *The King's Musick* (Lafontaine ([1909] 1973). This compilation provides a paraphrased listing of entries from the records of office of the Lord Chamberlain, the government official responsible for the appointment of musicians and other servants of the royalty. These entries show the musicians' names, the dates of their appointments, their positions, payments they received, and sometimes notations concerning their deaths. There are also notations concerning clothing and various kinds of repairs. This information pertains not only to the activities of the Chapel Royal but to secular musical events as well.

residence for royalty.¹⁴⁰ During the early years of the reign of Edward VI, it played a pre-eminent role as an experimental proving ground for the new liturgical services in English.¹⁴¹

The Chapel Royal has long been recognized as the cradle of English church music. Over the years it has provided professional opportunities for a number of organists and composers, including two whose names epitomize the era of Elizabethan music.¹⁴² The first is Thomas Tallis (ca. 1505-1585), who probably began his service at the Chapel Royal in 1543 following the dissolution of Waltham Abbey, the last of the monastic institutions to be closed. Tallis served under Henry VIII, Edward VI, Mary, and Elizabeth I. The other important organist of the Elizabethan era was William Byrd (1543-1623). *The Old Cheque-Book* provides the dates of Byrd's lengthy tenure at the Chapel Royal. An entry dated 1569 shows "Robt. Parsons was drowned at Newark upon Trent the 25th of Januarie, and Wm. Bird sworne gentleman in his place at the first the 22nd of Februarie followinge."¹⁴³ The final entry for Byrd records that "Wm. Bird, a Father of Musick, died the 4th of July" in 1623. Such a tribute appears very rarely in the *Cheque-Book* entries. Byrd is thought to have been a pupil and protégé of Tallis. Like Tallis, he was one of the founding fathers of English music.

Except for musical activity within the confines of the court, the availability and the standards of religious music continued to decline throughout England. However, Puritan sentiment was not entirely to blame. Another important contributing factor to this dismal condition was a different problem entirely – inflation. "For although the cost of living more than doubled between 1550 and 1600, stipends for the most part remained at their pre-Reformation levels" (Le Huray 1967, p. 39). The economic realities of inflation affected the ability of religious institutions to continue supporting expensive musical

¹⁴⁰ The building in which the Chapel Royal was housed was destroyed by fire in 1698, after which it was reestablished at its present location at St. James' Palace. Upon the accession of Charles I, the building was refurbished for Divine Service, after having previously served as a guard room (De Lafontaine [1909] 1973, p. x). Ironically, it served as the site of Charles' Last Sacrament before his execution in Whitehall in 1649.

¹⁴¹ On the role of the Chapel Royal as the center of liturgical reform, see Le Huray (1967, pp. 9-11).

¹⁴² For further biographical information on Tallis and Byrd, see <<http://www.grovemusic.com>>.

¹⁴³ *The Old Cheque-Book* (p. 2) records the date as 1569. The year 1572 is listed at <<http://www.grovemusic.com/shared/views/article.html?section=music.04487.8>>, where the full quotation is "Byrd was sworn in as a Gentleman of the Chapel Royal in February 1572, after the accidental death of Robert Parsons."

establishments. Church musicians expected to be paid. Not only did the music masters and singers require remuneration, the organs, organ players, organ builders, organ tuners, and organ blowers absorbed a substantial sum of money, especially for a small parish church. Many musicians found it necessary to take on additional employment, teaching and performing outside of the church, in order to support their families.

Another social factor in sixteenth-century England was a rapidly growing population. Foreign traders and merchants had begun to arrive in London during the High Middle Ages. In the course of the sixteenth century, numbers of religious refugees fled to London, especially from the Low Countries and France. In addition to their languages, their cultures, and their diverse forms of Protestant faith, they brought with them “craft skills and financial acumen” (Inwood 1998, p. xvii).¹⁴⁴

Records show that “galleries were added to London churches from the 1580s” indicating an increase in the population, “at least among the church-going.”¹⁴⁵ Roy Porter claims that England’s smooth transition from Catholicism to Protestantism was due not so much to the efficiency of the government as to “the astonishing success of the capital’s economy” (Inwood 1998, pp. xvii-xx).¹⁴⁶ In any case, despite the turmoil that had continued to spread across the European Continent, London had maintained a relative stability and a growing economy throughout the sixteenth century.

With the death of Queen Elizabeth on March 24, 1603, the Tudor era came to an end. During the early years of the seventeenth century, there appeared to be a glimmer of hope for the resurrection of the pipe organ in the Anglican service of worship, but that anticipated promise was premature. Instead, the conflict that had persisted throughout the sixteenth century was far from ended. The role of the pipe organ in Protestant worship remained bitterly contested throughout the seventeenth century.¹⁴⁷

¹⁴⁴ See the *Foreword* by Roy Porter.

¹⁴⁵ For details on John Stow’s *Survey* of London, see John Schofield on “The Topography and Buildings of London, ca. 1600” in Orlin (2000, p. 305).

¹⁴⁶ Porter points out this paradox of London’s success in the *Foreword*.

¹⁴⁷ Nor is there agreement on the role of the organ in the worship service even to this day. “The issue of music’s proper place in worship has never been fully resolved in the Church of England; both points of view are still represented in the Church to-day. The negative attitude to music, being based chiefly on intellectual arguments, has probably never had wide popular support, but it has been expounded by influential minorities” (Temperley 1979, p. 42). Neither has the organ always been well received in works of literature. Thistlethwaite (1990, pp. xi-xii) notes that the vocabulary of some writers reflects an instrument that “simply thunders, swells, peals or throbs, echoing only a limited field of human

The final resolution continues to lie somewhere on the long continuum between Erasmus and Longfellow - somewhere between those ranks of pipes that are blown by the breath of the devil himself and those silvery metallic tubes that join together with choir and congregation to proclaim with joyful voice to the Christian world, “Et verbum caro factum est!”

experience.” He recalls a statement that he claims to be “perhaps the most famous criticism of the organ uttered in this [the 20th] century - Igor Stravinsky’s comment that ‘the monster never breathes’.”

Chapter 3 – The Organ in Pre-Restoration England

On March 24, 1603, James VI of Scotland acceded to the throne of England as James I (1603-1625). The Puritans had looked forward to the new regime with some sense of confidence that the Reformation was about to be accomplished. However, their initial optimism proved to be unfounded. In April, the nonconformist ministers presented their Millenary Petition to the King as he traveled to London. This document “outlined the points at issue between their theology and practice and that of the state church” (Wilson 1996, p. 1). A number of offenses were listed that these ministers believed should be removed, amended, or qualified. In humble suit, they sought to have “the longomeness of service abridged” and to have the “church songs and music moderated to better edification” of the congregation (Gee and Hardy [1603] 1896, pp. 508-511). Most significantly, the ministers petitioned to abolish the teaching and defending of popish opinion.

However hopeful they might have been at the beginning, the Puritan faction was soon to be disappointed, “for the new King had no intention of disturbing the relative tranquility of the Church” (Temperley 1979, vol. 1, p. 49). In the following passage, Steven Bicknell summarizes the resulting state of affairs with respect to music in the church:

A conference was held at Hampton Court in 1604 at which Anglicans and Puritans could air their views, in the event James came down strongly against the Puritans. Richard Bancroft, James’s first Archbishop of Canterbury, continued the work of reconstruction, and influential opinion began to turn more in favour of cathedral music. Through the early seventeenth century the high church movement grew, reintroducing relatively elaborate musical performance as part of divine service and encouraging the building of organs (Bicknell [1996] 1998, p. 71).

The Puritans’ requests for liturgical reform and changes in church government were denied. Although minor revisions appeared in the prayer book, the position of the Anglican Church remained strong and it appeared that the liturgical practices of the parish churches were likely to remain unchanged.

Although revision of the Bible had not been on the Hampton Court Conference agenda, the matter came up for consideration during the course of the meeting. John Reynolds, the Puritan president of Corpus Christi College at Cambridge, moved that “there might be a new translation of the Bible, because those which were allowed in the reigns of Henry the eighth, and Edward the sixth, were corrupt and not answerable to the truth of the Original.”¹⁴⁸ The authorization of a new Biblical translation was the most significant liturgical outcome of the Conference (Wilson 1996, pp. 1-2).

This new translation was completed and dedicated to King James in 1611. The Preface is addressed “To the Most High and Mighty Prince James, by the Grace of God King of Great Britain, France, and Ireland, Defender of the Faith, &c.”¹⁴⁹ The Preface expresses the great hopes of the translators “that the Church of England shall reap good fruit thereby.” It is the earnest desire of the authors of this dedication that “the principal Mover and Author of the work” will offer his “approbation and patronage” for their labours. Furthermore, it is hoped that “the learned and judicious Prince” will provide powerful protection against “Popish Persons at home or abroad” and “self-conceited Brethren” who care for nothing except “what is framed by themselves, and hammered on their anvil.” In closing, the authors of the dedication petition for his Majesty's “grace and favour, which will ever give countenance to honest and christian endeavours against bitter censures and uncharitable imputations.”

The King James Bible had been available for eleven years when Henry Peacham published *The Compleat Gentleman* in 1622.¹⁵⁰ Peacham makes use of the Scriptures in his book. Responding to an increasingly encouraging atmosphere favoring the return of cathedral music, he explains that music is a principal means for praising God. In Peacham’s opinion, no man of wisdom ever questioned the lawful use of music, for music is a “sister to poetry” and serves as “an immediate gift of heaven bestowed on man,” although many men of lesser mind are “of such disproportioned spirits that they avoid her company ...” (Peacham ([1622] 1962, pp. 108-109).

¹⁴⁸ See a history of the King James Version of the Bible at <<http://www.av1611.org/kjv/kjvhist.html>>.

¹⁴⁹ See the dedicatory Preface to the King James Bible at <<http://www.jesus-is-lord.com/kjvpref.htm>>.

¹⁵⁰ Henry Peacham’s popular *Courtesy Book* was written for William Howard, the son of an earl, possibly for the occasion of the young man’s tenth birthday. This work touched on all of the important branches of knowledge, including music. It was intended for the edification of a well-cultivated English gentleman. See especially Chapter XI, “Of Music” in Peacham ([1622] 1962, pp. 108-109).

Peacham raises the issue of the sectarian controversy over the proper use of music in worship.¹⁵¹ To support his argument in favor of music, he cites a number of relevant Biblical references. The Psalms of David, for example, often speak of musical instruments.¹⁵² In the contemporary dispute, as Peacham explains, it is the prevailing attitude of the sectaries that the antiphonal singing and musical instruments customarily used in the cathedrals contribute nothing meaningful to the service. Peacham strongly disagrees with this interpretation. He argues that these established musical practices are fully supported by the Scriptures:

Wherein doth our practice of singing and playing with instruments in his Majesty's chapel and our cathedral churches differ from the practice of David, the priests, and Levites? Do we not make one sign in praising and thanking God with voices and instruments of all sorts?¹⁵³

Thus Peacham assures his young reader (and other aspiring young gentlemen of England as well) that the use of singing and musical instruments in the worship service is fully consistent with the ancient purity of the church. This becomes an intellectual matter to be settled on the basis of a close reading of the Scriptures.¹⁵⁴

¹⁵¹ Although Peacham was a devoted royalist, his work reflects a strong Puritan sense of duty. Music is a praiseworthy activity, but it should not distract from worship. See the introductory notes to Henry Peacham, *The Complete Gentleman* (1622) reprinted in Strunk (1998, pp. 346-347). *The Compleat Gentleman* can be considered an English Puritan counterpart to Baldassare Castiglione's *Il libro del cortegiano*, published in 1528. This work had been translated into English as *The Book of the Courtyer* in 1561. Castiglione writes that music is "used in the holy temples to render laud and thanks unto God" and is acceptable to Him. The Courtier is advised to be skilled in the playing of "sundry instruments" (most notably the lute) in order to please the women. See the excerpt on music from *Il libro del cortegiano* (1528) reprinted in Strunk 1998, pp. 326-328).

¹⁵² For example, Psalm 150:4 of the King James Version of the Holy Bible reads "Praise him with the timbrel and dance: praise him with stringed instruments and organs."

¹⁵³ This was a popular argument. See especially Chapter XI, "Of Music" in Peacham ([1622] 1962, pp. 109-110).

¹⁵⁴ In the King James Version of the Old Testament, Genesis Chapter 4:21 names Jubal as "the father of all such as handle the harp and the organ." Two passages from the Old Testament Book of Job cite the use of the organ. In Chapter 21:12, Job declares, "They take the timbrel and harp, and rejoice at the sound of the organ." The text of Chapter 30:31 is a lamentation: "My harp also is *turned* to mourning, and my organ into the voice of them that weep." Recent scholarship has shown that the word "organ" as it was used in the Scriptures could not have meant the instrument that we think of today. Most likely, the reference was to some kind of pipe. Newer translations reflect this vocabulary change. The Revised Standard Version text of Psalm 150:4, for example, reads "Praise him with timbrel and dance; praise him with strings and pipe!" The older word "organ" does not appear in the Revised Standard Version. However, since the contemporary arguments in favor of the use of the organ in worship service were based upon the literal authority of the King James Version, this scholarly distinction was not relevant in the seventeenth century. For a discussion of the etymology of the word "organ" see Williams (1980, 19-21).

The reign of King James came to an end in 1625. The entry for May 7 in *The Old Cheque-Book* (Rimbault [1872] 1966) provides a record of “The Order of the Funeralls of Kinge James, who was buried the vijth daye of Maye Anno Domini 1625.” The King had departed this life on March 27. Two days before the funeral, the body was brought into a chapel that had been prepared for the occasion at Denmark House, where “the Gentlemen of the Chappell from that tyme wayted there, and performed solemne service with the Organs brought thither for that purpose ...”.¹⁵⁵ In *The Old Cheque-Book* entry, the description of the King’s services with elaborate “mourning ornaments” paints a funereal picture of black velvet and other elegant fabrics. Orlando Gibbons (1583-1625), a Gentleman of the Chapel and the senior organist, was provided with an allowance of nine yards of black material, the same amount as the ministers received.¹⁵⁶ Even the Organ Blower was allotted four yards of cloth for the occasion.

Charles I (1625-1649), a son of James I, was ill prepared to become King of England, having demonstrated his lack of judgment in the year preceding his accession when he entered into negotiations to acquire a Catholic wife.¹⁵⁷ He was sincere in his religious devotions and had a love for music, drama and art. Like his father, Charles I maintained a strong belief in the divine right of kings. However, he lacked the necessary insight and experience for his position and proved unable to rule with acumen. His wife remained unpopular with the English people.

Henrietta Maria arrived in London in the autumn of 1625. Coming from France as the new Queen of England, “she brought with her a large retinue of French servants, musicians and priests, expecting that a new chapel would be provided for her private use in accordance with the terms of her marriage agreement” (Le Huray 1967, p. 86). At first

¹⁵⁵ The Gentlemen of the Chapel Royal who “wayted there” at the funeral were known as “waits.” The term refers to a band of musicians who were employed for an official function. The entry shows that “Kinge Charles was him selfe in person the cheife mourner” at his father’s funeral. See the description of the funeral services in Rimbault ([1872] 1966, pp. 154-156).

¹⁵⁶ Gibbons was baptized on Christmas Day, 1583. He was born into a musical family in the provinces, but managed to secure patronage and to rise in the profession in London. Along with William Byrd and John Bull, he was one of the most important composers and keyboard performers of his day. Gibbons died suddenly in Canterbury at the age of 41. He was described as having “the best hand in England” (Vining Nov. 1983, pp. 707-709).

¹⁵⁷ Charles I was crowned King of England on February 2, 1626. He had attempted to marry the Spanish infanta, but efforts failed. “Having escaped from a disastrous Spanish Catholic marriage, he embarked within weeks of his return upon negotiations for a disastrous French Catholic marriage, to the Princess Henrietta Maria, daughter of Henri IV” (Cannon and Griffiths 1988 p. 368). She was fifteen years old at the time.

Charles permitted her the use of a large room in Somerset House, but he ultimately lived up to his agreement to provide a new chapel. When it was finally completed,

the Queen ordered that the first High Mass there should be celebrated with all possible pomp and splendour. The choir, organ and instruments were placed in galleries to the north and south of the high altar, but hidden from view. On December 10th, Henrietta Maria and distinguished company took their seats in chapel for Mass. The building drew rapturous expressions of delight from all those present – as did the music, which seemed to come from paradise itself (Le Huray 1967, p. 87).

A number of entries in *The Old Cheque-Book* and *The King's Musick* reflect the musical interests of Charles I and his wife. Sometime in 1625, most likely shortly after his accession to the throne, he gave orders that the Chapel Royal was to provide appropriate music both morning and evening, at least during the times when he was in residence. “Our express pleasure is that our Chappell be all the year through kept both morning and evening with solemn musicke like a collegiate church: unless it be at such times in the summer or other times when We are pleased to spare it” (De Lafontaine [1909] 1973, p. 60).¹⁵⁸ An entry dated July 15, 1628, provides a “List of musicians who are discharged from paying the five subsidies lately granted by the Parliament.” The name of the organist Edward Norgate appears in this list as “Keeper of the Organs” (De Lafontaine [1909] 1973, p. 67).

Several warrants for payment to the Keeper of His Majesty’s Organs and other instruments offer evidence of the desire of the court of Charles I to insure that the royal musical instruments were maintained in playable condition. An entry dated January 12, 1628/9, shows that Norgate was paid £12 for the repair of the organs at Hampton Court and Whitehall and the virginals for his Majesty’s chamber musique.¹⁵⁹ On December 9, 1629, he received £37 10s. due to him for two years’ bills. Perhaps he had previously been underpaid, or maybe he was paid for additional work. An entry in May of 1631 indicates that he received £13 10s. for repairing the organs back in the year 1629. On December 22, 1631, he was paid £25 for repairing the organs and virginals at St. James’

¹⁵⁸ “Extract from a book of orders given by and signed by King Charles I” (De Lafontaine [1909] 1973, p. 60). The year is 1625, but no month or day is listed in the records of the Lord Chamberlain. These orders were probably given at the time of the King’s accession.

¹⁵⁹ Until the Gregorian calendar went into effect in England on January 1, 1753, the legal year, which was used in all public and state documents, began on March 25. This date notation reflects both the older style and the modern dating convention.

Palace, Hampton Court, Greenwich and Whitehall. A warrant for another £17 was issued to him on June 13, 1632, for repairing the organs at Whitehall and Greenwich.

Meanwhile, as of April 1, 1632, the Keeper of His Majesty's Organs had acquired an additional responsibility. He had apparently become the keeper of his Majesty's Flemish portrait painter as well. A rather extraordinary entry for May 10, 1632, reads as follows:

Warrant for the allowance of 15s. per diem to Edward Norgate for 'the diet and lodging of Signior Antonio Van Dike and his servants, to begin from the 1st April last,' and to continue during the stay of the said Van Dike.¹⁶⁰

The Flemish artist Anthony Van Dyck (1599-1641) traveled to England in 1632 to assume the position of court painter to Charles I. He had previously sojourned in England from November of 1620 until February of 1621, during the reign of James I. This arrangement had not been satisfactory, so he had left the country. From the entry in the Lord Chamberlain's records, it appears that upon his return, Van Dyck and his servants were placed under the care of Norgate. Apparently these living arrangements were only temporary, as the artist is known to have lived in Blackfriars, where the King often went to visit him. Although the entries in *The King's Musick* do reflect a certain level of support for the music of the Chapel Royal, Charles I is better recognized as his role as patron of the arts because of his interest in painting and tapestry.

Norgate was kept busy in the service of the King during the decade before the Civil War. On November 24, 1634, he received a warrant for the payment of £22 for repairing "His Majesty's organs at Whitehall, Greenwich and Hampton Court for two years last past." In December of 1635, he was paid £26 for "mending and repairing his Majesty's organs at his several houses." On February 3, 1636/7, Norgate was entrusted with the task of building a new organ at Hampton Court. The relevant entry is described in *The King's Musick* as follows:

Warrant to the signet, for a privy seal of £140, to be impressed unto Mr. Edward Norgate, to be employed for the altering and reparation of the organ in the Chappell at Hampton Court and for the making of a new

¹⁶⁰ The extensive notes provided by the editor of *The King's Musick* make no mention of this unusual entry. If the index to his 500+ page book is reliable, there is no other reference to "Antonio Van Dike" in the text.

chayre organ there conformable to those already made in the Chappells at Whitehall and Greenwich.¹⁶¹

Building the organ was not, however, a task that Norgate undertook on his own accord. It is more likely that he was charged with engaging an organ builder and overseeing the work. Recorded ten months later, on December 10, 1637, an entry in *The King's Musick* provides insight into the kinds of craftsmen and the labor involved:

Warrant for the payment of £140 to Edward Norgate for gilding and painting the new organ at Hampton Court, and for extraordinary wages paid to joiners, carvers, and others imployed therein, as also for repairing the great organ, and for the charge of several journeys, and attendance for 6 months.

The entry for April 3, 1638, indicates the continuing requirement for organ maintenance and possibly for new construction:

Warrant to Mr. Edward Norgate, keeper of his Majesty's organs and other musical instruments, to repayre to Richmond and upon view of the decayed organ there to cause the same to be repaired and made serviceable. In case it be not reparable, another organ is to be made in the same place for the service of his highness the prince ... And that he cause the organ at St. James' to be repaired and put in order for service.

On May 29, 1638, the entry reads:

Warrant (grounded upon the privy seal) for payment of £46 14s. to Mr. Edward Norgate for mending and repairing organs in his Majesty's several houses.

As it turned out, the decayed organ at Richmond was deemed by Norgate to be irreparable. On January 21, 1638/9, the following entry appears in *The King's Musick*:

Warrant for payment of £212 10s. to Mr. Edward Norgate: for a new organ made and set up at Richmond £120, for carved figures about the gallery of that organ £35, for new gilding and painting the organ at Hampton Court £30, for carved work about the organ loft there, and repaying the old organ £7, for repairing the organ at Whitehall £5 10s. For several journeys to Richmond and portage of utensils, attendance, and other expenses for eight months ending in November, 1638, £15.

Routine maintenance continued, with Norgate making repairs to the instruments at Whitehall, Greenwich and Hampton Court. On January 28, 1640/1, he was issued a

¹⁶¹ Recorded on page 146 of Volume 739 of the Lord Chamberlain's records.

warrant for £25 12s. “for one year ended at Christmas, 1640.” The last entry for Edward Norgate as “Organ keeper and tuner” appears in a list of court musicians for the year 1641 (De Lafontaine [1909] 1973, p.111). He died in 1650.

Outside the confines of the court, the future of the organ was tenuous at best. Christopher Hill writes that “evidence of the unpopularity of the whole church establishment is to be found in the popular iconoclasm which broke out whenever opportunity offered: in the late 1630s and 40s altar rails were pulled down, altars desecrated, statues on tombs destroyed, ecclesiastical documents burnt, pigs and horses baptized” (Hill 1972, pp. 29-30).¹⁶² A number of England’s cathedrals were badly damaged. Organ historian Andrew Freeman tells the story of events at Westminster Abbey, basing his account on a “long, gossipy letter” dated December 30, 1641 (Freeman 1923, p. 136).¹⁶³ As the author of the letter, Captain Slingsbie, depicts the scene, a mob of citizens and apprentices “assaulted the Abbey to pull down the organs and altar, but it was defended by the archbishoppe of Yorke & his servants with some other gentlemen that came to them.” In spite of these efforts on the part of the Archbishop of York and his attendants to save the organ, the soldiers eventually accomplished the task while they were quartered in the Abbey. As the letter goes on to explain, the soldiers “brake down the Organs, and pawned the pipes at severall ale-houses for pots of ale.” Since the metal from the organ pipes had a resale value on the London street market, this was not an isolated event.

The Civil War officially began in 1642. The most divisive issues were centered on economic insecurity, political polarity, and religious diversity. Opposing factions in the war were the Cavaliers and the Roundheads. The Cavaliers were Royalists who favored the monarchy, while the Roundheads supported Parliament. Cavalier backing came from opposite ends of the social spectrum: nobility of Episcopalian lineage joined forces with common soldiers from peasant stock. The Roundheads consisted for the most part of an emerging middle class and tradesmen with a Puritan heritage.

¹⁶² As is the case with this account, most of the reports of the desecration of churches during the English Civil War mention the statues, altar rails and sometimes the stained glass windows, but neglect to point out that the pipe organs were damaged or destroyed as well.

¹⁶³ The letter was written from Captain Robert Slingsbie to Sir John Pennington.

When the Roundhead soldiers from London went down to Canterbury to take control of the city, the local Puritans seized upon the opportunity to join with them in removing the trappings of Catholicism from the Cathedral. “The Great Rebellion broke out in 1642 and on August 26th of that year Colonel Sandys and his troopers committed irreparable damage in the Cathedral, destroying altars, images, service books and also the organs” (Harvey 1923, p. 3). A letter written by the Vice-Dean of the Cathedral to the Earl of Holland reported that the keys and bellows had been “cut and spoiled” (Huitson 2001).¹⁶⁴ Other cathedral organs suffered a fate even worse this. For example, the pipes from York Minster were sold, while an instrument from Rochester Cathedral seems to have wound up at a tavern in Greenwich.

Meanwhile, in addition to the devastation brought about due to the deep sense of divisiveness that pervaded the various Protestant sects, the old suspicious attitudes that separated the Catholics and the Protestants continued unabated. These feelings of alienation are reflected in a contemporary interview between two “Church-Quarrellers,” one a Catholic and the other a Protestant, who chance to meet on the street one morning. This pithy dialogue appears in a London broadside, *Newes from Pauls*, “Printed in the yeer of Discord.” The date is November 4, 1642. The atmosphere throughout England is fraught with religious tension. This accidental encounter quickly turns into a hostile debate over the innate sinfulness of the use of the organ in church. In the opening gambit of this cleverly contrived conversation, the Catholic protagonist, “Purple,” accosts the zealous Protestant, “Orange-Tawny.” Purple calls out loudly in order to catch Orange-Tawny’s attention and to inquire about his destructive intentions.

Orange-Tawny! Whither so fast in this sweating hast? whither doth the fierce zeal of disorder direct thy factious feet this early morning? what

¹⁶⁴ This was not to be the last time that the fortunes of war frowned upon the organs of Canterbury Cathedral. Almost three hundred years later, in January of 1940, after work had begun on a proposed new instrument, progress was halted due to the war. Sections of the organ that had already been installed were dismantled and stored in the Crypt, where they remained until 1945. Meanwhile, work on the instrument continued in London until a bomb fell on the workshop. Repairs were completed on the parts that had been damaged in the blast and by 1946, with the use of a temporary console keyboard, the organ was made playable and installed in its old position in the Cathedral. The originally planned instrument still had not been completed. Progress was further delayed by “a government interdict” issued in 1948 forbidding work that was not considered to be of “national importance.” The organ was finally completed in June of 1949. The first set of ideas for the current main organ came from a report written by the Cathedral organist in 1973. This design was intended to “bring the very heathen to their knees!” For a brief history and photographs of the Cathedral instruments, along with a list of organists dating back to 1381, see Huitson, 2001.

temple is to be ruined, or what religious man, that hath not got the trick to flatter you, must fall a sacrifice under your many-headed triumph? some mischief I know is in agitation, you are so fiery in the pursuit of it.

The Protestant's sweating haste must surely mean more mischief is afoot. The Catholic is immediately apprehensive that yet another sanctuary is soon to be despoiled. Indeed, as he quickly discovers from the Protestant's antagonistic reply, his fears are well founded. As soon as Orange-Tawny takes notice of the man who has addressed him in so provocative a manner, he recognizes his interrogator as a Catholic. His response is a counterattack of vile and vicious epithets against the persona of the Virgin Mary.

That wicked favour tied to thy hatband by the grandam of grievances, the mother of mischief, the sister of sin & Sodomy, the wife of wickednesse, child of perdition and daughter of damnation ...

Having contemptuously cast the Holy Mother of God into every possible role of womanhood save one, Orange-Tawny adds the ultimate affront. He pronounces that it was "the Whore of Babylon" who proclaimed the Catholic's name to be "Purple, yea verily Purple." Rudely refusing to engage in further debate, he announces his intention to jog along on his way to accomplish his steadfast mission. He has set out to commit "holy violence" against "those pipes of Popery & Superstition" that are so despised by the members of the Protestant sects. "I will hold no disputation with thee, but jog on in my holy violence to erect a religious battery against (those pipes of Popery & Superstition) the Organs."

But the Catholic manages to detain him by posing a serious question, inquiring of him, "but why these Organs, which were well thought of, and by the judicious worthily esteemed before you were nine days old, or your untuneable nurse taught you to lap milk, should by your extravagant zeal be now refuted and opposed, is my wonder."

To this question Orange-Tawny responds with a readymade answer. He informs Purple that organs are surely the instruments of the Devil, luring the congregation with "fancy sounds of vanity, whilst the smock appareled Singing men fill the ears of our select Brethren with crotchets."

Orange-Tawny's mention of crotchets provides Purple with the opportunity to turn the argument toward the intrinsic value of these musical notes. Purple accuses the Protestant of harboring a thinly veiled envy of the art, suggesting that music is of such a

“high nature” that his “dull soul” has not the capability to understand it. Instead of taking offense at such an insulting assessment of his and his fellow sectarians’ artistic intellect, Orange-Tawny agrees with Purple on this point. Organ music is well beyond his understanding. Furthermore, this incomprehensibility is all the more reason why the detested organ should not be permitted in the service. “Because we understand it not, we hold it most abominable, there ought nothing to be allowable but what the Brethren understand.”

Purple escalates the argument by reminding Orange-Tawny of the traditional role of music as “one of the 7 liberal Sciences.” But this gambit fails, as it only serves to reinforce the Protestant’s position. “That is the reason we abhorre it,” he explains, adding that the “seven Sciences” are even more to be defied than the seven deadly sins, since the latter are more familiar and therefore less threatening to the Brethren.

Purple concurs that pride, covetousness, envy, lechery and gluttony are familiar sins, but he fails to understand what they have to do with organs, and what organs could possibly do that would cause them to incite religious men to civil disobedience. Curious about this matter, he asks Orange-Tawny “what particular hindrances to devotion are Organs, that you hold them so contemptible, that without respect of time, place, Law or equity, you dare (to the disturbance of Divine Service) attempt such riots?”

To this the Protestant replies, “Surely thou speakest like a Purple Papist ...”. The Catholic requires further explanation. He comments that on a previous occasion, he had engaged in a disputation with a Protestant who had given him “sufficient proof why Organs were detestable, and not fitting to be suffered,” but so far, Orange-Tawny has given him no proof at all.

Showing a genuine interest in this response, the Protestant continues the dialogue. “And what was our Brothers answer?”

He said, the sweetness of the musick lull’d him into so sweet a sleep, that another by him (inspired with the spirit of providence) stole away his hat and Bible, for which disaster he verily thought Organs were ordained to no other or no better purpose, but to give assistance to pilferers, and such as come not to pray to God, but prey upon their neighbours.

In response, Orange-Tawny offers a personal anecdote as a further rationale. “And verily, a sound reason; but short of mine; for whilst I was sleeping, one stole away

my wife.” But Purple considers this to be both a stroke of good fortune for Orange-Tawny and a victory for the Organ.

Is that all? I would never have been so violent against the Organs for so small a cause, surely I should rather love Organs the better all the days of my life, that should rid me of so great a trouble.

Orange-Tawny would likely have expressed his complete agreement on this score, had it not been the case that his good luck had turned out to be short-lived. Alas, his wife had returned. But enough of these personal accounts; he has something more serious to say on this matter. The chief reason for condemning the music of the Catholics is that the Protestants “know not what they sing, or what they say.” The result of this mindless incomprehensibility is that the members of the congregation become inattentive during the worship service. Instead of paying heed to the text of the psalms and the sermon, on a “tedious winter morning” while the organs are blowing, they become preoccupied and busy themselves blowing on their fingers to keep them warm. For this reason, he goes on to explain, if the organists will not “put up their pipes” and put an end to these offensive distractions, then the Protestants will be forced to take the matter in hand. They will see to it that the “smock appareled Singing men” will sing no more.

Surely, so should I had I not been troubled with her againe; but the chiefe cause why we condemne their musick is because we know not what they sing, or what they say, but in a tedious winter morning, whilst they are singing, and blowing of the Organs, we may blow our fingers, therefore they shall down; if they will not put up their pipes, we wil pull down their pipes, and then the Quiristers may go whistle.

Purple meets this threat of violence with a counterattack. He assures Orange-Tawny that Catholics are indeed weary of this madness. Their patience is at an end. Unless the Protestant can provide appropriate philosophical and legal authority in support of his cause, the Catholics are prepared to risk their lives for the sake of protecting the civil rights, rituals, property and music of their Church.

I tell thee man of madnesse and distraction there be many hundreds of resolved men that (unlesse you can bring sufficient Authority for your devout battery) will secure the Church-musick with the hazard of their lives, who, after a great deale of patience, grow sensible of your former riots upon other Churches, in which the Railes, Windowes, Organs, and other civill Rites have suffered demolishment.

The list of authorities is forthcoming from Orange-Tawny. “Certainly we have the hands of very able men for the performance of this good work which we make such haste to begin.” To which the Catholic responds, “I pray let me heare your sacred catalogue.”

The Protestant’s list consists of common tradesmen who (for the sake of this dialogue) have been provided with clever but derogatory names, such as Michael Meddle-much Pin-maker. Women and apprentices are included as well, but these remain nameless because Purple becomes impatient and refuses to allow the tedious listing to continue. In opposition, he offers an inventory of his own, all gentlemen and esquires with surnames such as True-heart, Loyall, Royall-thought and Goodcause. There are more, but Purple tells the Protestant that he is not worthy to hear them, nor would he be capable of understanding their arguments.

Purple decides his time has now become as hasty as Orange-Tawny’s, and that he must also be on his way. But the Protestant detains him, desiring to continue the dialogue in poetry. The conversation draws to an end as Purple sings a ditty against the Protestants, which Orange-Tawny answers verse for verse, to show the Catholic that even though the Protestants despise the organs, “the Brethren can poetize, and have some skill in Prick-Song.” With these verses concluded, the two part company and go about their separate ways.

Another dialogue reflecting the tenor of the times was published in a pamphlet entitled *The Organs Funerall or the Quirister’s Lamentation for the Abolishment of Superstition and Superstitious Ceremonies* (1642). The text consists of a conversation between a concerned chorister and an organist. However, the title is somewhat misleading. In 1642, when this dialogue was printed, the “Superstition and Superstitious Ceremonies” of Catholicism had been abolished, but the organ itself had not yet been officially banished from the church. Although the death of the organ was no doubt anticipated, this discourse concerning a “funerall” was still a bit premature.

The chorister opens the discussion with a short lamentation for the demise of the liturgical Ceremonies of the Church: “Woe and alas,” he says to the organist, “the day of absolution is at hand whereby wee shall be freed from our sinnes of superstition and worshipping of God in his Service with superstitious Ceremonies ...”. Although the

chorister is sympathetic at heart, he realizes William Laud, whom he calls “the great Patriarch at Lambeth” is now in disgrace, a situation that the Archbishop of Canterbury would have endeavored to prevent had he been in a position to predict his fate.¹⁶⁵ The Patriarch had previously seemed “so confident of his power and safety in his place of dignity, that if *Augustus Cesar* had been now to warre against him, he could not be vanquished ...”. Now he was in limbo. The chorister has come to understand “how vaine a thing it is to trust in riches, in friends, or in the favour of princes in the time of danger ... ” for none of these can serve as an adequate defense against the vengeful wrath of God.

As the dialogue develops, the chorister speaks of his neutral position toward the Ceremonies to which he had become accustomed through his religious upbringing. “I thought as I was taught that it was no sinne to use Ceremonies, but that they were things of an indifferent quality, and might be used without offence, but one comfort is I could not be brought to conceive the exercise of them to be of absolute necessity to salvation, as some of the learned prelates would have it, but a thing that might be as well refused as used ...”.

On the other hand, the chorister confesses that he had no power to refuse the ritual Ceremonies, for he had been indoctrinated to them and they still held a “predominant” place in his brain. He thought it “better to live in some good fashion, pleasing to men” than to live in the “disgrace and disfavour of the higher powers” with the likely result that he would have been in daily danger of being “questioned and sentenced to be pillored” or perhaps worse. He was wise to be fearful of the consequences, for under those circumstances he might have lost his ears, or been fined and banished, or even been subjected to “perpetuall imprisonment.” In the past, as he explained to the organist, he had loved his “reputation, eares, money and liberty” much too much to refuse to partake in the Ceremonies.

Now the chorister understands that he must adapt himself to the religious environment of the times. The contemporary current “runnes in another channel” and he must “goe with the tyde.” He has a wife and children in his care, so he must continue to

¹⁶⁵ William Laud served as Archbishop of Canterbury from 1633 until 1645. A persecutor of the Puritans, he was impeached for high treason in December of 1640 and sent to the Tower. He was thus “in limbo” when this dialog took place in 1642. Laud was brought to trial in 1644 and executed on January 10, 1645.

secure the means to support them. He reflects that in the past he might more profitably have spent his time supplementing his “yearely pension for singing” by teaching “young Artists in that Science” and also earning money in other ways. However, at the time he was concerned with more pleasurable interests. Now he laments that in his earlier days he was “too much given to the Taverne and Ale-house, yea, and to play now and then at Venus Game with loving Citizens wives (whom he would almost persuade to pardon him for that offence).” Alas, he continues, “those joyes are gone,`” and now he must now find another course for his life.

“But what thinke you,” he inquires of his friend the organist, “will Organs and singing be put downe as well as Ceremonies.” To this questioning comment the Organist gives a positive reply: “Truly I have heard there are many enemies towards us as to you,” who are attempting “to bring us to destruction, so that our Ancient and famous Sound may be no more heard in this famous Iland of *England*.” Yet in spite of this adversity, the organist hopes that both their professions “will still be continued as a decent and comely thing in the Church ...” and that their music will continue to show that they acknowledge the Law as well as the Gospel in their religious activities.

The chorister responds to the organist that he will do as he is told, for he can sing just as well without a Surplice or black Hood or any other Implement. He will do whatever he is commanded to do because he is “of the same religion with the Parliament and the State.” The best policy is to serve the times and to “change with the wind” in order to “be safe when others are questioned, at home in peace and security” and to keep himself “at all times, and upon all occasions from danger.” He is motivated much more by concern for personal safety and financial security than by religious conviction.

The organist brings this dialogue to a close by suggesting that they talk again “concerning this business” and then they will be able to decide what course to take. As they part company, the chorister answers in agreement, “Let us then so doo. Farewell.” In fact, as to what course of action the musicians should take, there was no decision to be made. The matter was soon to be entirely out of their hands.

On January 10, 1643, Oliver Cromwell penned a cautionary epistle to the Reverend Hitch at the Cathedral of Ely:

Lest the soldiers should in any tumultuary or disorderly way attempt the reformation of your Cathedral Church, I require you to forbear altogether your choir-service, so unedifying and offensive: and this as you will answer it, if any disorder should arise thereupon.¹⁶⁶

The Reverend was politely but firmly informed on threat of military intervention that the choir service should cease. He was instructed that the Scriptures should be read and expounded upon without contamination by the singing of the choir. In addition, the Reverend should expect further direction from Parliament, under the advisement of the Assembly of Divines. Furthermore, Cromwell wrote, it was his desire that the sermons should be delivered in the usual place in the worship service, but should be more frequent. With that being said, he signed the letter affectionately “Your loving friend, Oliver Cromwell.”

These instructions fell on deaf ears, at least for the time being. It thus became imperative for Cromwell to pay a visit to the Cathedral. On this occasion he was accompanied by his soldiers and followed by a rabble of reinforcements. Speaking politely at first, and then with a voice of authority, he commanded the Reverend to stop his foolishness. Thomas Carlyle, the Victorian historian and “elucidator” of Cromwell’s collected letters and speeches, relates the story:

Mr. Hitch paid no attention; persisted in his Choir-service: - whereupon enter the Governor of Ely with soldiers, ‘with a rabble at his heels,’ say the old *Querelas*. With a rabble at his heels, with his hat on, he walks up to the Choir; says audibly: “I am a man under Authority; and am commanded to dismiss this assembly,” – then draws back a little, that the Assembly may dismiss with decency. Mr. Hitch has paused for a moment; but seeing Oliver draw back, he starts again: “As it was in the beginning” -!- “Leave off your fooling, and come down, Sir!” said Oliver, in a voice still audible to this Editor; which Mr. Hitch did now instantaneously give ear to. And so, ‘with his whole congregation,’ files out, and vanishes from the field of History (Gaunt 1996, p. 34).¹⁶⁷

¹⁶⁶ From *Gentleman’s Magazine* (London, 1788), lviii, 225. Quoted in Lomas ([1845] 1904, pp 166-167). Thomas Carlyle explained that Cromwell, who was Governor of Ely in 1643, had made “a transient appearance in the Cathedral one day; memorable to the Reverend Mr. Hitch and us.” It seems that Mr. Hitch “under the very eyes of Oliver” and in blatant defiance of Parliament had been continuing the choir service at Ely Cathedral.

¹⁶⁷ Cromwell would likely have known Mr. Hitch quite well. He and his family were residents of Ely for about a decade, living there until the mid-1640s. He had been a Steward of the Cathedral. See also Le Huray (1967, pp. 53-54). Excerpts from Gaunt are reprinted with the permission of Blackwell Publishing.

Cromwell's interdiction at Ely had been concerned only with the choral service in the Cathedral, not with the organ itself. When he wrote to his friend Mr. Hitch in January of 1643, the organ had not yet been officially banned, but that day was coming.

In March of 1643, services ceased at Somerset House. "On Thursday in Holy Week the chapel doors were broken down, the altars demolished, the furnishings destroyed and a costly Rubens thrown into the river" (Le Huray 1967, p. 88).¹⁶⁸ Choral services were discontinued in the Chapel Royal and the musicians were dismissed to make their livings elsewhere.¹⁶⁹

The fears expressed in *The Organ's Funerall* that the "Ancient and famous Sound may be no more heard in this famous Iland of *England*" were well founded. Public sentiment in support of abolishing organs and other service music was appearing in the press. On June 7, 1643, five months after Oliver Cromwell sent his letter to Mr. Hitch, a tract was published in London bearing the title *The Holy Harmony: OR, A Plea for the abolishing of Organs and other Musick out of the Protestant Churches of Great Britain, and demolishing of superstitious and idolatrous Monuments*.¹⁷⁰ Invoking the authority of the Holy Scriptures, the anonymous author argues that "we must know, that our hearty devotions are the only musick for the house of God, Psalms and Prayers are not the heavenlier for Copes and Vestments, not the louder for wind-Instruments."

The author claims that organs are not a necessary requirement for true devotion. On the contrary, the loud cries from the leather bellows only serve to distract the congregation from the sweetness of the hymns. Furthermore, admiration for the organist is misdirected. The lazy worshipper who allows his thoughts to wander in the direction of the musicians does not benefit from the worship service. The "vulgar sort" is led thereby to mistake the unholy sounds of the organ for the holiest harmony found in the Psalms:

¹⁶⁸ The Flemish painter Peter Paul Rubens was a devout Roman Catholic and an important artistic contributor to the Counter-Reformation movement. He was commissioned to decorate the ceiling for the Banqueting House in Whitehall (built by Inigo Jones between 1619 and 1622). This painting is still intact. See <<http://www.nationalgallery.org.uk>>.

¹⁶⁹ Entries into the Records of the Lord Chamberlain were suspended after January 12, 1643/4.

¹⁷⁰ *The Holy Harmony: OR, A Plea for the abolishing of Organs and other Musick out of the Protestant Churches of Great Britain, and demolishing of superstitious and idolatrous Monuments. WITH A plenary Expression OF The Parliaments Piety, The Cities Charity, The Countreys Constancy* (London: Printed by R. Austin and A. Coe, 1643).

Lazy and sluggish devotion is cold in operation, holy duties have their life, and vigour without such secondary assistance as is borrowed from leatherne bellies: what needs such horrid shouts unlesse it bee to confound that sweetnes of a hymne? tis hard for the vulgar sort to know the Psalme which is cleerely lost by the Organs, and the Quire, well may they admire the art of the Musician, but not edify themselves; yet many I suppose have gon to see the praiers but they could not distinguish by the sound they were so, yet was this applauded by the unholy, for the holiest harmony.

The Bible is to serve as the only reliable guide for the appropriate use of music in the worship of God. The author draws extensively on the Scriptures to cite a number of illustrations for his interpretation of the true meaning of the holy harmony. For example, surely it is the silence of the soul and not the sound of the sackbut that represents the holiest harmony. In the words of the author, “The soule should appear to God, as God to *Moses*, in a soft, and a still winde, the holy and sweet sighes, or silent expressions of the soul are most acceptable, *Paul* knew the sweetness of this still Musick, these heavenly breathings, and would have preferred one of them before a thousand crouds of sackbutts, this is the holy harmony.” So too is the Apostle Paul’s desperate cry, “*Oh wretched man that I am, who shall deliver mee from this body of death?*”¹⁷¹ This is the holy harmony.

Like Paul, the Publican also understands the holy harmony of real devotion. While the Pharisee speaks out with a loud voice, “the poore Publican dares hardly whisper his devotions, yet makes up a more approved Harmony.” In the early days, the author explains, worship was a calm and quiet experience, without unnecessary pomp and circumstance. “I dare avouch the Primitive times sent up speaking devotions with a little noise or pomp, their holy melodie did not swell their cheeks, but their hearts with sighes, and eyes with teares, they sought not to give that a sound which was dumbe, for they knew they praied to him that was not deafe ...”. This is the holy harmony.

The author’s plea for holy harmony commends the dedication of the Parliament, the Cities, and indeed the whole Country toward furthering the cause of purifying the worship service. The Parliament, for its part, is making every attempt to cut out the “cores” of Catholicism from the Protestant Church, as these would otherwise cause the

¹⁷¹ “O wretched man that I am! who shall deliver me from the body of this death? I thank God through Jesus Christ our Lord.” See “The Epistle of Paul the Apostle to the Romans” in the King James Version of the New Testament, Chapter 7:24-25.

holy devotions to decay. “These coares in our devotions doth the Parliament strive by all meanes to cut out, as carefull confectioners from Apples, or Peares, or the stones from fruit, that so they may preserve with the Sugar of reformation the fruit itselfe, which else would putrifie.” The Cities also are joining the ranks, performing social and charitable services in support of the Church. The author lists some of these services and notes that “*Rome* quakes more now at the name of *London*, then once at *Carthage* ...”.

Throughout the land, the author goes on to say, the Army is in readiness to fight the battle of the Lord of Hosts. “Harfordshire, Essex, and Cambridgeshire ... have lent in 20000 able, wealthy, well armed, trained men all of the army of the Lord of Hosts ... forsaking their wives with as great joy as first they met them, every man putting two moneths pay in his pocket, and have marched with a noble resolution to procure to us a Harmony here which shal be a preparation to that Harmony the Angels make at the throne of the Lamb, to whom be glory now, and for evermore. Amen.”

With this paragraph concluded and the final “Amen” inscribed to the document, the author has escalated his hostile rhetoric to the point of commending England’s earthly Army of the Lord of Hosts for engaging in full-fledged battle against the unholy harmony of the Church. For their blessed acts of violence against the organ, the Harmony of Heaven will be the soldiers’ ultimate reward.

On August 28, 1643, Parliament passed “An Ordinance of the Lords and Commons assembled in PARLIAMENT, For the utter Demolishing, removing, and taking away of all *MONUMENTS* of *Superstition* or *Idolatry*.”¹⁷² This Ordinance enumerates in very specific detail those items that are to be removed immediately from the Churches, Chapels, and Cathedrals of the Realm of England the Dominion of Wales:

The Lords and Commons in Parliament taking into their serious Considerations, how well pleasing it is to God, and conducive to the blessed Reformation in his Worship, so much desired by both Houses of Parliament, That all Monuments of Superstition or Idolatry, should be removed and demolished, doe Ordain, that in all and every the Churches and Chappells, as well Cathedrall and Collegiate, as other Churches and

¹⁷² Transcribed from the first of “TWO ORDINANCES of the Lords and Commons Assembled in Parliament, For the speedy Demolishing of all *Organs*, *Images*, and all manner of Superstitious *Monuments* in all Cathedrall Parish-Churches and Chappells, throughout the Kingdom of *England* and Dominion of Wales, the better to accomplish the blessed Reformation so happily begun, and to remove all offences and things illegall in the Worship of God” (May 9, 1644, pp. 5-8).

Chappels, and other usuall places of publick Prayer authorized by Law within this Realme of *England* and Dominion of *Wales*, all Altars and Tables of stone, shall before the first day of *November* in the Yeere of our Lord God 1643, by utterly taken away and demolished, And also all Communion Tables removed from the East end of every such Church, Chappell, or place of publicke Prayer, and Chancell of the same, and shall be placed in some other fit and convenient place or places of the body of the said Church, Chappell, or other such place of publick Prayer, or of the body of the Chancell of every such Church, Chappell, or other such place of publick Prayer; And that all Rayls whatsoever, which have been erected neere to, before, or about any Altar, or Communion-Table, in any of the said Churches or Chappells, or other such place of publick Prayer as aforesaid, shall before the said day be likewise taken away; And the Chancell-ground of every such Church or Chappell, or other place of publick Prayer, which hath been within twenty yeares last past raised for any Altar or Communion-Table to stand upon, shal before the said day be laid down, and leveled as the same was before the said Twenty years last past; And that all Tapers, Candlesticks and Basons, shall before the said day be removed and taken away from the Communion Table in every such Church, Chappell, or other place of publick Prayer; and neither the same, nor any such like shall be used about the same at any time after the said day; And that all Crucifixes, Crosses, and all Images and Pictures of any one or more Persons of the Trinity, or of the Virgin *Mary*, and all other Images and Pictures of Saints, or superstitious Inscriptions, in, or upon all and every the said Churches or Chappells or other places of publick Prayer, Church yards, or other places to any the said Churches and Chappells, or other place of publick Prayer belonging, or in any other open place, shall before the said firstday of *November* be taken away and defaced, and none of the like hereafter permitted in any such Church or Chappell, or other places as aforesaid.

It is further ordained that following the removal and demolition of each of these offending symbols of idolatry and superstition, the walls, windows, grounds and other places that had suffered damage must be repaired by the Dean, Sub-Dean, or Chief Officer accountable for the edifice. In the Universities, the Heads or Governors will see to the repairs, and in the Inns of Court, the Benchers and Readers will assume responsibility for the work. Furthermore, in case of default, the “cost and charges of all and every such Person or persons, Body Politick or corporate, or Parishioners of every Parish respectively, to whom the charge of the repaire expense was to be born” would be subjected to fines which would be levied and donated to the poor. Expressly excluded from the provisions of the Ordinance are those images, pictures, of coats of arms that

served as monuments for “any King, Prince or Nobleman, or other dead person which hath not been commonly reputed or taken for a Saint.” Curiously, whether by design or by neglect on the part of Parliament, this Ordinance makes no reference whatsoever to the pipe organ. The anti-organ sentiments previously expressed in the treatise on “The Holy Harmony” have not yet influenced Parliament’s very specific selection of banned artifacts.

This important oversight was officially remedied the following year. On May 9, 1644, Parliament passed “An Ordinance for the further demolishing of Monuments of Idolatry, and Superstition.”¹⁷³ This is a shorter document, but in content it reads much the same as the previous ordinance. It begins with similar wording:

The Lords and Commons assembled in Parliament, the better to accomplish the blessed Reformation so happily begun, and to remove all offences and things illegall in the worship of God, do Ordaine ...

The now familiar introduction is followed by an abbreviated account of the specific items that were previously forbidden. This time, however, a crucial amendment appears in the text:

And that all Organs, and the frames or cases wherin they stand in all Churches and Chappels aforesaid shall be taken away, and utterly defaced, and none other hereafter set up in their places ...

This single statement offers the only new item in the list of offending artifacts that had been specified in the original Ordinance. The addition of the organ appears to be the sole justification for issuing a revision that mandates the “further” demolishing of monuments of idolatry and superstition. However, there is also an important change in policy. After listing once again the familiar popish trappings that are required to be defaced, the Ordinance appends a revised penalty clause for noncompliance:

... and that all Copes, Surplisses, superstitious Vestments, Roods, and Fonts aforesaid be likewise utterly defaced, whereunto all persons within this Kingdome whom it may concerne are hereby required at their peril, to yield due obedience.

¹⁷³ Transcribed from the second of “Two Ordinances of the Lords and Commons Assembled in Parliament, For the speedy Demolishing of all *Organs, Images*, and all manner of Superstitious *Monuments* in all Cathedrall *Parish-Churches* and Chappels, throughout the Kingdom of *England* and Dominion of *Wales*, the better to accomplish the blessed Reformation so happily begun, and to remove all offences and things illegall in the Worship of God” (London: Printed for John Wright in the Old-baily, May 11, 1644), pp. 3-4.

This time, Parliament mandates that instead of having to pay the former fine of forty shillings for the benefit the poor, all responsible parties, at their peril, must comply or be subject to an unspecified punishment for their disobedience. The remainder of the Ordinance reads much the same as the previous decree, which continues to remain in effect. It concludes by instructing that all subsequent repairs to the premises

shall be done and performed by such person and persons, as are for the same end and purpose nominated and anointed by a former Ordinance of Parliament of the eight and twentieth of August, 16.3. For the utter demolishing of Monuments of superstition or Idolatry.¹⁷⁴

In response to the ethical question of whether it was right and proper for a soldier to demolish church property, a tract entitled *The Souldiers Catechisme* provided moral direction.¹⁷⁵ Printed in 1644, this document covered military rules, requirements and regulations. The catechism was a familiar format to use for the purpose of instruction, discussion and satire in seventeenth-century England. Its question-and-answer dialogue served as a model for many Puritan pamphlets of the day. This particular document taught that God had placed the sword of the Reformation into the hand of the soldier. Therefore it was not deemed unsuitable for him to make use of his weapon, especially when the magistrate and the minister had neglected to take appropriate action against the icons of popery. Thus the English soldier was well armed with both his sword and his conscience. Encouraged to usurp the power of the civil and church authorities, he was physically and mentally prepared to commit acts of premeditated violence against the organ.

Hawkins' summary of this widespread devastation reflects his unsympathetic attitude toward the zealous rabble-rousers who had wantonly demolished the organs, ornaments and monuments:

By an ordinance made in the year 1644, organs in churches and chapels had been commanded to be taken down; and the fury of the rabble was not less remarkable in their demolition, than in that impious zeal which prompted them to despoil churches of their ornaments, and, as far as it was in their power, by the destruction of funeral monuments, to efface from the remembrance of mankind those virtues of the illustrious dead, which it is

¹⁷⁴ August 28, 1643.

¹⁷⁵ *The Souldiers Catechisme: Composed for the Parliament's Army* (1644). "Written for the Incouragement and Instruction of all that have taken up Armes in this cause of God and his people; especially the common Souldiers."

the end of monuments and sepulchral inscriptions to perpetuate” (Hawkins [1776, 1853] 1963, vol. II, p. 689).

As a matter of fact, the 1644 ordinance “to remove all offences and things illegall in the Worship of God” had specifically excluded the destruction of funeral monuments in any “Church, Chappell, Church-yard or place of publick Prayer” that had been erected in memory of any “King, Prince or Nobleman, or other dead person which hath not been commonly reputed or taken for a Saint.” Parliament had expressly permitted all such “Images, Pictures, and coats of Armes” to remain standing, so long as they did not venerate sainthood. In reality, however, the zealous desecration by Cromwell’s army was indiscriminate. Memorials to saints and sinners alike fell beneath the soldiers’ swords.

Influenced by Hawkins’ account, subsequent historians continued to maintain that the Ordinance of 1644 effectively resulted in the destruction of numerous organs across the land, and that Cromwell and his soldiers were responsible for widespread violence toward the instruments. However, there is some evidence that Cromwell was less involved in the destruction than has traditionally been assumed. Even when physical damage did occur during the course of the Civil War, the association of that destruction with Cromwell himself was sometimes erroneous. Furthermore, he was not personally to blame for the policies of Parliament. In defense of Cromwell, Peter Gaunt notes that

his travels, though extensive, did not take him to all parts of the country and to all the theatres of war and, in the early stages of the civil war at least, his political and military influence was very limited. ... Again, such cleansing of churches by stripping out images and ornate decoration as did occur in the mid-seventeenth century was the policy of Parliament and Parliament’s local agents; very little iconoclasm was undertaken by Cromwell in person or by troops under his direct and immediate command (Gaunt 1996, p. 6).

Hawkins comments that although the use of the organ was forbidden, strictly speaking this statement held true only for the role of the instrument in religious services. This was very much a political issue directed toward a specific offense. Secular usage was not affected. The Ordinance did not apply at all to the performance of organ music for public events or for private entertainment. It became necessary, however, under immanent threat of violence, for many of the church organs to be dismantled and put into

storage. Some were carefully removed and set up at other public locations. Others were kept for private use. The organ at Salisbury Cathedral was taken down and stored.

In December of 1653, Oliver Cromwell was appointed Lord Protector for life to rule England and Wales, Scotland and Ireland. He then served as head of state until his death in September of 1658 (Gaunt 1996, p. 153). Ironically, the organ from Magdalen College at Oxford was moved to Hampton Court, where it was placed into service for his entertainment (Norman 1984, p. 68).¹⁷⁶ Cromwell was known to be a lover of music and it played an important role in his domestic life:

Although he felt that music should play no part in divine service, he was otherwise fond of music and singing. As Protector, he reportedly had organs installed at Whitehall and Hampton Court, and his household included a Master of the Music, gentlemen of the music and a number of 'lads brought up to music'. Instrumental music, singing and dancing played an important role at many of the principal social occasions of the Protectorate, not least the wedding celebrations of his two youngest daughters (Gaunt 1996, p. 224).¹⁷⁷

In spite of Cromwell's fondness for music and his personal interest in the organ, outside of Whitehall and Hampton Court it became extremely difficult for organists and organ builders to maintain employment during the era of the Commonwealth. As Hawkins describes the situation,

the makers of those instruments were necessitated to seek elsewhere than in the church for employment; many went abroad, and others betook themselves to such other occupations for a livelihood, as were nearest related to their own; they became joiners and carpenters, and mixed unnoticed with such as had been bred up to those trades (Hawkins [1776, 1853] 1963, vol. II, p. 689).

It has traditionally been assumed that the zeal of seventeenth-century Puritanism and the destruction of pipe organs by Oliver Cromwell's army significantly retarded the technological progress of the English pipe organ.¹⁷⁸ Lamenting the events of the Civil

¹⁷⁶This instrument had been built by Robert Dallam in 1631. John Milton was reported to have played on it after it was moved to Hampton Court in 1645. The organ was returned to Magdalen in 1660 and reinstalled during the following year. It was remodeled by Renatus Harris in 1690 and sold to Tewkesbury Abbey in 1736. See < <http://www.tewkesburyabbey.org.uk/msg19.htm>>.

¹⁷⁷ Cromwell also saved some of the art collection belonging to Charles I. He acquired additional pieces for Whitehall and Hampton Court.

¹⁷⁸ For example, as Christopher Dearnley observes, "The technical and musical development of the organ was disturbed to some extent by a ground-swell of controversy about its suitability in church. At the

War, Hopkins and Rimbault recall the violent events of earlier years. “The puritanical spirit which doomed *organs* to destruction had long been gaining ground” (Hopkins and Rimbault [1855, 1870, 1877] 1987, vol. 1, p. 92).¹⁷⁹ Describing the aftermath of this senseless ruin, these historians report, “The devastation committed upon organs by those misguided ruffians, the soldiers and commanders of the Parliamentary army, was not easily remedied” (Hopkins and Rimbault [1855, 1870, 1877] 1987, vol. 1, p. 97). Certainly the banning of liturgical organ music by the English Parliament and the destruction of numerous cathedral and parish pipe organs by Cromwell’s soldiers and sectarian civilians brought to a halt any further building and development of organs in England.¹⁸⁰

Other writers have also reflected upon these unfortunate circumstances. Many years later in a letter to a friend, Jane Austen (1775-1817) related the story of the efforts of local organ-building craftsmen to continue working during these difficult years.¹⁸¹ She wrote of a visit she made by carriage to a church at Wingfield in Suffolk, where there assembled “sundry Scholars, Musicians, Antiquarians and Fellows that make Organs, having come thither from all Parts of the Kingdom.” The object of this gathering was to hear about a project “to try to recreate an Organ from some Fragments, lately discover’d in the Charnel House, that once stood upon a Screen between the Quire and a quondam Holy Trinity Chapel.” One of the presenters made a point that Jane Austen found intriguing. This speaker, Dr. Harper, told the gathered assembly that

in the Old Times many small Towns may have had their own Craftsmen well able to make Organs - of which there were formerly many even in East Anglian Village Churches - but when Organs were Disdain'd by the Puritan Faction and Fell in Disuse, then these Town Craftsmen also laps'd into Desuetude, leaving such Work as was later perform'd under

Restoration few parish churches, as distinct from cathedral and collegiate establishments, retained any tradition of using instrumental accompaniment in their services” (Dearnley 1970, pp. 169-170).

¹⁷⁹ For a summary of the various acts of violence against the organ, see Hopkins and Rimbault [1855, 1870, 1877] 1987, vol. 1, p. 91 *ff*).

¹⁸⁰ “For the period between 1526 and 1600 no organ contracts have yet come to light; by the fourth quarter of the century it is clear that organs had been removed or destroyed across large parts of the country” (Bicknell [1996] 1998, p. 43).

¹⁸¹ “In Search of the Sixteenth Century: BIOS, The Plainchant and Mediaeval Music Society, and The Early English Organ Project. Saturday, 7 October, 2000, Wingfield.” Martin Renshaw, “A hitherto unpublished letter from JANE AUSTEN.” Jane Austen lived from 1775 to 1817. The year the letter was written is not recorded in the published copy. The letter begins “My Dearest Cassandra, Chawton, 10 Oct---”. See the *BIOS Reporter*, vol. 25, No. 1 (Jan., 2001); <<http://website.lineone.net/~glandy/BIOS/jan01/c01.html>>.

Archbishop Laud and the Restoration of the Monarchy to be done by a few Metropolitan Workmen who were Perforce encamp'd at the Cathedrals etc. while they Fabricated their Instruments. Some of these men had also been forc'd to Flee to Brittany in France where their Grand Designs may still be seen, during the Great Usurpation.

In his work on *Organ Literature of the Seventeenth Century*, Shannon suggests that as long as the organ “remained one of the symbols of the struggle between religious moderates and radicals, it could hardly thrive as a musical, much less a liturgical, medium” (Shannon 1978, p. 134). He adds that “when Puritan ascendancy reached its zenith, the history of the organ was at its lowest.” During these troubled times, it seems abundantly clear that hardly any organ builder, composer, or performer in England could find work in his profession.¹⁸²

¹⁸² Bicknell gives an account of the limited amount of organ-building activity that took place in England during the Commonwealth (Bicknell [1996] 1998, p. 104).

Chapter 4 – The Organ in Restoration England

Charles II (1660-1685), “by the Grace of God King of England, Scotland, France, and Ireland, Defender of the Faith, &c.,” returned to London from his sojourn in France to claim the throne on May 29, his 30th birthday. He brought to the monarchy an attitude of religious tolerance and an interest in fostering French influence on English culture (Chan and Kassler 1990, p. 262).¹⁸³ His arrival was met with great celebration.¹⁸⁴

Burney reflects on the mood of the country upon the king’s return: “The nation tired of the gloomy and tyrannical government of Cromwell, manifested how much they languished for the restoration of Royalty, by the degree of enthusiasm and intoxication with which they received the son of their murdered sovereign” (Burney [1776-1789, 1935] 1957, vol. II, p. 340).¹⁸⁵

As Burney points out, in the midst of this enthusiasm it became immediately apparent that there was hardly any organ builder in all of England capable of restoring the instrument and returning it to its traditional place in the service of worship. It may be true that the problem of recovery from devastation “was not easily remedied,” as Hopkins and Rimbault reported; however, during the remaining decades of the century, this remedial task was ultimately accomplished. Finding the job market favorable once again,

¹⁸³ According to Roger North, “King Charles 2 was a professed lover of musick, but of this [French] kind onely ...” (Chan and Kassler 1990, p. 262).

¹⁸⁴ John Evelyn’s diary entry for May 29, 1660, describes the joyous return of Charles II on his birthday. “This day came in his Majestie Charles the 2d to London after a sad, & long Exile, and Calamitous Suffering both of the King and Church: being 17 yeares: This was also his Birthday, and with a Triumph of above 20000 horse and foote, brandishing their swords and shouting with unexpressable joy: The wayes straw’d with flowers, the bells ringing, the streetes hung with Tapissry, fountaines running with wine: The Major, Aldermen, all the Companies in their liveries, Chaines of Gold, banners; Lords & nobles, Cloth of Silver, gold and vellvet every body clad in, the windos and balconies all set with Ladys, Trumpets, Musick, & myriads of people flocking the streetes & was as far as Rochester, so as they were 7 houres in passing the Citty, even from 2 in the afternoone ’til nine at night: I stood in the strand, & beheld it, & blessed God: And all this without one drop of blood, & by that very army, which rebell’d against him: But it was the Lords doing, *et mirabile in oculis nostris*: for such a Restauration was never seene in the mention of any history, antient or modern, since the returne of the Babylonian Captivity, nor so joyfull a day, & so bright, ever seene in this nation: this hapning when to expect or effect it, was past all humane policy.” See <http://astext.com/history/ed_1660.html#1660>.

¹⁸⁵ See Burney ([1776-1789, 1935] 1957, vol. II) for additional details concerning the effects of the Restoration on the music of England.

families of organ builders traveled to England in search of opportunity. The arrival of these specialized craftsmen in Restoration England heralded a new era in organ construction.¹⁸⁶

According to Hawkins, there was a serious shortage of available clergy to serve the Church of England. There had been twenty-six bishops before the conflict (Burney [1776-1789, 1935] 1957, vol. II, p. 341), but no more than nine were still alive in 1660 (Hawkins [1776, 1853] 1963, vol. II, p. 688). These clergymen immediately resumed responsibility for their bishoprics and other vacant positions in the church hierarchy were quickly filled. As the formal liturgy was reestablished in the church, it quickly became apparent that the choral service had suffered greatly due to the grievous loss of cathedral and parish organs.

With the Restoration also came the realization that newly revived liturgical services depended on the reconstruction of musical instruments used for worship, in particular the pipe organ. In his *Short Account of Organs Built in England from the Reign of King Charles the Second to the Present Time*, Sutton writes:

During the Rebellion all the Organs in England were destroyed by order of the Parliament, with all other Church furniture, which was considered as appertaining to the Romish ritual; so that at the Restoration, when Choral Service was about to be revived, the difficulty of obtaining Organs seems to have been very great, for tradition says, that at that time there were only four Organ builders in England, Dallans, Loosemoor of Exeter, Thamar of Peterborough, and Preston of York; but as it was impossible for these four to supply all the Cathedrals, College Chapels, and Parish Churches in England, as they all wanted new Organs at the same time, early in the reign of King Charles the Second premiums were offered to foreign Organ builders to settle in this country ([Sutton] [1847] 1979, pp. 15-16).¹⁸⁷

The task of reconstruction took a long time, although some of the organs that had been rescued and sequestered were immediately recalled from private use. In Hawkins' words, "these, upon the emergency that called for them, were produced, and the artificers above named [Dallans, Loosemore of Exeter, Thamar of Peterborough, and Preston of York] were set to work to fit them up for use" (Hawkins [1776, 1853] 1963, vol. II, p.

¹⁸⁶ Bicknell claims that a "musical and technical revolution took place between 1660 and 1700, in the wake of the restoration of the monarchy" (Bicknell [1996] 1998, p. xx).

¹⁸⁷ Sutton and previous organ historians have claimed that Bernard Schmidt, the first organist to arrive after the Restoration, was German. His nationality has subsequently been disputed. More recent research shows "Father" Smith to have been of English descent.

689). Instruments that had been only partially damaged but still remained in place were repaired and returned to service.

As soon as these restored organs were installed and made ready to be played, it became necessary to locate an adequate supply of musicians to participate in the choral services. “The next step towards the revival of cathedral service, was the appointment of skilful persons for organists and teachers of music in the several choirs of the kingdom” (Hawkins [1776, 1853] 1963, vol. II, p. 689). Hawkins names a number of organists who were called upon to fill the various restored positions. One of these was Christopher Gibbons (1615- 1676), the son of organist and composer Orlando Gibbons. Hawkins notes that he was appointed to the position of principal organist and master of the children at the Chapel Royal, in addition to his appointment to the position of organist of Westminster Abbey (De Lafontaine [1909] 1973, p. 118).¹⁸⁸

Not only were organists required, but composers and other musicians were in great demand as well. “The restoration of monarchy, and religious establishments, drew from their retreats all the surviving musicians who had been degraded and involved in the calamities occasioned by the Civil War, and subversion of the national government and established church” (Burney [1776-1789, 1935] 1957, vol. II, p. 341). Some of these musicians, including Christopher Gibbons, were awarded doctorates upon their return to service. Hawkins relates the circumstances of the awarding of a doctorate to Gibbons, who was “licensed to proceed Doctor in music of the university of Oxford” (Hawkins [1776, 1853] 1963, vol. II, p. 713).¹⁸⁹

In the matter of acquiring organists, other religious institutions did not fare so well as Westminster Abbey. Most of the parish churches and even the cathedrals had to make the best of whatever level of musical knowledge and ability was at hand. Because a number of years had passed since the liturgy of the Anglican worship service had been followed in the cathedrals, it was thought necessary to provide appropriate guidance for the restoration of the Anglican Cathedral service. To this end, a booklet bearing the title *A Short Direction for the Performance of Cathedrall Service* was published at Oxford on

¹⁸⁸ Christopher Gibbons was appointed “musician upon the virginals” on November 17, 1660.

¹⁸⁹ He was granted this authority by virtue of a letter from Charles II, written on his behalf, in which it was stated that Gibbons had so well improved himself in music that in the judgment of the King and others well skilled in that science, he was worthy to receive the honour and degree of doctor. The completion of his degree was celebrated at St. Mary’s at Oxford on July 11, 1664.

January 17, 1661 (Lowe 1661). This “little book of instructions” offers “To All Gentlemen that are true Lovers of Cathedrall Musicke” a set of specific guidelines for maintaining “Harmony and Order” in the worship service.¹⁹⁰ The author is Edward Lowe.¹⁹¹ His introduction describes his rationale for preparing this document:

IT is too well known what hath bin practiced in Cathedrall Churches (in order to the publique worship of God, for many years past) instead of Harmony and Order. And therefore it may be rationally supposed, that the Persons and things relating to both, are not easily rallied, after so fatall a Route. But Since the mercy of God hath restored a Power, and by it put life into the Law, to promote and settle it as it was. It hath been judged convenient, to revive the generall practise of the ordinary performance of Cathedrall service for the use of them, who shall be called to it, and are desirous to doe it with devotion and alacritie. To this end a Person is willingly imployed, who hath seen, understood, and bore a part in the same from his Childhood: And therein thinks himselfe happy to be now a Meane Instrument to doe God, and the Church service, in such a time when there are so many Cathedralls to be furnisht, and so few Persons knowing enough (in this particular) to performe the solemnity requisite in them (Lowe 1661, p. 2).

Even though Lowe was getting on in years at the time, he was appointed to the position of organist of the Chapel Royal. He had been musically trained in the Cathedral at Salisbury. He was appointed organist of Christ Church, Oxford, in 1630, a position he had lost during the Commonwealth and to which he was restored in 1661 (Wilson 1996, p. 23). In his booklet, he explains that his purpose is to impart to the new generation the knowledge gained by someone who has seen, understood, and participated in the worship service from the days of his childhood. He accomplishes this task by illustrating the various components of the worship service for the benefit of both the priest and the choir. Lowe expresses the hope that his Brethren in the same profession will accept his publication in good faith and learn from it during this difficult time of transition in the Cathedral Church. Continuing to speak of his own efforts to provide musical instruction, he writes:

¹⁹⁰ Burney notes that immediately after the cathedral service was re-established, “for want of boys capable of performing the duty, the treble parts were either played upon cornets, or sung by men in falset.” He explains that “the cathedral service had so long been laid aside, that scarcely any two organists in country cathedrals performed it alike; till the appearance of a little book of instructions . . . ” (Burney [1776-1789, 1935] 1957, vol. II, pp. 342-343).

¹⁹¹ Only the initials “E. L.” appeared at the time of publication.

He hath therefore put together and published, the Ordinary and Extraordinary parts, both for the Priest, and whole Quire. Hoping that his Brethren in the same Imployment will look on it as Candidly as he intends it, since what is done, is only as a help to those that are Ignorant of it. The Tunes in foure parts, to serve only so long, till the Quires are more learnedly Musically, and thereby a greater variety used. Lastly 'tis fit some few reasons be given why, as directions how it may be understood in this forme (Lowe 1661, p. 2).

The tunes that the author provides are simple ones, composed of only four vocal parts. These harmonizations are intended to serve only until such time as the choirs have become more proficient and can sing a greater variety of music. This explanatory text is followed by a list of four specific instructions "TO THE READER." The musical scores are accompanied by explanations indicating the appropriate placement of each one in the order of service. Specific musical performance techniques are also explained. The last of the four instructions makes a brief reference to the use of the Organ:

As for the three Tunes, which are put downe in Black notes for Foure parts, and may serve for *Magnificate*, & *Nunc dimittis* at Evening as well as *Te Deum*, & *Benedictus* in the Morning service, Those, (as also the Letany, and *Veni Creator* that follow in foure parts) may easily be ordered to be plaid on the Organ to the Quire, if there be any one, that can prick out the upper, and lower parts, one over against another, and hath but so much ability only, as to play a Psalme from Notes (Lowe 1661).

It is obvious from the text that qualified organists were in short supply in 1661. At this critical point in the musical life of the cathedral, the author suggests that the choirmaster might direct that organ be played by anyone with barely enough ability to pick out a Psalm tune at the keyboard.

In addition to organists, organ builders were in short supply as well. Many of these craftsmen had sought work abroad during the difficult years when "Harmony and Order" were not practiced in the church:

The number of workmen in England being found too few to answer the demand for organs, it was thought expedient to make offers of encouragement for foreigners to come and settle here; these brought over from Germany Mr. Bernard Schmidt and Harris; the former of these for his excellence in his art, and the following particulars respecting him, deserves to live in the remembrance of all such as are friends to it" (Hawkins [1776, 1853] 1963, vol. II, p. 691).

As a matter of fact, no subsequent documentation has surfaced that would provide information on any of these “offers of encouragement” that might have been extended.¹⁹² Nevertheless, enough employment opportunities were available to entice the organ makers back to England. Two of these builders, Bernard Smith and Renatus Harris, became especially well known for the high quality of their work.

As Hawkins relates the story, “Bernard Schmidt,” or “Father Smith” as he was often called, arrived in England in response to “the invitations of foreign workmen to settle here” (Hawkins [1776, 1853] 1963, vol. II, p. 691). He brought with him two nephews, Gerard and Christian, to assist him in his work. Historians have noted that Smith was called “Father” both out of reverence for his talents and to distinguish him from his nephews. Although his birthplace has never been confirmed, his name appears as ‘Baerent Smitt’ in Hoorn in the Netherlands. Apparently he had gone there from Bremen in 1657.¹⁹³

The details of Smith’s arrival and his early work in England have been obscured by much speculation. A number of earlier organ historians, misinterpreting various bits of information, have erroneously reported that upon Smith’s appearance in London, his first task was to build an organ for the Chapel Royal at Whitehall. The story of the construction of this organ can be derived from several entries in *The King’s Musick*, which record the responsibilities of John Hingeston for the acquisition and maintenance of the royal instruments. On July 23, 1662, a warrant was issued “for the enlarging of his Majesty’s organ loft at Whitehall as John Hingeston, keeper of his Majesty’s organs, shall inform you shall be necessary” (De Lafontaine [1909] 1973, p. 146). The recipient of this warrant is not named. On the same day a warrant was issued to Hingeston for the payment of £76.5s “for mending and repaying his Majesty’s organs in the Chappell Royall at Whitehall, for a bass violl, and for erecting an organ in the Banqueting house” (De Lafontaine [1909] 1973, p. 146). It appears that Hingeston was responsible for overseeing and paying the organ builder and even for arranging for the final touches

¹⁹² Clutton and Niland point out the unlikely scenario that “an impoverished government” would have offered premiums to organ builders, nor would anyone else have done so at the time. Native craftsmen would have offered strenuous opposition, “however overworked they might have been” (Clutton and Niland [1963] 1982, p. 55).

¹⁹³ “In 1660 ‘Baerent Smit, organist’ requested a fee for repairs to the organ in Hoorn Parish Church, and in 1662 he contracted to build two organs, for the Grote Kerk and the Cleinjne Kerk in Edam.” See the article on ‘Father’ (Bernard) Smith [Bernhard Schmidt] in *The New Grove Dictionary of Music Online*.

related to the installation of the instrument. On October 7, 1662, a warrant provided that John Hingeston should receive “a curtain of crimson damaske 12 yards in breadth and 2 yards in depth for the organ loft and gallery in his Majesty’s Chappell Royall at Whitehall (De Lafontaine [1909] 1973, p. 149).”

Hawkins reports on the speed with which the organ at Whitehall was completed, suggesting that, “as it was built in great haste, it did not answer the expectations of those who were judges of his abilities” (Hawkins [1776, 1853] 1963, vol. II, p. 691).¹⁹⁴ Burney claims that this organ, “being hastily put together, did not quite fulfil the expectations of those who were able to judge of its excellence” (Burney [1776-1789, 1935] 1957, vol. II, p. 343). Later organ historians have propagated the myth that this instrument was built by Father Smith. Burney, for example, speculates that Smith apparently learned from this experience and subsequently profited from his mistake. “It was probably from some such early failure, that this admirable workman determined never to engage to build an organ upon short notice, nor for such a price as would oblige him to deliver it in a state of less perfection than he wished” (Burney [1776-1789, 1935] 1957, vol. II, p. 344). Sutton quotes Burney word for word in retelling the story ([Sutton] [1847] 1979, pp. 18).

However, more recent research has shown that Smith was falsely accused of this hasty craftsmanship. Stephen Bicknell reports that he was otherwise engaged at the time, working at Edam and Amsterdam until 1667. It is known that in 1667 Smith served as the organ tuner at Westminster Abbey. This seems to have been his first position in London.¹⁹⁵

It is possible that Smith had arrived in London in response to the acute need for organ builders following the Great Fire of 1666:

The rebuilding Act of 1667 allowed those who were not Freemen of London to work in the city for seven years, or until the work of reconstruction was finished. This would have given Smith access to

¹⁹⁴ More than a century later, Poul-Gerhard Andersen repeats the same story. “English organ building needed fresh blood at this time, and this requirement caused a Continental master to be attracted to England.” This author hypothesizes that perhaps the king summoned Smith to build the organ at Whitehall (Andersen 1969, p. 170).

¹⁹⁵ Stephen Bicknell notes that England was at war with the Netherlands during the years from 1664 until 1667, and it is not likely that Smith would have moved to England before the end of the war. Bicknell notes that Smith built a small organ for a church in Amsterdam in 1665-7. For further details on Smith’s background and early work in England, see Bicknell ([1996] 1998, pp. 123-127).

contracts that would have been denied him at any other time” (Bicknell [1996] 1998, p. 127).

Besides the destruction of instruments as a result of the fire, there were several social factors that caused this to be an especially opportune time for organ builders to come to England. The royal court had been re-established, providing patronage to musicians once again. The trade wars with the Netherlands had ended. And finally, the plague had run its course. London was once again a safe and profitable city in which to live and work.

Whatever the immediate reason that brought Smith to England, upon his arrival he gained employment in important places and he gained access to important people. He was associated with Richard Bentley, John Evelyn, John Locke, Isaac Newton and Christopher Wren (Clutton and Niland [1963], p. 75).¹⁹⁶ He also maintained a friendship with the organists John Blow and Henry Purcell, whom he later engaged to play his instrument. Several organ historians have suggested that it was Bentley who bestowed the title “Father” on Bernard Smith:

This title has conferred on him a general paternity for every development in English organ building since, and over succeeding generations he has acquired a reputation verging on sainthood. Organs attributed to Father Smith are as common – and as unreliable – as beds slept in by Queen Elizabeth (Bicknell [1996] 1998, p. 123).¹⁹⁷

Smith soon became well established in English society and well respected as an organ builder. His Protestant background benefited him in obtaining work. Smith also held a higher social standing than would ordinarily have been expected for a craftsman in the mechanical arts.

Meanwhile, sometime after Smith’s appearance in England, an organ builder named Thomas Harrison returned to England after a sojourn in France. He brought with him his son Rénatus, to whom he taught the organ-building trade. His family settled in Salisbury, where he signed his name Harriss, perhaps to avoid an unpleasant association with the Thomas Harrison who had been a signatory to the warrant to execute Charles I.

¹⁹⁶ See also Freeman (Apr.1922, p. 199).

¹⁹⁷ Bicknell also remarks on the difficulty of saying anything definitive about Father Smith (Bicknell [1996] 1998, p. 123).

He subsequently became known as Harriss or Harris.¹⁹⁸ Burney describes Thomas Harris' son *René Renatus* as “an ingenious and active young man, to whom he had confided all the secrets of his art” (Burney [1776-1789, 1935] 1957, vol. II, p. 343).¹⁹⁹ Because Harris was a Catholic, it is very likely that his religion impeded his access to opportunities for work, “especially amongst the mercantile classes who funded and organized the rebuilding of London and were much involved in the rapid growth of other English towns and cities” (Bicknell [1996] 1998, p. 127). Harris and Smith became intense professional rivals during the decades that followed.²⁰⁰

The position was improving for the organ in English society. New instruments were being installed and old ones restored in the royal courts, the cathedrals, the parish churches, and the universities. Furthermore, there was a continuing interest in acquiring smaller instruments for entertainment purposes in the theaters, taverns and private homes. One other institution where pipe organs (and organ pipes) had a role to play turned out to be the Royal Society of London.

The Royal Society was founded in 1660 and granted a Charter of Incorporation on July 15, 1662. In the early years of the meetings of the Society, a certain amount of attention was devoted to the theory of music. Among the participating members who made contributions related to this topic were John Wallis (1616-1703), Robert Boyle (1627-1691), Robert Hooke (1635-1703) and Isaac Newton (1642-1727). The eldest of these was Wallis, a mathematician and a founding Fellow of the Society. He served as Savilian Professor of Geometry at Oxford for over fifty years, from 1649 until his death in 1703 (Feingold 1984, pp. 86-88).²⁰¹ Among his other pursuits, he was concerned with

¹⁹⁸ The signature of Thomas Harriss[on], dated 10 March 1660/1, was found in the Salisbury Cathedral library (Bicknell [1996] 1998, p.107).

¹⁹⁹ Harris was not only the son of an organ builder, he was also the grandson of an English organ builder, Thomas Dallam. Bicknell ([1996] 1998) provides a chapter on “The Dallams in France 1642-1700.”

²⁰⁰ Additional details on the complex relationship between Smith and Harris, along with descriptions and specifications of their instruments, can be found in Chapter Eight, “The Glorious Revolution 1660-1715” (Bicknell [1996] 1998, pp. 122-147).

²⁰¹ Dr. Wallis was considered to be a gifted mathematician. His autobiography offers a retrospective of his university years, during which he claims to have spent his spare hours in the pursuit of mathematics as a “pleasing Diversion.” His recollection is that the “Study of *Mathematics* was at that time more cultivated in *London* than in the Universities.” Mordechai Feingold refutes this claim with evidence that studies in the mathematical sciences were taken seriously in the universities during the time that Wallis was a student. Wallis’ autobiography also provides one of the few known accounts of the origins of the Royal Society.

problems related to acoustics and temperament.²⁰² Wallis continued to hold “a lively interest in music until the end of his life, submitting letters and papers to the Society from 1664 until 1698 (when he was over 80 years old) on such topics as tuning systems, ancient music, and the speaking trumpet” (Miller and Cohen 1987, p. 7).²⁰³ Another founding member was John Evelyn (1620-1706), whose Diary entries reflect his lively interest in music as well.

Samuel Pepys (1633-1703), also a music lover and an amateur composer, was elected to the Royal Society in 1664. He frequently attended theatrical and musical performances around and about London. As he recorded the events of the day in his Diary, he often made references to the various pipe organs he had heard.²⁰⁴ In the year 1660, as part of his entry for July 8th (Lord’s day), Pepys wrote that he had gone to “White Hall” chapel, where “the organs did begin to play” before the King. For the King of Instruments to perform once again in the presence of the King of England symbolized a significant event in the history of music.

In 1644, when the organ was banned from the worship service, Pepys was only eleven years old. In his diary, he reflected that on this occasion the music was very good. He also remarked that he heard organs along with singing-men in surplices for the first time that he could ever remember doing so. Later in the same year, on November 4th

²⁰² A number of methodologies were being proposed for tuning the musical scale, including equal temperament, mean-tone temperament, and quarter comma mean-tone temperament. The issue was not settled until well into the eighteenth century. It became quite unsettled again in the twentieth. (The inquisitive reader is invited to type the word “temperament” into a web search engine for varied insights into the nature of the current controversies related to tuning systems.) For a discussion of temperament especially relevant to the organ, see Thistlethwaite (1990), Chapter 4, “Temperament and pitch,” by Christopher Kent. As Kent explains, “It is not improbable that a high proportion of the readership of this book will have accepted early in their musical education the principle of an octave being divided into twelve semitones of equal size, implicit within this being the notion of enharmonic notes and equal temperament tuning. Yet the second half of the twentieth century has seen an increasing preoccupation of the part of musicians with matters relating to heightened stylistic awareness in performance” (Thistlethwaite 1990, p. 42). Kent notes further that unlike the pianoforte, the organ has made use of equal temperament tuning as a universal norm for barely a century.

²⁰³ Miller and Cohen (1987) have compiled an annotated bibliographical catalog of the music-related items found in the *Philosophical Transactions* and other manuscript collections in the Society archives, dating from the beginning of the Society until 1806. For an introduction to the role of the mathematician John Wallis in musical matters, see Miller and Cohen (1987, p. 7).

²⁰⁴ Pepys’ Diary began on January 1st, 1659/60. He faithfully recorded the daily events of his life, from the most important affairs of state to the most trivial details of his toilette. He brought the Diary to an end on May 31, 1669, when his eyesight no longer permitted him to continue writing in his own hand. For these quotations and other episodes from his life, see Pepys ([1660-69] 2001).

(Lord's day), he went to Westminster Abbey, where he heard the organ in a cathedral for the first time in his life!

Even though the art of music had an aesthetic appeal for some of the gentlemen of the Royal Society, the theory of music was not a primary topic of interest. Nevertheless, the records of the Society show that the Fellows were actively involved in a certain amount of observational and experimental research related to the field:

The emerging empiricism of the seventeenth century, with its emphasis on experimentation and observation, is revealed through a number of descriptions of acoustical experiments in the Society's proceedings; at the same time, more practical areas of interest – such as tuning systems, the therapeutic role of music in medicine, and the structure of musical instruments – became viable topics for study by the encyclopedic scientist/philosophers of the day (Miller and Cohen 1987, pp. xiii-xiv).

For a long period of time in England, this curiosity with regard to musical matters remained for the most part exclusively theoretical. “Unlike the activity of the Paris academy, that of the Royal Society showed little evidence of the revolutionary developments in instrument building that took place during the eighteenth century” (Miller and Cohen 1987, p. 18).²⁰⁵ This is not to say that English musicians accomplished nothing at all in the way of improvement to their old musical instruments, nor does it imply that they failed altogether in the invention of new instrumental designs. Rather, it simply means that the Society as a formal institution took little notice of change or progress in the area of applied musical instrumentation.

One of the Fellows who did conduct investigations in the theory of music was John Wallis. He had a long-standing mathematical interest in various tuning systems. Writing in a letter to Henry Oldenburg, who served as a Secretary of the Royal Society from 1663 until 1667, Wallis discussed the general problems associated with tuning the musical scale in a manner based on precisely calculated mathematical intervals, as opposed to tuning by means of the inexact process of depending on the ear alone. This three-page epistle was penned at Oxford on May 7, 1664, and read before the Society on May 18 (Miller and Cohen 1987, p. 95). It constituted a response to certain theories of music that had recently been proposed by John Birchensha, a well-known contemporary

²⁰⁵ One of the few references to new instruments is the mention of a new organ invented by “M. Perrot” (Claude Perrault, 1685). See Miller and Cohen (1987, p. 18).

composer who had begun presenting papers to the Society in 1662. Birchensha was very much interested in disseminating his innovative ideas on composition. He also engaged in discussions with Wallis and Christiaan Huygens and was invited to take part in some of the experiments of the Society.²⁰⁶ Professionally, Birchensha played the viol and taught both music theory and applied music.²⁰⁷

Samuel Pepys was an erstwhile student of Birchensha. As Pepys recorded the episode in his Diary, the teacher-student relationship was initiated when Birchensha, an acquaintance whom Pepys had not seen for a long time, paid him a visit on January 13, 1662. They spoke of music at some length, with the outcome that Pepys optimistically resolved to study composition with him. His lessons were scheduled to commence on the following day. As arranged, Birchensha appeared at Pepys' home for the next three mornings to begin instructing his new pupil in the "composition of musique." He came again on January 23rd and stayed throughout the morning. He returned on the 28th for another lesson of "musique practice."

On February 24, the composer spent a considerable amount of time working with Pepys on finishing a vocal composition, "Gaze not on Swans," which was a two-part song that turned out not to please Pepys very well. This day happened to be payday for "Mr. Berkenshaw," so Pepys reluctantly gave him £5 for the several weeks of lessons he had received to date. The large amount of this fee pleased Pepys not at all. He recorded in his Diary that he was troubled to part with it. Perhaps hoping to get more of his money's worth, that afternoon Pepys went to Birchensha's house, where the composition instructor explained "his great card of the body of musique, which he cries up for a rare thing, and I do believe it cost much pains, but is not so useful as he would have it."²⁰⁸

²⁰⁶ Birchensha also wrote an unpublished work for Robert Boyle on "Practical" and "Mathematical" aspects of music. See the article on "John Birchensha" in *The New Grove Dictionary of Music Online*.

²⁰⁷ The viol is a six-string bowed instrument with frets, which were adjustable for tuning. It was fashionable in the court of Henry VIII and during the Elizabethan era it became popular in the home. It remained so in England long after the violin replaced it as the instrument of choice on the European Continent. See "The Viol" (viol da gamba) at <http://www.s-hamilton.k12.ia.us/antiqua/t_viol.htm>. For a more comprehensive treatment, see Galpin ([1910] 1965, p. 65ff).

²⁰⁸ Birchensha was attempting to codify his new rules of composition and to make use of his innovative ideas about the mathematical tuning of the musical scale for pedagogical purposes. Penelope Gouk points out that Birchensha was "trying to enlist the Society's support for his plans to publish an encyclopaedic system reconciling the practical and mathematical principles of music" (Gouk 1999, p. 188).

Pepys spent the morning of February 27th composing music in the company of his instructor, but on the following day the two fell into a bit of a tiff. It seemed that the student had challenged the teacher on a theoretical point, which appeared to the student to be “somewhat lame.” Birchensha took offense at the challenge and left in a huff. Pepys neglected to take appropriate steps to stop him, since he had already planned to break off the professional relationship. After so many lessons and so much money, he was beginning to feel that he had learned all he needed to know. He was also greatly relieved at the savings of £5 per month. So he set himself straight to work organizing and recording his newly acquired rules of composition, which, in spite of their imperfections, he acknowledged to be the best that had ever been devised. After the day was done, Pepys documented the turn of events in his Diary:

This morning came Mr. Berkenshaw to me and in our discourse I, finding that he cries up his rules for most perfect (though I do grant them to be very good, and the best I believe that ever yet were made, and that I could not persuade him to grant wherein they were somewhat lame, we fell to angry words, so that in a pet he flung out of my chamber and I never stopped him, having intended to put him off today, whether this had happened or no, because I think I have all the rules that he hath to give. And so there remains not the practice now to do me good, and it is not for me to continue with him at; £5 per month. So I settled to put all his rules in fair order in a book, which was my work all the morning till dinner (Pepys [1660-69] 2001).²⁰⁹

Two years later, in a letter dated April 26, 1664, Birchensha explained that by applying his rules of composition, “not only those, who skillfully can sing or play on some Instrument, may learn to compose but also those, who can neither sing nor play.”²¹⁰ The letter was obviously written to advertise his work and to promote himself to the Royal Society. He had devised a chart showing a musical scale that included all of the consonant and dissonant intervals including double flats and double sharps necessary for composition. Pepys had referred to this innovative chart that Birchensha had prepared as his “great card of the body of musique.” His intonation system was based on the Pythagorean system of ratios. Significant to Birchensha’s theory is his notion that all

²⁰⁹ February 27, 1662. For years Pepys continued to be ambivalent in his own mind about the theoretical work of “Mr. Berkenshaw.”

²¹⁰ Quoted in the article on “John Birchensha” in *The New Grove Dictionary of Music Online*.

aspects of music were subject to rationalization.²¹¹ His work had an ongoing influence on the musical proceedings of the Society, especially on discussions of temperament in the subsequent work of Wallis (Harley 1968, p. 162).²¹²

During the early years of the Royal Society, the members gathered for regular weekly meetings in Christopher Wren's room at Gresham College (Turner 1998, p. 103).²¹³ However, not all of the activities could appropriately be held in that location, and other sites were used.²¹⁴ On August 3, 1664, following a meeting of the Society, John Evelyn attended a musical performance in which Birchensha was a participant. Evelyn recorded his response to that unusual event in his Diary.

This day was a Consort of Excellent Musicians especially one Mr. Berkenshaw that rare artist, who invented a mathematical way of composure very extraordinary: True as to the exact rules of art, but without much harmonie.²¹⁵

To Evelyn's ears, Birchensha's inharmonious attempt at applying the science of music to the art of music was a failed experiment. Evelyn was not alone in this critical assessment. Pepys was in full agreement about the disappointing musical quality of Birchensha's work. As he recorded in his Diary entry for August 10th after dining with one friend and visiting with another for an hour or two, he joined an old acquaintance. Together they went to the "Post Officer to hear some instrument musique of Mr. Berchenshaw's ... " (Pepys [1660-69] 2001). His reaction was even less enthusiastic than Evelyn's had been the week before. "I must confess," he wrote, "whether it be that I hear it but seldom, or that really voice is better, but so it is that I found no pleasure at all in it,

²¹¹ See the article on "John Birchensha" in *The New Grove Dictionary of Music Online*.

²¹² John Harley (1968, p. 162) observes that Berkenshaw's manuscript *Rules and Directions for Composing in Parts* and some of his other works seemed to have had a certain amount of influence among amateur musicians.

²¹³ Sir Thomas Gresham had donated the Royal Exchange to the City and the Mercers' Company with the understanding that some of the profits would be used to provide for seven lecturers on the topics of divinity, astronomy, music, geometry, law, physic and rhetoric. The lectures were to be free and open to the public, and would be delivered at the newly-formed Gresham College, formerly his home. His intent was to give the businessmen an opportunity to become familiar with the latest scientific ideas (Inwood 1998, p. 199).

²¹⁴ Alternate sites for experiments by the Fellows of the Society included Oxford, the Royal Palace and the Temple Church in London. "What would the Benchers of the present day think of their beautiful church being made a place of meeting for the trial of experiments?" Yet this was not an unusual occurrence. The Temple Church was also the site of the experimental "Battle of the Organs." See Weld ([1848] 1975, vol. I, p. 175, n. 9; p. 118, n. 32).

²¹⁵ See John Evelyn's Diary entry for August 3, 1664 at <http://astext.com/history/ed_1664.html>.

and methought two voyces were worth twenty of it. So home to my office a while, and then to supper and to bed" (Pepys [1660-69] 2001).²¹⁶ In the opinion of both Evelyn and Pepys, and others as well, Birchensha's influence as a theoretician far outweighed his contributions to applied music.

In the course of the following year, London experienced a devastating outbreak of the plague. An account of this episode appears in the historical satire *1066 and All That: A Memorable History of England*.

During Charles II's reign the Great Plague happened in London. This was caused by some rats which had left a sinking ship on its way from China, and was very fortunate for the Londoners, since there were too many people in London at the time, so that they were always in bad health (Sellar and Yeatman [1930] 1955, p. 71).²¹⁷

Conditions were such that it became necessary for the Royal Society to disband for a time. "On the 28th June, 1665, the weekly Meetings of the Society were discontinued on account of the plague, which was then extending its fatal influence throughout London and Westminster" (Weld [1848] 1975, vol. I, pp. 182-185). Most of the Fellows left the city for the countryside, where they were expected to continue their tasks in order to "give a good account" of their work when they returned to London.²¹⁸

The worst was over by the following February, at which time the meetings of the Council were resumed at Gresham College. When regular weekly meetings of the Society started again in March, little time or attention was devoted to music. There were more serious problems to consider. Some of the subsequent inquiries were centered on medical topics, especially having to do with theories and investigations related to the plague. At the same time, a new matter of great interest emerged from an experiment that had taken place at Oxford. Notice of this noteworthy event, a successful blood transfusion, was recorded in the Society's Journal-book on June 20, 1666. Wallis

²¹⁶ August 10, 1664. As was his custom, Pepys had already spent a very busy day full of activities. Perhaps he was not in the right frame of mind to appreciate modern music. Furthermore, he preferred familiar vocal music to this unfamiliar instrumental work. With a touch of vanity, he no doubt believed that his own compositions were of much better quality. In any case, the unusual tuning of Mr. Berchenshaw's instrument had no appeal to him.

²¹⁷ "History is not what you thought. *It is what you can remember.* All other history defeats itself." See the "Compulsory Preface (This Means You)" in Sellar and Yeatman ([1930] 1955, p. v). On this account, the plague was a "Good Thing."

²¹⁸ While the other Fellows departed, Oldenburg's concern for the safety of the books and papers of the Royal Society kept him in London in order to look after them.

reported that the transfusion was carried out between a mastiff and a greyhound. As a result of this groundbreaking scientific experiment, the donor animal had died, but the greyhound survived the trial and ran away.

The Society had planned to perform a transfusion on its own, but in September of 1666, progress toward conducting the experiment was temporarily brought to a sudden halt. “The great Fire of London, which broke out on Sunday, September 2nd, not only delayed the trial of this experiment, but interrupted the Meetings of the Society ... ” (Weld [1848] 1975, vol. I, pp. 192-193).²¹⁹ Pepys, who was then Clerk of the Acts and Secretary to the Admiralty, played an important role in containing the fire. He made immediate contact with the King and communicated the King’s commands to the Lord Mayor. He was able to save the Navy Office by gathering together a number of workmen who were instructed to pull down the houses in the vicinity in order to stop the spread of flames. Large hooks were brought to the site from the churches and chapels to accomplish this task.

Pepys’ Diary entries for September of 1666 have preserved an extraordinary account of the fire.²²⁰ At around three in the morning on September 2nd (Lord’s day), Pepys’ maid Jane, who had been sitting up late with some of the other maids preparing for the feast day, woke him and his wife to tell them of the “great fire they saw in the City.” Pepys arose and slipped on his nightgown, went to the maid’s window, and looked outside to see what was going on. Unaccustomed as he was to assessing the size and distance of such a conflagration, he concluded that the fire was far enough away not to cause any immediate danger. He returned to his bed and went back to sleep.

The next morning (September 3rd) when he arose at seven, he judged the blaze to be smaller and farther away, so he went about his business of straightening his closet to set things right after it had been cleaned the day before. He had planned to show off his closet to a friend, but that occasion was not to be. Jane came in with an updated report that more than 300 houses had burned and that the fire was spreading. Pepys dressed, walked to the Tower of London, climbed to a high place, and saw that the houses near London Bridge were in flames. With his “heart full of trouble,” he went to see the

²¹⁹ Although the fire did not reach Gresham College, it was necessary for the Lord Mayor and the merchants of the city to make use of the property for business purposes.

²²⁰ Pepys’ quotations and descriptions of the following events are extracted from Pepys ([1660-69] 2001).

Lieutenant of the Tower and was told that the fire had begun at the house of the King's baker in Pudding-lane.

Pepys then went down to the water, took a boat through the bridge, and observed "a lamentable fire." He vividly described the efforts of the citizens to save what possessions they could, observing that they remained in their houses as long as possible. He noticed that even the poor pigeons hesitated to leave their homes; some had their wings burned so badly they couldn't fly. Nobody seemed to be making any attempt to quench the fire, but only to remove as many personal belongings as possible. There had been a drought, the wind was high, and the blaze was spreading quickly.

Those who were able to make their way to the waterside loaded as many of their belongings as they could onto lighters and boats, flinging the rest into the water.²²¹ Pepys recorded the scene at the water's edge in his mind and later in his Diary:

River full of lighters and boats taking in goods, and goods swimming in the water, and only I observed that hardly one lighter or boat in three that had the goods of a house in, but there was a pair of Virginalls in it.

Ordinary household goods were left behind as the population tried to preserve the most valuable possessions. It was quite like the music-loving Pepys to take notice of a boat that was carrying "a pair of Virginalls."²²² He was no doubt pleased to see the instrument being rescued from the flames.²²³

From the Tower, he went directly to the "Chappell at White Hall." Word of his arrival was passed along to the King and he was summoned to give a full report. He told the King and the Duke of York (later to become King James II) what he had seen, strongly suggesting that "unless his Majesty did command houses to be pulled down nothing could stop the fire." He noted in his Diary the fact that the King and the Duke of York seemed to be much troubled. Repeating the instructions the King had given him, he recorded that the King

²²¹ A lighter is a large, flat-bottomed barge.

²²² The obsolete expression "a pair of Virginalls" refers to a single virginal, the rectangular keyboard instrument supposedly named after the young women who customarily played upon it. Organs, clavichords and virginals were typically referred to as a "pair." This usage is similar to the phrase "a pair of scissors."

²²³ He later purchased a similar instrument that he described as "a little espinette" on April 4, 1688. "Espinette is the French term for a small harpsichord, so named because its quill plectra resemble spines or thorns. In Pepys' day, it was referred to as a "spinet" in England. Pepys was fond of using French phrases in his diary.

commanded me to go to my Lord Mayor from him, and command him to spare no houses, but to pull down before the fire every way. The Duke of York bid me tell him that if he would have any more soldiers he shall; and so did my Lord Arlington afterwards, as a great secret.

In fact the King did follow Pepys' advice and the efforts to stop the fire from spreading to the Navy Office were successful, although it continued to extend to areas of the city. In Pepys' own words, he

saw the fire grow; and, as it grew darker, appeared more and more, and in corners and upon steeples, and between churches and houses, as far as we could see up the hill of the City, in a most horrid malicious bloody flame, not like the fine flame of an ordinary fire. ... The churches, houses, and all on fire and flaming at once; and a horrid noise the flames made, and the cracking of houses at their ruins.

Inside the churches, of course, were the pipe organs. Some were newly built and some were newly restored. Many of these, including the instrument at St. Paul's Cathedral, were destroyed as well.²²⁴

Around four o'clock the next morning (September 4th), Pepys loaded his own belongings – all his money, plate, and best things - onto a cart, and left home in his nightgown to go to the house of a friend. In Pepys' memory it was quite an incredible scene. "Lord! to see how the streets and the highways are crowded with people running and riding, and getting of carts at any rate to fetch away things." On the following day, September 4th, his host dug a pit in the garden to bury his wine, and Pepys took that opportunity to save his most valuable possessions – his papers from his office, his wine, and his "Parmazan" cheese.

On September 5th, Pepys' slept on a quilt in his office, having lain down so weary and so sore in his feet that he could hardly stand. In the night his wife called him up to tell him that the fire was at the bottom of their lane. "I up," he wrote, "and finding it so, resolved presently to take her away, and did, and took my gold ... but, Lord! what a sad sight it was by moone-light to see, the whole City almost on fire ...".

At last, on September 7th Pepys arose by five o'clock and found that all was well. He went by boat to "Paul's Warfe," then walked toward St. Paul's church and saw "all

²²⁴ "... London was set on fire in case anyone should have been left over from the Plague, and St. Paul's Cathedral was built instead. This was also a Good Thing and was the cause of Sir Christopher Wren, the memorable architect" (Sellar and Yeatman [1930] 1955, p. 71-72).

the towne burned, and a miserable sight of Paul's church; with all the roofs fallen, and the body of the quire fallen into St. Fayth's; Paul's school also, Ludgate, and Fleet-street, my father's house, and the church, and a good part of the Temple the like." As for the Royal Society, it was displaced, for on the same day, the Merchants of the City met at Gresham College, which by official proclamation was to become their temporary Exchange.

These two devastating events, the plague and the fire, understandably caused a disruption to the experimental work of the Society, but they did not put an end to it. Blood transfusions remained a topic of major importance for some time, as did an ongoing philosophical debate over the nature of the vacuum. It is understandable that with more pressing scientific matters to consider, there would be less time to devote to theoretical considerations related to music.

However, at least one of the Fellows of the Royal Society maintained his amateur interest in music. Samuel Pepys was becoming increasingly interested in the pipe organ. In 1667, the year following the great fire, he recorded in his Diary that on April 4th he went to Hackney²²⁵ on a pleasant outing to take the air. He was told, to his delight, that at the church "there was "a fair pair of organs, which play while the people sing ...". He would have liked for his church in London to have one and would have gladly provided the tidy sum of £50 toward the purchase of such an instrument. On April 21st he went out to Hackney. In his Diary, he reflected upon his admiration for the pretty young ladies of the boarding schools (for which Hackney was famous), and then he continued:

... and also the organ, which is handsome, and tunes the psalm, and plays with the people; which is mighty pretty, and makes me mighty earnest to have a pair at our church, I having almost a mind to give them a pair, if they would settle a maintenance on them for it. I am mightily taken with them.

On the evening of November 16th Pepys took the coach to "White Hall" on the occasion of a musical event to be held in the presence of the King. When he arrived, the company had not yet appeared. While waiting for the performance to begin, he "did go into the musique-room," where he heard the best and smallest organ that he had ever seen. Pepys was smitten. The moment he heard the beautiful sounds of the instrument, he vowed that

²²⁵ Hackney is a borough in London's East End.

such a one as, by the grace of God, I will have the next year, if I continue in this condition, whatever it cost me. I never was so pleased in my life.

His interest in the organ and his curiosity about the instrument continued to grow. One evening in December of 1667, while walking in the vicinity of Westminster Hall, he chanced to come upon “Mr. Hingston.”²²⁶ The two men fell into step together. Asking many questions of the musician, Pepys discovered that

he can no more give an intelligible answer to a man that is not a great master in his art, than another man. And this confirms me that it is only want of an ingenious man that is master in musique, to bring musique to a certainty, and ease in composition.²²⁷

Like many other professionals who are unable to explain their line of work to the layman, John Hingston lacked the linguistic ability to elucidate the art of music to the man on the street. It appears that after his disappointment five years earlier with the pedagogic skills of the composer Birchensha, whose “rules” he believed were the best to date but whose music had given him no pleasure at all, Pepys was once again in search of a man who was both a clever mathematician and an accomplished master of music.²²⁸

Pepys still had music on his mind the following February 24th, in the year 1668, by which time he had decided to begin shopping for an organ for his home. As he related the story, after dropping off his translation of Kircher’s *Musurgia* to the bookseller’s to be bound, he left his wife at the Exchange, where he met the organist Dr. Christopher Gibbons. The two of them went together to Westminster Abby to look over an organ located in the lodgings of the Dean. At home he wrote of his decision regarding the instrument: “Here I saw the organ; but it is too big for my house, and the fashion do not please me enough; and therefore will not have it.” Pepys was much concerned with the size and appearance of the instrument, and apparently concluded that his house would not accommodate an organ at all. Perhaps another keyboard instrument would serve his purpose. On April 4th, he found a substitute, a “little espinette,” or spinet. The instrument was to be finished for him according to his taste. The organ-shopping expedition

²²⁶ John Hingston (or Hingston) was an organist and a viol player. He also served as tuner and repairer of his Majesty’s organs, virginals, and wind instruments until his death in December, 1698. His name appears frequently in the records of the Chapel Royal.

²²⁷ December 10, 1667.

²²⁸ Such a man, had he been available to musical society in the seventeenth century, might have hastened a resolution to the long-standing problem of temperament.

appeared to be accomplished and finding the perfect instrument for his home pleased him greatly:

Up betimes, and by coach towards White Hall, and took Aldgate Street in my way, and there called upon one Hayward, that makes virginalls, and did there like of a little espinette, and will have him finish it for me; for I had a mind to a small harpsichon, but this takes up less room, and will do my business as to finding out of chords, and I am very well pleased that I have found it.

At that moment, Pepys seemed determined to learn to play his new instrument. He was eager to begin “finding out the chords” so that he could continue with his practice of composition. However, the purchase apparently did not take place. Three months later, on July 10th 1668, he wrote of an after-dinner outing to Haward’s to look over the espinettes once again. Still indecisive, Pepys “did come near the buying one, but broke off.” Nevertheless, he still had a mind to do so. Three days later, after having been let of about fourteen ounces of blood in the morning in hopes of curing his failing eyesight, and then taking care of various other matters during the day, he went out to buy his espinette. This time he agreed to pay for it. On July 15th the instrument was delivered, at a cost of £5.²²⁹

On the 20th Pepys stopped by the ironmonger’s to buy a music rest for his little espinette. It would seem from his acquisition of the music rack to hold his books that he was about to being practicing in earnest. Unfortunately, his eyesight was becoming “out of tune.” How much he practiced his musique is not apparent from his Diary, for he had little else to say about the espinette during the subsequent year that he made entries in his own hand. Meanwhile, business matters demanded his energies. Social engagements offered distractions. A dalliance with his wife’s maid consumed time and attention that might otherwise have been devoted to “finding out of chords” at the keyboard. On May 31, 1669, his eyesight almost gone, Pepys made his final Diary entry, albeit without his customary closing, “And so to bed.”²³⁰

²²⁹ This was exactly the same amount of money he had paid for his series of composition lessons with Birchensha.

²³⁰ “Among the famous characters of the period were Samuel Pepys, who is memorable for keeping a Diary and going to bed a great deal, and his wife Evelyn, who kept another memorable Diary, but did not go to bed in it” (Sellar and Yeatman [1930] 1955, p. 72).

Samuel Pepys was an amateur musician with a fondness for the performance of music and a personal interest in the theory of composition. He was not, however, a contributor to the advancement of knowledge in the field. John Wallis, on the other hand, was very much interested in the theoretical aspects of music. He published his ideas on this topic for the benefit of the members of the Royal Society and for the public.

On April 23, 1677, a letter appeared in *Philosophical Transactions*²³¹ with the heading “Dr. Wallis’s Letter to the Publisher, concerning a new Musical Discovery; written from Oxford, March 14, 1677.”²³² Wallis was concerned with a discovery that had been made about three years before at Oxford which he thought might be of interest to those members of the Royal Society who were “Musical and Mathematical.” In more modern terminology, his topic was sympathetic vibration. He explained that it had long been known that a vibrating string, such as a viol or lute string, would cause another string on the same or a nearby instrument, if tuned to the unison or octave, or the like, to “tremble of its own accord.”

Wallis examined the cause and effect of this phenomenon, summarized the previous work, and added a point of his own. Then he appended a Postscript in which he observed that a lute or viol string would answer not only to a consonant string on the same or a neighboring instrument, but also to a consonant note from a wind instrument. An experiment showed that a viol string would answer “very remarkably” to a consonant note from a Chamber-Organ. Although Wallis failed to tell the reader where this trial with the chamber organ was performed, his letter does provide evidence that the pipe organ was used as an experimental instrument. Pipes have certain advantages in an experimental setting that strings fail to offer. Stringed instruments are portable and easy to tune, but they are more subject to variations in temperature and humidity. Pipes maintain their pitch more consistently and thus offer better reliability than strings in an experimental environment.²³³

²³¹ The first volume of *Philosophical Transactions*, the principal publication of the Royal Society, appeared on Monday, March 6, 1664/5, under the editorship of the Society’s first secretary, Henry B. Oldenburg. For a history of the Society and its various publications, see Weld ([1848] 1975).

²³² For the full text of the paper, see *Philosophical Transactions (1665-1778)*, vol. 12 (1677-1678), no. 134, pp. 839-842.

²³³ On the use of musical instruments as experimental equipment, see Maconie (1997, pp. 167-177).

Components of the organ were also used or suggested for use in experiments of the Royal Society.²³⁴ Denis Papin had worked with Christiaan Huygens on air pump experiments in Paris from 1671 to 1674, after which he went to London, where he worked with Robert Boyle. In 1679 he served as Robert Hooke's assistant at the Royal Society and became a Fellow of the Society in 1680.²³⁵ On March 11, 1684, Papin used an organ pipe in a study concerning air (Miller and Cohen 1987, p. 202). The following year, a letter dated September 16, 1685, and "subscribed W. Tenon" was published in *Philosophical Transactions*.²³⁶ The author of the letter had recently read a description of the effects of Papin's water engine.²³⁷ He offered some of his own ideas for improvement, modestly suggesting that a "variety of fancies gives hints many times to better new inventions." In addition to the use of pipes (which might have been organ pipes), he had a new proposal for the pumping device. "Instead of the bladders may be other contrivances, as of suckers or little Organ bellows, playing alternately with two leaves about an axis in the middle."

Experiments and proposals such as these very likely represented the extent to which the pipe organ served the Royal Society's philosophical work, although issues related to tuning and temperament were still being discussed. The Society itself was moving away from the disciplines of the Liberal Arts as they had traditionally been defined in the scholastic curriculum. The Seven Liberal Arts had been divided into two main categories, the Trivium (literally, "the three roads") and the Quadrivium ("the four roads"). The disciplines represented in the Trivium were Grammar, Rhetoric, and Logic, while the Quadrivium consisted of Arithmetic, Geometry, Music (Harmonics) and Astronomy. As the years went by and the Scientific Revolution ran its course, music disappeared from the scholastic curriculum. The theory of harmonics slowly evolved into the physics of acoustics, while the newly emerging discipline of applied music joined the fine arts.

²³⁴ For an overview of the use of scientific instruments in experiments, see Turner (1998), especially the chapter on "Philosophical Instruments" (pp. 103 ff).

²³⁵ See "Denis Papin" at <<http://www-gap.dcs.st-and.ac.uk/~history/Mathematicians/Papin.html>>.

²³⁶ W. Tenon, "A Letter, subscribed W. Tenon, concerning Dr Papin's new Water-Engine" (*Philosophical Transactions (1683-1775)*, vol. 15 (1685), pp.1254-55).

²³⁷ Papin is credited with inventing the pressure cooker and is best known for his work on the steam engine.

Nevertheless, from time to time, certain musical concepts continued to occupy the minds of the Fellows of the Royal Society. One of the topics of concern had to do with sympathetic vibration, a curious phenomenon that constituted an inexplicable kind of “action at a distance.” The mysterious concept of “sympathy” appears to have been of great interest to the natural philosophers. This particular manifestation was easily reproducible. Experiment yielded observable fact. When one string from a musical instrument was caused to vibrate, a similar string placed at some distance from the first would respond to the vibration. Similarly, a note from an organ pipe or a wind instrument was shown to produce the same effect on a string.

A related topic of general interest was centered on both the theoretical aspects of temperament and the practical aspects of tuning the musical scale. This was the issue that eventually brought the organ builder Renuart Harris into philosophical discourse with the mathematician John Wallis. In the meantime, however, Harris became involved in a competition with Father Smith to build a new pipe organ for the Temple Church in London.

The Temple Church is jointly owned by the two Societies of the Temple, the Inner Temple and the Middle Temple.²³⁸ Sometime during 1682, the Master and Benchers of both Societies made plans “to have as complete an organ erected in their church as possible” (Burney [1776-1789, 1935] 1957, vol. II, p. 344).²³⁹ Edmund Macrory relates that the Societies had already been “in treaty with Smith” to build the new organ, “when Harris (who, from this and the subsequent proceedings, seems to have had some warm supporters among the Benchers of the Inner Temple) was introduced to their notice” (Macrory [1859, 1861] 1911, p. 20). Throughout the competition, Smith

²³⁸ The two legal societies known as the Inner Temple and the Middle Temple are “Inns of Court” in the English legal structure. These two societies occupy separate halls at a site in London called the Temple. The recorded history of the Temple dates back to approximately 1160, when the land was acquired by the Knights of the Military Order of the Temple of Solomon in Jerusalem. The Church is located on this site. It was patterned after the round design of the Church of the Holy Sepulchre, which Heraclius, the Patriarch of Jerusalem, consecrated in 1185.

²³⁹ To put this event into additional historical perspective, it should be noted that Johann Sebastian Bach and George Frideric Handel, two of the most famous organists and composers in history, were both born in 1685, which was approximately the mid-point of the Temple Church competition. (Incidentally, at this point in time the pianoforte had not been invented.) In the same geographical and temporal context, an event of great significance was taking place in England. Isaac Newton was in the midst of his work on *Philosophiæ Naturalis Principia Mathematica*, published in 1687. Handel played the organ at the Temple Church after he went to London in 1712.

appears to have been the preferred candidate of the Middle Temple, while Harris maintained an association with the Inner Temple.

Hawkins provides the earliest published account of the ensuing rivalry between Smith and Harris over the awarding of the contract for the new organ:

The contest between Smith and the younger Harris was carried on with great spirit; each had his friends and supporters, and the point of preference between them was hardly determined by that exquisite piece of workmanship of Smith, the organ now standing in the Temple church; of the building thereof the following is the history, as related by a person who was living at the time, and intimately acquainted with both Smith and Harris (Hawkins [1776, 1853] 1963, vol. II, p. 691).

Smith was the ultimate winner of the spirited competition, although as Hawkins points out in this passage, the outcome of the event appears to have been decided more on the basis of favoritism than on the results of Smith's "exquisite" craftsmanship.

Hawkins credits his knowledge of the details of the competition to an informative letter written by Dr. Thomas Tudway to his own son.²⁴⁰ Hawkins relates that

the doctor drew up, in the form of a letter, such an account of music and musicians as his memory enabled him to furnish. Many very curious particulars are related in it, and some facts which but for him must have been buried in oblivion; among which are the contest between father Smith and Harris about the making the Temple organ, and the decision of it by Jefferies, afterwards Lord Chancellor – a fact scarcely known to any person living except such as have perused the letter (Hawkins [1776, 1853] 1963, vol. II, p. 795).

Closely following Hawkins' account, Burney also describes the lively "spirit" in which the competition was carried out. He also alludes to the unusual circumstances that accompanied the contest:

The contention between these eminent artists at the time of erecting the admirable organ which still stands in the Temple-church, was carried on with such spirit, not to say violence, as perhaps never happened before, or since, on a similar occasion (Burney [1776-1789, 1935] 1957, vol. II, p. 344).

²⁴⁰ Dr. Thomas Tudway was a child of the Chapel Royal and a pupil of John Blow. Later, after composing an anthem upon the occasion of a visit to Cambridge by Queen Anne in 1705, "he gained permission to style himself composer and organist extraordinary" to the Queen (Hawkins [1776, 1853] 1963, vol. II, p. 795). The original letter to his son has apparently been lost.

The records of the Inner Temple show the that names of Smith and Harris first appear together in a Bench Table Order dated February 16, 1682/3:

Whereas Mr Smith and Mr Harris, organ makers, have been employed by the treasurers of both societies of the Temple to prepare two organs respectively by them to be made, the said society to have the election jointly of that which shall be esteemed the best organ both as to sound and price ... (Knight 1997, p. 77).²⁴¹

However, the records of the Middle Temple reflect an account of earlier contact with Smith that seems to conflict with the Inner Temple records. The Middle Temple archives include a statement given on May 8, 1683, by a surveyor named William Cleare, who testified that in September of the previous year, he and “divers other workmen” (whose names are listed as witnesses) had heard the treasurers of both Societies “give full ordre and directions unto Mr Bernard Smith” to build an organ for the Church and to supervise the setting up of the organ loft (Macrory [1859, 1861] 1911, p. 21). Cleare further testified “that then neither Reny Harris, nor any other Person whatsoever, was ever mentioned to have any Ordres or Directions to make any Organ for the Tempell Church, or in the least mentioned to stand in competicion with the said Smith for or about making of the same...” (Macrory [1859, 1861] 1911, p. 21). While this statement offers no solid proof that Smith was originally the sole organ maker engaged to build the instrument, it does indicate that there was concern on the part of the Middle Temple over the legitimacy of Harris’ entry into a prolonged competitive event.

According to Burney, each of these talented artists came well equipped with outstanding recommendations from “such an equal number of powerful friends and celebrated organists, that they were unable to determine among themselves which to employ (Burney [1776-1789, 1935] 1957, vol. II, p. 344).” Because of their inability to arrive at a decision that was agreeable to both Societies, the Master and Benchers decided that each builder should construct and install an organ to be tested on a trial basis. The rules of engagement were laid out explicitly. Each organ was to be erected in a different part of the church. An audition would be held to determine which instrument was more suitable. The final determination would be based on the best empirical evidence

²⁴¹ Knight’s source for this quotation is Inderwick, F. A., ed., *A Calendar of The Inner Temple Records* (London, 1901), vol. III, p. 194.

available. At the conclusion of the trial, the Temple Church would retain only the organ that exhibited “the greatest number of excellences” (Burney [1776-1789, 1935] 1957, vol. II, p. 344).

Agreement was eventually reached on the terms of the competition and each builder started construction on a new instrument. In Burney’s words, “Smith and Harris agreeing to this proposal, in about eight or nine months, each had, with the utmost exertion of his abilities, an instrument ready for trial [1684]” (Burney [1776-1789, 1935] 1957, vol. II, p. 344). Knight provides details on the preparations, noting that on June 13, 1683, “Harris was ready to set up his organ for trial, and in a petition to the Inner Temple of this date, he complained that Smith was not yet ready to erect his instrument (Knight 1997, p. 77). Harris requested and was granted permission by the Benchers of the Inner Temple to set up his organ on the south side of the communion table (Macrory [1859, 1861] 1911, p. 22). Macrory also notes that Smith’s organ must have been installed not long after that time, because the Middle Temple accounts indicate that a payment was made to the organist John Blow and others in August of 1683 for giving their opinion about the instrument (Knight 1997, p. 77).²⁴²

According to the Middle Temple records, after the construction and installation of the organs was completed, each builder engaged the services of an eminent organist who would be qualified to assess his instrument and show it off to its best advantage. From all accounts, these musicians served quite well in this capacity. The story of the competition as provided by Hawkins includes the following quotation from the letter written by Dr. Tudway:

Dr. Blow and Mr. Purcell, who was then in his prime, shewed and played Father Smith’s organ on appointed days to a numerous audience; and, till the other was heard, every body believed that Father Smith certainly would carry it (Hawkins [1776, 1853] 1963, vol. II, p. 691).

Burney’s account is a paraphrase of the same information from Tudway’s letter:

Dr. Blow and Henry Purcell, then in their prime, performed on Father Smith’s organ, on appointed days, and displayed its excellence! and, till the other was heard, every one believed that this must be chosen (Burney [1776-1789, 1935] 1957, vol. II, p. 344).

²⁴² Knight’s source is Hopwood, C., *A Calendar of the Middle Temple Records* 3 vols. (London, 1903), Vol. I, 180).

Significantly, both Hawkins and Burney report that the competition was a public event and that both instruments were well received by the audience. The records of the Middle Temple for June 2, 1685, mention that these various auditions were held over a period of time with the two competitive instruments being heard on alternate Sundays and alternately on the same Sunday. The same account also shows that the Masters of the Bench of the Middle Temple had grown weary of this tedious competition and had come under pressure to reach a final decision:

The Masters of the Bench at this Parliament taking into their Consideration the tedious Competicion betweene the two Organ-makers about their fitting an Organ to the Temple Church, and having in severall Termes and at severall Times compared both the Organs now standing in the said Church, as they have played severall Sundays one after the other, and as they have lately played the same Sunday together alternately at the same service. Now at the Suite of several Masters of the Barr and Students of this Society pressing to have a speedy Determination of the said Controversie; and in Justice to the said Workmen as well as for the freeing themselves from any Complaints concerning the same, doe unanimously in full Parliam^t resolve and declare the Organ in the said Church made by Bernard Smith to bee in their Judgments, both for sweetnes and fulnes of Sound (besides y^e extraordinary Stopps, quarter Notes, and other Rarities therein) beyond comparison preferable before the other of the said Organs made by — Harris, and that the same is more ornamentall and substantiall, and both for Depthe of Sound and Strengthe fitter for the Use of the said Church; And therefore upon account of the Excellency and Perfection of the said Organ made by Smith, and for that hee was the Workeman first treated with and employed by the Tre^{ors} of both Societyes for the providing his Organ; and for that the Organ made by the said Harris is discernably too low and too weake for the said Church, their Ma^{pp}^{es} see not any Cause of further Delay or need of any reference to Musicians or others to determine the Difference; But doe for their parts unanimously make Choise of the said Organ made by Smith for the Use of these Societyes — and M^r Tre^{or} is desired to acquainte the Tre^{or} and Masters of the Bench of the Inner Temple with this Declaration of their Judgments wth all respect desiring their Concurrence herein (Macrory [1859, 1861] 1911, p. 24).

Unfortunately, except for this entry reflecting the desires of the Mastershipes of the Middle Temple to put an end to the whole affair, “very little detail survives in the records of either Society of the Temple about the public aspect of the dispute” (Knight 1997, p. 78). Nor have other records have come to light that would provide further information on the public reaction to the competition.

As an act of diplomacy, this appeal failed. As Macrory relates, “The Benchers of the Inner Temple, upon consideration of the above declaration, sent to them by their brethren of the Middle Temple, did not concur in the course therein suggested, but on the 22nd June, 1685, made an order, in which, after expressing their dissatisfaction that such a resolution and determination should be made to the Benchers of the Middle Temple in a matter which equally concerned both houses, without a conference being first had with them, they declared:”

That it is high time, and appears to be absolutely necessary, that impartial Judges (and such as are the best Judges of Musick) be forthwith nominated by both Houses, to determine the Controversie betweene the two Organ-makers, whose Instrument is the best, which this Society are ready to doe, and desire their Mastershippes of the Middle Temple to join with them therein, in order to the speedy putting an end to so troublesome a Difference ... (Macrory [1859, 1861] 1911, p. 25).

The Inner Temple designated a committee that was instructed to arrange a meeting with representatives from the Middle Temple to consider the appointment of appropriate judges as well as to discuss prices and pipe specifications for the organ. On June 24th, the Middle Temple responded to the Inner Temple with an adverse reaction to the proposal of June 2nd. The points of dissension included a rejoinder to the perceived audacity on the part of the Inner Temple for taking matters into their own hands when they declared their choice of Smith’s organ without the concurrence of the Inner Temple. In addition, the Masters of the Bench of the Middle Temple had not yet met in Parliament to make a choice between the two organs, but if they were to decide upon the other one, then they would find “some other Expedient for the Determination of the said Difference” instead of a judgment made by a jury of impartial musicians (Macrory [1859, 1861] 1911, p. 26). They also took note of Smith’s adamant refusal to set a price for his organ, leaving the final determination of the value of the instrument to the judgment of the Treasurers of both Societies. They declared this to be a reasonable approach. Curiously, however, in the matter of final specifications for the instrument,

their Mastershippes think it below them to trouble themselves therein, because the Proposal can have no other ground than a Supposition of such Fraud in the Artist as is inconsistent with the Credit of his Profession (Macrory [1859, 1861] 1911, p. 26).

This defensive reaction reflected a perception on the part of the Middle Temple that the Inner Temple was suspicious of Harris.

The Societies remained at odds over the issue of final judgment in the matter. The Middle Temple was determined to have impartial judges selected, while the Inner Temple, convinced that they had already made the better choice, refused to yield. Further negotiation was necessary. On June 26th, the Middle Temple appointed a committee to state the differences in writing for The Lord Keeper (Lord Guildford) and to ask for his determination in the dispute. Nothing seems to have come of this effort.

The controversy continued. On January 29, 1685/6, the Middle Temple appointed a committee to meet with the Inner Temple to discuss the matter further. There is no record that the Middle Temple reached an agreement with the Inner Temple to appoint a committee that would choose “impartial judges who are also masters of Music” (Knight 1997, p. 80). In February of 1685/6, the Middle Temple appointed yet another committee to state the differences in writing, this time for the purpose of appealing to Lord Chancellor Jeffreys for a final determination (Knight 1997, p. 80). There is no further record of this application.

Sometime around the end of 1686, both Smith and Harris made written submissions to Judge Jeffreys to plead their cases. Harris submitted one proposal that enumerated a step-by-step method by which the organs would undergo an orchestrated trial based on the comparison of each individual stop. He also proposed that each workman would have verbal access to Judge Jeffreys so that “the Competitors may have full Liberty of Speech to represent object or justifie what they have to say” (Knight 1997, p. 96). The other submission from Harris was a defense that related a history of the dispute and his difficulties during the course of the competition. In this document Harris brought up the great expense of a project that he had at first proposed to accomplish for a price of one thousand pounds. He also described certain acts of maliciousness that had occurred during the course of the competition:

First severall of my pipes having been cutt and spoiled in my absence as they stood in the Organ, I was not only constrained to make them good but alsoe for preventing of the like Inconvenience have beene necessitated to

Employ and keepe a watchman day & night in the church for about the space of three years at five shillings p[er] weeke (Knight 1997, p. 96).²⁴³

As an incentive, Harris offered to discount his price one hundred pounds for every fifty pounds that his instrument was found to be overvalued by the experienced practitioners in Musick who were to be invited to consult in the dispute.

Smith's submission to Judge Jeffreys recapitulated his own version of these events. He related that after he had been engaged, "Mr Harris prevailed w[i]th S[i]r Tho[mas] Robinson to be admitted to worke in the Church upon competition w[i]th the said Smith upon another Organ" (Knight 1997, p. 97). Smith's account indicated that Harris was not invited by the Societies to build an organ for trial, but rather took it upon himself to arrange to be allowed to compete with Smith.

After years of dispute, the documented conclusion to the "Battle of the Organ" seems anticlimactic. In Burney's words,

At length, the decision was left to lord chief justice Jefferies, afterwards King James the Second's pliant chancellor, who was of that society, and he terminated the controversy in favour of father Smith [1685]; so that Harris's organ was taken away without loss of reputation, having so long pleased and puzzled better judges that Jefferies (Burney [1776-1789, 1935] 1957, vol. II, pp. 345).

Macrory notes that Burney's statement is not corroborated in the records of either of the Temple Societies, and that furthermore, "it is not probable, if the decision had been left to Jefferies, that there would not have been some record either of his appointment, or of the decision" (Macrory [1859, 1861] 1911, p. 28). The date in this quotation from Burney (1685) is correct year for the decision of the Middle Temple in favor of Smith, but premature for the termination of the controversy. Concerning the matter of the manner in which the dispute was finally settled, Bicknell explains that

according to tradition, it was eventually Judge Jeffries who made a casting vote in favour of Smith's organ. In truth Smith won by four votes. Harris simply would not take no for an answer, and with very poor grace made a further attempt to challenge Smith ... (Bicknell [1996] 1998, p. 129).

²⁴³ This is probably the source of the Burney's reference to the "violence" that took place during the competition (Burney [1776-1789, 1935] 1957, vol. II, p. 344).

Knight observes that the last of the contemporary documents in the Middle Temple Library relating directly to the dispute date from November and December of 1687, but neither these nor the records of the Inner Temple mention the trial or the judgment of the organs, not do they explain “how Smith’s organ came to be allowed to stand in the Temple Church” (Knight 1997, p. 81). The Middle Temple records include the contracts for the organist, Francis Pigott, and the organ tuner, who was Father Smith. These records also include Smith’s Bill of Sale for the new organ, dated June 21, 1688. “Smith was paid £1000 for his three-manual instrument of twenty-three speaking stops, with three full sets of keys including quarter notes” (Knight 1997, p. 82). Curtains and curtain rods were also included. The amount of the payment was divided equally and paid by the Treasurers of the two Societies. Smith, who all along had refused to name a price, received the same amount that Harris had originally asked for the instrument he proposed to build. Figure 5 shows Father Smith’s design for the Temple Organ.²⁴⁴

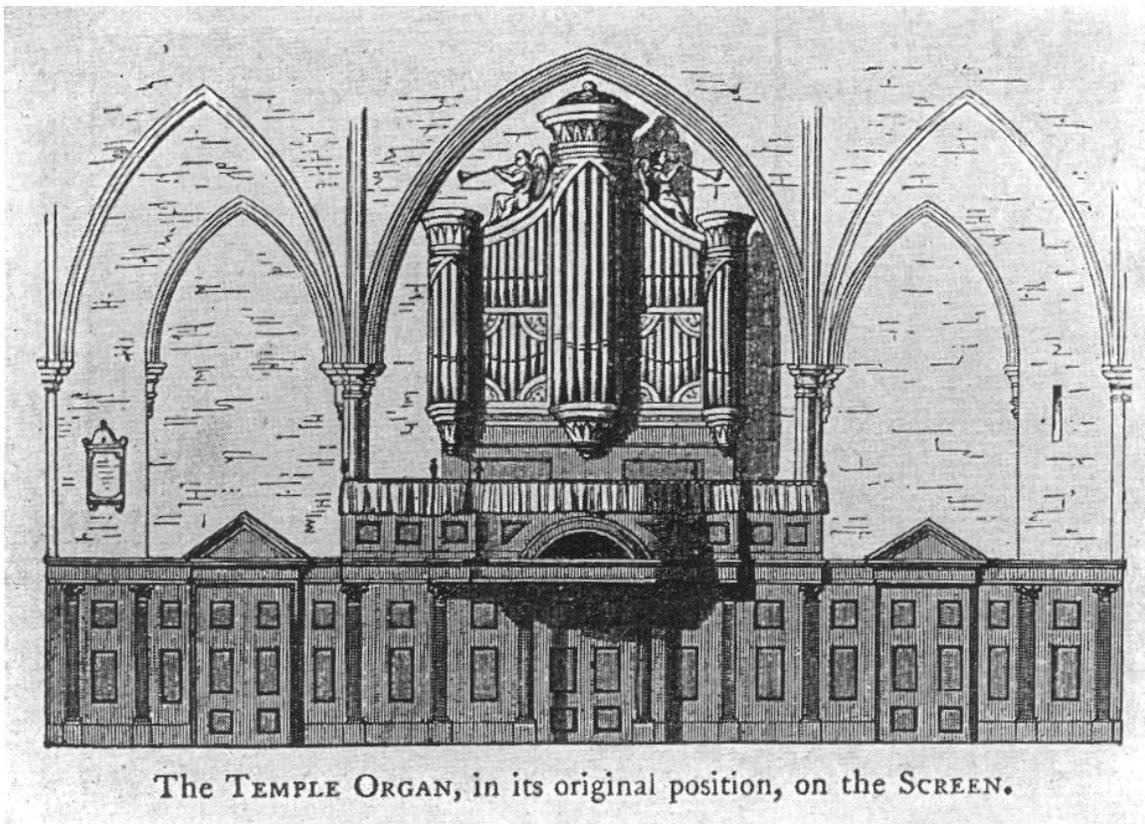


Figure 5

²⁴⁴The illustration appears between pages 34 and 35 in Macrory ([1859, 1861] 1911).

On February 20, 1690, Harris signed a Quitclaim document that released the Honorable Society of the Inner Temple from all manner of actions, obligations, damages, demands, sums of money, quarrels, controversies and trespasses that Harris might subsequently have claimed against the Inner Temple (Knight 1997, p. 82). The fact that Harris was required to sign a Quitclaim indicates that the Masters of the Inner Temple, who had supported Smith throughout the competition, were perhaps anticipating more unpleasantness from Harris and were taking this legal action to prevent the possibility of any further difficulties. With this document, the episode of the “Battle of the Organs” comes to a final conclusion.²⁴⁵

Because of the professional relationship between the builders and the organists who participated in this competition, a brief account of the lives of these musicians provides additional insight into the status of the pipe organ in English society. Hawkins, quoting Dr. Tudway again, writes that “Mr. Harris brought Mr. Lully, organist to Queen Catherine, a very eminent master, to touch his organ, which brought Mr. Harris’s organ into that vogue; they thus continued vying with one another near a twelvemonth” (Hawkins [1776, 1853] 1963, vol. II, p. 691). Burney offers essentially the same account, explaining that Harris had employed M. Lully “to touch his organ, which brought it into favour; and thus they continued vying with each other, for near a twelve-month” (Burney [1776-1789, 1935] 1957, vol. II, pp. 344-345). According to a footnote in Hopkins and Rimbault ([1855, 1870, 1877] 1987, vol. 1, p. 104n.) the musician engaged by Harris was not Lully, but was instead Giovanni Batista Draghi (c.1640-1708).²⁴⁶

Draghi was an Italian composer, harpsichordist, and organist. He was appointed first organist at Somerset House in 1673, where he served Queen Catherine Braganza, the wife of Charles II, who had brought him to England in the failed hope of establishing opera in London. The fact that Harris had been able to secure the services of the organist to the Queen implies that he enjoyed a certain degree of royal favor. This assumption is

²⁴⁵ Harris removed his instrument from the Temple Church and used parts of it to construct two different organs, one for St. Andrew at Holborn and the other for Christ Church Cathedral in Dublin.

²⁴⁶ “Dr. Tudway (from whom Burney derived this account) wrote *Baptist*, which he interpreted to mean *Baptist Lulli*” (Hopkins and Rimbault [1855, 1870, 1877] 1987, vol. 1, p. 104n.). Dr. Tudway might have been thinking of the well-known Italian-born French composer Jean-Baptiste Lully. However, Lully was in service at the court of Louis XIV at the time. Hopkins and Rimbault inform the reader that this mistake “has been repeated *ad infinitum* by writers who ought to have known better” (Hopkins and Rimbault [1855, 1870, 1877] 1987, vol. 1, p. 104n.).

reinforced by a statement based on historical records of the Temple Church to the effect that Harris “enjoyed a certain amount of Court patronage through influential friends whom he had known in France.”²⁴⁷ In 1687, Draghi received an appointment as organist in the private chapel of James II (Chan and Kassler 1990, p. 260, n. 453).

In the matter of court patronage, however, the Protestant Father Smith held the advantage over the Catholic Renatus Harris. Smith had been appointed organ-maker at the Chapel Royal on May 30, 1681. Both of the musicians he selected to demonstrate his instrument, Dr. John Blow (1648-1708) and Henry Purcell (1659-1695), were associated with the Chapel Royal. Blow was serving as “Master of the children of his Majesty’s Chappell Royall” and was appointed musician in ordinary to his Majesty in 1674.²⁴⁸ He was appointed organist of Westminster Abbey in 1668, but resigned this position in 1679 “in favour of his gifted pupil Henry Purcell, resuming it upon the younger man’s death in 1695.”²⁴⁹

Until his voice changed, Purcell had been a child of the Chapel. It would have been customary for him to leave the Chapel when he could no longer sing in the boys’ choir, but Purcell remained and assumed other responsibilities. A number of entries recorded in *The King’s Musick* reflect his successful career as an organist, and he is still considered one of England’s greatest composers.²⁵⁰ In addition to playing and composing, he was also expected to serve as a technician. Purcell was accountable for the repair and maintenance of all of the wind instruments at the Chapel Royal. On June 10, 1673, he was appointed to the position of “keeper, maker, mender, repayrer and tuner of the regalls, organs, virginals, flutes and recorders and all other kind of wind instruments whatsoever, in ordinary, without fee, to his Majesty, and assistant to John

²⁴⁷ For additional details, see “The History of The Temple Church Organ” at the Temple Church website at <<http://www.templechurch.com/pages/history/organ/organhistory2.htm>>. Bicknell notes that “Renatus was friendly with members of Charles II’s court (engaging the Queen’s organist to demonstrate his instrument at the Temple Church), and during the short reign of the Catholic James II, the satisfaction of royal preferment fell to him; for the considerable sum of £1,100 he built an instrument for the Queen’s Catholic chapel in Whitehall in 1686-8” (Bicknell [1996] 1998, p. 123).

²⁴⁸ Dr. John Blow first appears in the records of *The King’s Musick* on December 14, 1660 (?), when he was listed as “master of his Majesty’s music.” The last entry with his name is also the last entry in the book. His name appears in the “Accounts ending Michaelmas, 1700. He was still serving as master of the children of the Chapel Royal, and on this date received payment for the liveries for ten children. See De Lafontaine ([1909] 1973, pp. 120 & 437).

²⁴⁹ See the article on “John Blow” in *The New Grove Dictionary of Music Online*.

²⁵⁰ For a discussion of Purcell’s role in the music of the Restoration, see Fellowes (1981, pp. 162-178.)

Hingston, and upon the death or other avoydance of the latter, to come in ordinary with fee” (De Lafontaine [1909] 1973, p. 225). The warrant issued on this date guaranteed that Purcell would eventually take Hingston’s place. It is possible that he studied under the tutelage of Hingston during these years and was possibly apprenticed to him.²⁵¹

Purcell apparently remained in this position for ten years. Then on December 17, 1683, he was made “organ-maker and keeper, etc., in the place of Mr. Hingston, deceased” (De Lafontaine [1909] 1973, p. 361). On the following February 16, he was assigned further duties as “keeper, maker, repairer and mender and tuner of all and every his Majesty’s musicall wind instruments; that is to say all regalls, virginals, organs, flutes, recorders and all other kind of wind instruments whatsoever . . .” (De Lafontaine [1909] 1973, p. 364).²⁵² Purcell’s new appointment as an instrumental technician carried with it a number of additional responsibilities. It appears that he was to be in charge of all arrangements relevant to the acquisition and installation of organs, including negotiating with the builder, contracting for the carpentry work, purchasing the necessary materials of metal and wood, and providing for transportation as required. Purcell or his assignees had also the license and authority

to take up within ye realme of England all such mettalls, wyer, waynscote and other wood and things as shalbe necessary to be employed about the premises, agreeing, paying and allowing reasonable rates and prices for the same. And also in his Majesty’s name and upon reasonable and lawfull prices, wages and hire, to take up such workmen, artificers, labourers, worke and store houses, land and water carriages and all other needefull things as the said Henry Purcell or his assignes shall thinke convenient to be used on ye premises. And also power and authority to the said Henry Purcell or his assignes to take up all tymber, strings, and feathers, necessary and convenient for the premises, agreeing, paying and allowing reasonable rates and prices for the same, in as full and ample manner as the said John Hingston . . . formerly had (De Lafontaine [1909] 1973, pp. 364-365).

This appointment as instrument maker and keeper was a paying position for Purcell, although it was soon to be terminated. Between 1680 and the death of Charles II in 1685, Purcell also served as a court composer, a position that was to come to an end as

²⁵¹ For a summary of Purcell’s association with the Chapel Royal, see the entry for Henry Purcell in De Lafontaine ([1909] 1973, p. 462-463).

²⁵² His wages were set at £60 per annum, plus allowances for “workinge, labouringe, making and mending any of the instruments aforesaid” (De Lafontaine [1909] 1973, p. 364).

well. At the death of Charles II on February 6, 1685, his brother James, the Duke of York, succeeded him. On April 22, James II (1685-88) was crowned at Whitehall Palace in a private ceremony that adhered to the rites of the Catholic Church. The next day, the service for his public coronation at Westminster Abbey was held according to the rites of the Church of England.

Following the accession of James II to the throne, a warrant was issued on August 13, 1685, for the swearing in of the “musicians for his Majesty’s private musick in ordinary with fee and salary.” It appears that the arrival of a new king brought about a restructuring of the Chapel Royal. Dr. Blow appears as “*Composer*” on the list dated August 31, 1685, while Henry Purcell now has the unique title “*Harpsicall*” (De Lafontaine [1909] 1973, pp. 371-371).

After the required oath to the new king was administered, a certificate of appointment was issued to John Blow on September 10 “for the private music in ordinary to his Majesty King James II.” A similar certificate for Purcell was dated October 9. However, his former position as “Keeper of the Instruments” was now to be filled by a gentleman named Henry Brockwell. Furthermore, little attention seems to have been paid to his former role as court composer. In any case, as the official “Harpsicall,” Purcell did continue to serve as court organist. A curious entry on May 29, 1687, places the organ room off limits to anyone who had no official business there. A command was issued stating that “I doe hereby order that noe person presume to go into ye organ roome in his Majesty’s Chappell Royall but ye musick who are to officiate their” (De Lafontaine [1909] 1973, p. 382).²⁵³

It is likely that all of the musicians were experiencing financial inconvenience during the political transition period under James II. An entry for September 21, 1686, notes that £2,484.6s.3d. was still due to the late Majesty’s musicians. This list of names includes John Blow, who was still owed money for services rendered during the years 1669-73 and 1678-84. The funds to pay these musicians were to come from “the new imposition on tobacco and sugar” (De Lafontaine [1909] 1973, p. 378). From the number of entries listed in *The King’s Musick* that relate to trumpets and kettledrums, it would seem that ceremonial instruments had been his primary musical interest during his reign. Organs apparently were not, but this period of neglect was to be short-lived.

²⁵³ No further explanation for this order is given.

With the assistance of William of Orange, James II fled to France in 1688 and remained in exile there until his death in 1701. The subsequent reign of William III and Mary II (1688-1702) seems to have brought about a revival of interest in court organs.²⁵⁴ On May 4, 1689, a warrant was issued “to swear and admit Bernard Smyth organ-maker in ordinary to his Majesty” (De Lafontaine [1909] 1973, p. 392).

Further court patronage and additional responsibilities were granted to Bernard Smith on February 6, 1690, when an order was issued for the organ builder “to view all their Majesties’ organs and to keep the same in repair, and to see the same be not embezzled or destroyed, and all persons who have any of their Majesties’ organs in their custody are hereby required not to molest or disturb you in the execution of this your office” (De Lafontaine [1909] 1973, p. 398).

In addition to his duties as a court musician, Purcell kept his post at Westminster Abbey until his death on November 21, 1695. He was buried near the organ in the Abbey. Both Blow and Smith were appointed on November 30 to take Purcell’s place at court as tuners of the various wind instruments. To this appointment a stipulation was attached to the effect that whichever musician outlived the other would eventually assume the full position: “The place between them, and the survivor to enjoy the whole place” (De Lafontaine [1909] 1973, p. 420). In December of 1697, Smith was listed as “*Organ maker,*” while the position of “*Tuner of the regalls, organs, virginals, flutes, etc.*” was held by “Dr. John Blow and Mr. Bernard Smith, and the longer liver” (De Lafontaine [1909] 1973, p. 429). On December 7, 1698, a warrant was issued to pay Smith an advance of £200 to build an organ for his Majesty’s Chapel at Whitehall. This warrant was followed by another on May 5 of the following year “to fit up a shed in Whitehall for Mr. Smith, his Majesty’s musicall instrument maker to work in during the time he is preparing an organ for his Majesty’s Chappell at Whitehall. This particular warrant was directed to “Sir Christopher Wrenn, surveyor generall of his Majesty’s works” (De Lafontaine [1909] 1973, p. 429).

Although not one of the competing organists in the Battle of the Organs, another of the interested parties in this event was the Honorable Roger North (c. 1651-1734).

²⁵⁴ William of Orange landed in England in 1688 to save the country from Catholicism. He died in 1702 after a fall from his horse. Queen Mary had died from smallpox in 1694.

North was very much interested in the performance of music, having begun lessons on the viol sometime around 1660. Even at an early age, he was concerned with the technical aspects of music. In 1663, he undertook the task of constructing an organ.

North was admitted to the Middle Temple on April 21, 1669, and called to the bar on May 29, 1674. On January 26, 1679, a fire had damaged the Middle Temple. Sir Christopher Wren was invited to provide a design for rebuilding the cloisters. Although Wren has been given credit for the Great Gateway, it was actually Roger North himself who designed this entrance. In all respects, North was well qualified to be an active participant in the selection of a new organ for the Temple Church. In February of 1684, he was among the Benchers of the Societies of the Temple who shared responsibility for inviting the Smith and Harris to compete for the organ contract:

His interest in the technology of musical instruments was revived in February 1683, when he and other benchers of the Inner and Middle Temple invited the organ builders, Bernard Smith and Renatus Harris, to submit designs for a new organ for the Temple Church. Subsequently, the successful competitor, Smith, built North's own organ, which was set up in the long gallery at Rougham Hall (Chan and Kassler 1990, p. xv).²⁵⁵

The name of Roger North appears as one of the signatories to the Bill of Sale for Smith's organ in 1688 (Chan and Kassler 1990, p. 268, n. 483).

Forty years later, in *The Muscicall Grammarian 1728*, North reflected upon the nature and the role of competition in musical events. Speaking of "the prize musick, and the ill effects, of competition," he called to mind the outcome of a previous contest in which "one of the competitors who had resided in England many years, went away upon it; declaring that he thought he was to compose musick for men, and not for boys" (Chan and Kassler 1990, p. 267). That artist had placed fourth in the competition, and sometime afterward had left the country. Following this anecdote, North added a final, definitive argument against the devastating effects of musical competitions. In North's opinion, Smith and Harris had barely managed to survive the Battle of the Organs.

So much a mistake it is to force artists upon a competition, for all but one, are sure to be malecontents. And wors happened upon a competition for an organ at the Temple Church in which the 2 competitors[,] the best

²⁵⁵ North had bought an estate at Rougham, Norfolk, on December 26, 1690 (Chan and Kassler 1990, p. 214, n. 315).

artists in Europe, Smith and Harris, were but just not ruined (Chan and Kassler 1990, p. 268).

This erroneous assessment by Roger North that Smith and Harris were all but ruined professionally as a result of the Temple competition has often been quoted in the literature. In fact, quite the opposite was the case. Both builders were subsequently awarded a number of important contracts.²⁵⁶

Following his success at the Temple Church, Smith built the organ at St. Paul's Cathedral. He was once again in competition with Harris, although this time there was no trial involved in the awarding of the contract. This instrument was constructed between 1695 and 1697. It has become the subject of a legendary tale. The Dean of the Cathedral insisted that the organ should be placed on the screen, in spite of the wishes of the master architect, Sir Christopher Wren. According to the story, Wren refused to allow several of the largest pipes to be installed in the Cathedral, including the five lowest pipes of the diapason. His verbal reaction is unsubstantiated, but the alleged quotation persists in the literature. Wren would not have that "box of whistles" upsetting the symmetry of his new Cathedral. In this conflict between architecture and technology, the architect won the argument. Smith's largest pipes remained in storage on site. However, since Wren outlived Smith, these were never installed (Clutton and Niland 1963, p. 73).

One of the social aspects of organ building was the necessity to solicit funds to pay for the instrument. The purchase of an organ was a significant financial investment. For religious institutions, subscriptions were customary. In March of 1695, a public "Advertisement" appeared for the purpose of soliciting subscribers to contribute funds for a new organ at Tiverton in the county of Devon. The three short pages that constitute this formal Advertisement provide essential information on contemporary fundraising for a very costly piece of mechanical equipment. Sufficient financial support was required for each of the many and diverse aspects of organ building and maintenance. Adequate funding was needed to provide for carpentry work and preparation of the site where the new organ was to be erected, for meeting the contractual obligations to the organ-builder

²⁵⁶ For example, Harris received the contract to construct the organ Salisbury Cathedral in 1710. This was the largest of his six Cathedral organs.

and his assistants, for transportation expenses from the builder's workshop in London down to the installation site at Tiverton, for the elaborately carved casework, for the installation and final assembly of the instrument over the screen, and finally for the voicing, tuning and ongoing maintenance of the completed organ.²⁵⁷

The Advertisement is subtitled "*It is thought fit here to set down the Method of our Proceeding, and the PROPOSALS were made, for the Erecting of the ORGAN in our Parish Church of TIVERTON by way of Subscription, March 6, 1695.*"²⁵⁸ The Undertakers, who are listed by name at the end of the Advertisement, dutifully promise to all those who voluntarily subscribe that they, the Undertakers, will apply to the Bishop for his approval of the project, not doubting that he will concur with the subscription effort for the benefit of his Church. They also promise to apply for the approval of the Arch-Deacon, who has already recommended the work. Furthermore, the Arch-Deacon has "offered the Interest he has in an Excellent Artist, who shall be employed for the making of the same with all convenient speed." In addition, the Undertakers describe exactly what they have in mind for the proposed project:

They do undertake to procure an excellent and well-contrived Organ, of a sufficient Bigness, and with decent and proper Ornaments of Carved Work, answerable to the Parish Church; and the convenient Place there is for the Erecting of it over the Skreen in the said Church. And that they will forthwith give Directions for the making of the same, as soon as they shall receive sufficient Subscriptions from good and piously disposed People, for a suitable Sum of Money, to discharge the Expence of the Organ it self, the bringing it down from *London*, and setting it up in a decent Gallery to be made for that purpose.

A payment schedule is described whereby the subscribers are expected to pay half of the money to the Undertakers at *Lady-day* and the other half at the next *Midsummer*, or at other appointed times. The names of the subscribers who contribute at least ten shillings will be placed "in a decent Table in the Church, there to remain for ever, as a lasting Testimony of their being Benefactors to so Religious and generous an Undertaking." The Undertakers themselves have already gone to "great Care and

²⁵⁷ The casework for this organ was designed with an "unusual frieze of foliated coving on the tower caps" Bicknell ([1996] 1998, p. 151).

²⁵⁸ No publication details are given for this three-page Advertisement.

Trouble and Expence” in hopes that a great many others who have the means and ability to do so will follow their good example.

The Advertisement is signed with the names of seven Undertakers. First on the list is John Newte, Rector (1656-1716). Following his name, there are five men listed as “Capital Burgesses in the Corporation” and two who are “Assistants in the Corporation.” At the end of the document is an additional note: “The Excellent Artist, who makes our Organ, is Mr. *Christian Smith*, a very Honest and Ingenious Man, and lives in *Hart-street* nigh *Bloomsbury Market, London.*”²⁵⁹

The Advertisement accomplished its purpose. In spite of opposition, the subscriptions were raised, the organ was built and installed, and the dedication took place on September 13, 1696. The dedicatory sermon by John Newte recapitulates the turbulent history of the organ in early modern England.

The man responsible for writing and delivering this sermon had succeeded his father, Robert Newte, as rector at Tiverton in 1678. He shared with his father a love for Hebrew and the classical languages, but his main interest was recent history. At the end of his life, he bequeathed a collection of some 250 volumes to start a parochial library.²⁶⁰ His library served him well. In this sermon, he derives proof for his well-ordered set of arguments from numerous Biblical references, from philosophical and literary authority, and from commonplace practice in the various churches. The rhetoric of Newte’s discourse reflects the variety and intensity of the contemporary arguments involving music and the use of the organ in the service of worship.

²⁵⁹ Christian Smith was the nephew of Father Smith. The records of the Lord Chamberlain’s Office for October 31, 1690, show that he had filed a petition against his uncle Bernard Smith, who was required to appear to answer the charges against him (De Lafontaine [1909] 1973, p. 400). The entry reads “Petition of Christian Smyth against Bernard Smyth, organist. Bernard Smyth to appear.” Clutton and Niland report that Christian and Smith’s other nephew, Gerard, had set up independent workshops sometime around 1689 or 1690. Neither of them, according to these authors, attained “any great eminence” (Clutton and Niland 1963, p. 75). *The New Grove Dictionary of Music Online* confirms these dates as 1689 for Gerard and 1690 for Christian. See the article on “Bernard Smith.” This entry notes that Christian built a new Great Organ for Ely Cathedral in 1691. Apparently, neither of the nephews was able to equal his uncle in the skills of organ craftsmanship. The statement that this new instrument was constructed with a “Harris-style case” confirms a stylistic break between Christian and Bernard.

²⁶⁰ John Newte’s father Robert Newte had an active interest in following the intellectual activities that led to the formation of the Royal Society. One of the volumes in his personal library was Thomas Sprat’s work on the *History of the Royal Society* (1667). For details on the lives and contributions of both Robert and John Newte, see < <http://www.devon.gov.uk/library/locstudy/bookhist/west37.html>>.

The sermon is entitled “The Lawfulness and Use of Organs in the Christian Church.” It constitutes a sustained vindication for the use of the organ in an ecclesiastical setting (Newte 1696).²⁶¹ The sermon is dedicated to the Right Reverend Father in God, Jonathan Lord Bishop of Exeter. The text of the Dedicatory Epistle begins with a short explanation of the events leading up to the present day:

My Lord,

WE Have at last, with your Favour and Encouragement, Erected an Organ in our Parish-Church: A thing which I have almost these Ten years endeavoured to do, and had once obtained the Recommendation of it from your Lordship’s worthy Predecessor, the late most Reverend Arch-Bishop of York.

Newte briefly recounts the difficulties that had to be surmounted during the years spent planning and constructing the Organ. He reflects that in the early days, it seemed that the ambitious undertaking was “Embraced and Subscribed to with great Affection by the whole Body of our Corporation.” However, as time went on, there were some who lacked sincerity, others who prosecuted vigorously, and even those who “under the Everlasting Pretence of the Badness of the Times” discouraged the design of the Organ. He reminds the Bishop that this is the first Organ to be built in the Diocese (outside of the city) since the destruction of Organs during the Great Rebellion. The Reverend believes that is “most proper” to dedicate this published sermon, which was delivered “to a very Numerous Auditory” on the day the Organ was first used, to the Bishop, whose presence provides safety and protection for the Church. He concludes this dedication with a blessing, an admonition, and an expression of hope for the future:

May you still go on with a Primitive Zeal and Courage to support this best Part of Christianity; For, if this be ever suffered to fall, we have too much reason to think, That little else but Anarchy and Confusion, if not Atheism and Profaneness, will quickly follow. Past Experience of this will, I hope,

²⁶¹ The Sermon is prefaced by an Epistle Dedicatory “To the Right Reverend Father in God, Jonathan Lord Bishop of Exeter.” It was signed on September 24. The text of the sermon is forty-four pages long, plus the four-page dedication. Photographs of St. Peter’s Church at Tiverton and the organ, built by Christian Smith and dedicated in 1696, can be seen online at <http://www.lodgehill.co.uk/ch_stpeters.htm> and at <<http://www.geocities.com/stpeterstivi/build.htm>>. According to the website, the instrument was rebuilt in 1867 by Henry Willis of London. Many of the pipes were retained and other materials were reused. The instrument still has its original case. Tradition holds that the conventional “Wedding March” adapted from Mendelssohn’s “Incidental Music for a Midsummer Night’s Dream” was first played on this organ in the 1840s.

sufficiently forewarn us against future Danger. And that the former may never again be tried, nor consequently the latter ever more be felt in our Land, is and shall be the constant Prayer and Endeavours of,

*My Lord,
Your Lordships
most Obedient and
most Faithful Servant*

Jo. Newte.

The sermon begins with a citation from the latter part of Psalm 150, Verse 4, which in the King James Version of the Holy Bible reads: "... praise him with stringed instruments and Organs." The Reverend Newte reminds his congregation that on those occasions when "holy David, the great Pattern for Adoration and Praise," was moved either by a signal from the "Hands of God" or by an "Impulse of the Spirit" to offer praise to the holy Name, or when he addressed the Lord "in Publick Prayer and Thanksgiving," he would often compose a Psalm.²⁶² David would then send for the "chief Prefect of his Choir," who would arrange the Psalm for "some Musical Instrument, suitable to the Occasion, to Elevate his Mind, and to Excite his Devotion." The Reverend quotes further from the Old Testament, this time from the text of I Samuel. He explains that on a certain occasion when David's predecessor Saul was possessed by an *Evil Spirit*, resulting in a deep Melancholy which had been instigated by the mischief of the Devil, the cure for the affliction was an application of music: "David took an harp, and played with his hand: so Saul was refreshed, and was well, and the *Evil Spirit* departed from him"(I Samuel 17:23). The Reverend admonishes his congregation to follow the example of David and to drive away the *Evil Spirit* of "Division, and Hatred, and Animosity" as well as "The Spirit of Anger, of Envy, of Malice, of Revenge, and other such disorderly and mischievous Passions, which this will be apt to drive from our Minds ...". Thus the proper remedy against evil spirits and passions propagated by the Devil is music. Based on Biblical support for the palliative effects of music, this argument contradicts the claims of dissenters who have in the past maintained that the Organ is an instrument of the Devil.

²⁶² The sermon quotations in this paragraph are taken from John Newte, "The Lawfulness and Use of Organs in the Christian Church," pp. 1-3.

The Reverend Newte proposes to illustrate in his sermon how the use of the Organ will provide the means for promoting peace of mind and for many other accomplishments, which he will proceed to describe. But first, he expresses his sincere gratitude to the congregation for its financial support. The “Pious and Exemplary Beneficence” on the part of the patrons has resulted in

erecting this stately and magnificent Structure of an *Organ*, now Dedicated to the Honour of God, the Service of his Church, and the Good of his People. By an happy Providence, is this again restored to that very Place, from whence the other, by Sacrilegious Hands, was sometime since, pull’d down and destroyed.

This is his explanation of the unfortunate events of history that led to the necessity for replacing the former instrument. It is followed by a proper acknowledgement to the generous subscribers, those who have “so freely contributed towards it.” Newte has no doubt in his mind that these charitable parishioners will find that their money has been “put to a very good Use” and that they will discover “a great Satisfaction” in the new Organ. He asks that the blessing of God might “Descend upon the Heads of those particularly, who have been the Encouragers and Promoters of it” (Newte 1696, pp. 3-4). Now the “Business of the Day” for the Reverend Newte is “to Assert the Lawfulness, and Recommend the Use” of the Organ, which is the greatest help to Devotion. The method by which he intends to proceed is the following (Newte 1696, p. 5):

First, I shall assert the Lawfulness of Music ...

Second, I shall shew the great Use and Advantages of it.

Thirdly, I shall Answer the most material Objections, which the Adversaries of the Church-Musick, have against this Practice, And

Lastly, I shall conclude the whole, with an Exhortation to you to stick heartily and devoutly to the performance of that Excellent Church-Service of ours, established in the Church of *England* ...

The first order of business is to “Assert the Lawfulness of Musick, both Vocal and Instrumental,” particularly the latter, and to show the proper place of music in the Divine Service, both in the present Christian Church and in the ancient Jewish worship service. This is a difficult task. He proposes to use the scholastic method of proof based on logical arguments from appropriate authorities: “Towards the Proof of which, I shall

draw some Arguments.” He makes his case by presenting five of these arguments, after which, he presumes, the lawfulness of the Organ “cannot well be called in question” (Newte 1696, pp, 6-18).

The first argument comes “From the Light of Nature and the Reason of the Thing.” From ancient times, musical expression has been inherent in the “Dictates of Natural Religion.” It is an innate characteristic that “Men were not so much Taught as Born to.” Music has been a part of “the general Practice of all Nations” around the world. It is well documented by the Scriptures, several verses of which are quoted in the sermon. He argues that even the heathen populations – the Greeks (as Homer attests), the Phrygians, the Egyptians, the Romans, and others – used music in their various styles of worship.

The second argument “From the Authority of the Scripture” shows that music was well established in the Jewish Church, having been instituted by the Prophet David. One of the strongest traditional arguments against the use of music was based on its absence from the Primitive Christian Church. To refute this claim, Newte maintains that it was only through necessity, not by choice, that instrumental music was lacking in the early Church. The obvious explanation is that the Primitive Christians were under persecution for three hundred years. Music would have posed a danger to the clandestine meetings during those times.

The third argument emerges “From the Sense of the Apostles in the New Testament.” For example, the Apostle Paul “recommends the use of Psalms and Hymns, and Spiritual Songs ...”. The sermon cites a number of other New Testament scriptures that attest to the tradition and usefulness of music in the Church.

The fourth argument comes from “the Opinion and Practice of the Reformed Churches, both at home and abroad.” Newte explains that music has had more than “a Thousand years standing in the Christian Church; and been Received and Approved of by the Reformed, as well as the Popish Churches ...”. In support of this argument, he notes that Luther himself had spoken in favor of music. Wherever it is politically possible, the more fortunate followers of the Lutheran doctrine “have the Exercise of Vocal and Instrumental Musick in the Worship of God; and where they have not this Advantage, ‘tis reckoned more their Unhappiness than their Choice.”

The final argument is based on “the Judgment of the most Eminent Men among those, who dissent from our Church in other Matters.” Some of the “Eminent Divines,” such as Mr. Baxter, who had separated from the Anglican Church, also spoke in favor of Organs and other musical instruments in the worship service. Newte enumerates Baxter’s list of five reasons for permitting their use. Among these, he points out that neither Jesus Christ nor the Scriptures spoke against music.

With these arguments concluded and the case established and proven in favor of the lawfulness of music, Newte proceeds to the second general topic, which is to show “the great Use and Advantages of it” (Newte 1696, pp. 20-30). Because there are so many of these, he finds it necessary to reduce the number to five:

1. It will regulate the untunable Voices of the Multitude and make the Singing in the Church more orderly and harmonious.
2. It will stir up the Affections of Men, and make them the fitter for Devotion.
3. It will compose their Thoughts, and drive away Evil Suggestions from their Minds.
4. It will prepare them for the being better Edified in the Divine Service they are about.
5. Lastly, It will make the whole Service of God be the more Solemn and August, and the People more Serious and Reverential, when they are at it; and more Silent and Grave at their coming in, or going out of the Church.

The sermon expounds upon each these uses and advantages. Newte even garners literary support from the “Prophane Authors.” Alexander the Great, for example, could be worked into a fit of rage, ready to grab his sword for combat, at the sound of certain music. The sermon also relates that Homer tells of Agamemnon, who at the height of his fury was appeased by music. The Greeks were careful to teach music to their children as part of their education. Pythagoras “did mollifie fierce Minds by Musick” and Xenocrates was able to “cure Mad-men by the same means.” However, as Newte is careful to make clear, he is hopeful that no one is presently in need of such experiments. These secular authorities, and others that are mentioned in the sermon, lend their support to his argument for the “Use and Advantages” of Organ music. He calls on one additional authority, St. Augustine, who among his Confessions speaks in favor of

Church-Musick. With this last and most significant endorsement in place, Newte has offered sufficient proof in the matter. He concludes his argument from authority.

The last advantage of the Organ is a pragmatic issue. The instrument makes the whole service more solemn, because the people are “more serious and Reverential when they are at it; and more Silent and Grave at their coming in or going out of the Church.”

The *Voluntaries* played on the Organ at this time serve a practical purpose:

This sort of Musick, is either made just before the Service begins, which seems a very proper time for it, to engage the Congregation to a serious Thoughtfulness, and to a civil Deportment and Behaviour, when they are taking their Places, and about to enter upon the most Solemn Acts of Religion in the Worship of God.

In addition to being heard during the times for coming in and going out, the Organ is also played following the reading of the Psalm and before the reading of the Lessons for the purpose of bringing about a “reverential awe upon our Spirits” and also “to melt us into a fit Temper to receive the best Impressions from the Word of God.” Finally, at the conclusion of the service the Organ must assume one remaining responsibility, which is “to take off some little whispering Disturbances, through the Levity of some People, and to drown that ungrateful rushing Murmur and Noise which the stirring of so many People together, at that time of going out of the Church, must occasion.”

The House of God ought to be a quiet and reverent place, and it is the designated task of the Organ to help make it so. Nothing should be heard “but the Word of God, and the Voice of humble Supplicants; the Prayers of the Devout, and the Praises of such as be joyful in the Lord.” By playing appropriate music at proper times, the Organ contributes to the mood of the congregation. Newte has one more thing to say on this matter, rather as an aside:

And therefore by the way, the indecent Noise which is too often made by the opening and clapping fast of Pew-doors (a reason why anciently Seats in the Church had no Doors to them) and the nauseous Rawkings, and unnecessary Coughing and Spitting, which are made by the People, though little regarded, come within the Censure of a Disturbance, and may doubtless in a great measure be avoided, if they be not at that time very much indisposed for Civility as well as Devotion (Newte 1696, pp. 30-31).

It does not seem to be so much Newte’s intent to suggest that the Organ should mask these indecent noises as that it should keep the congregation in such a calm and

worshipful mood that they would not find it necessary either to cause or to be disturbed by these rude distractions. With the conclusion of these extraneous comments, Newte has shown and at the same time hopes that he has “in some measure proved, The Use and Advantages, as well as the Lawfulness of Organs in the Christian Church.”

He moves on to the third topic, which is to the extent possible to remove the prejudices and answer the objections of the adversaries of Church music. Otherwise, his previous arguments will have been in vain. The “Principal Objection” against the use of music is that it is part of a Jewish Ceremony that ought to have been done away with by the coming of Christ, as was the case with the other Ceremonies of the Hebrew Law. Newte counters this objection by arguing first of all that the “Institution of Musical Instruments in the Service of God” was never a part of the Ceremonial Law. He supports this argument with an exegesis of several passages from the Old Testament. Secondly, if it had been a component of the Hebrew Ceremonial Law, it would have been eliminated by the coming of Christ and the teachings of the New Testament as “those other Typical Things were” (Newte 1696, pp. 31-36).

The next objection maintains that it is not by means of “External Ceremonies” and the “outward Formality” of the Jews that Christians worship God. Instead, Christians worship “in Spirit and in Truth.” For this reason, some have argued, instrumental music is detrimental to worship and ought to be abolished. To counter this argument, Newte answers “That it is no way Repugnant to the most Spiritual Worship whatsoever.” On the contrary, it is important for the congregation to know that the playing of instruments in the service “tis highly advantageous to make the Christian Worship the more Spiritual, and to stir up the Affections of the Soul ...”.

There are lesser objections as well, but they “scarce deserve a serious Answer.” One of these is simply that “*They don’t like it and they shall never endure it.*” The Reverend has little patience with this trite and trivial objection. “Such a Dislike argues a morose, sowre, and ill-natur’d Disposition, or else a stupid, dull and heavy Temper, and that in no small degree neither.” For those possessed with a manner of disposition such as this, he prescribes “Church-Musick” as the best means to a cure.

With these sundry objections now soundly dismissed, Newte arrives at his final point. As he moves toward a conclusion, he exhorts the congregation to “stick heartily

and devoutly to the Performance of that Excellent Church-Service” that has been established by the Church of England. He praises the Worship Service as the best means to have a happy life on earth and to gain entrance into Heaven. This is surely Glory of the Reformation, and against it “Let neither the Malice of Devils, nor the Policy of *Rome*, nor the Craft of *Geneva*, be ever able to prevail ...” (Newte 1696, p. 37).

In summary, Newte speaks again of the many benefits of instrumental music and the art and beauty of the singing the psalms. Finally, perhaps glancing at his watch,²⁶³ he informs the members of the congregation that he does not wish to detain them any longer “from the grateful Harmony which is to follow, through the Excellency of our Organ, and the Sweetness of so many well tuned Voices as joyn in Consort with it.” He brings the sermon to a conclusion with the calm reminder that by means of “Peace, Unity and Agreement,” the congregation can ultimately hope to enter Heaven, there “to sing Eternal Praises and *Hallelujahs* unto him that sitteth upon the Throne, and to the Lamb for evermore. *Amen*” (Newte 1696, pp. 42-44).

After preaching his dedicatory sermon, Newte was accused by the Puritans of being Popish. However, this accusation was ill founded. As a “high-church” Anglican, he was opposed to the religious views of both the Catholics and the Dissenters. His religious and philosophical arguments were intended to counter the same set of Puritan ideals that had been presented to the public in “*The Holy Harmony: or, A Plea for the abolishing of Organs and other Musick out of the Protestant Churches of Great Britain, and demolishing of superstitious and idolatrous Monuments.*” That document had appeared in 1643, over half a century earlier. The debate was still unsettled, as is evidenced by the fact that a second edition of Newte’s sermon was printed in 1701.

Writing in 1776, in the midst of a discussion on the revival of the choral service at the time of the Restoration, Hawkins refers to this sermon briefly in a footnote. He mentions that at the close of the seventeenth century,

²⁶³ Various decorative mechanisms were already available to show the minutes on a watch, but beginning in the 1690s, second hands were added as well. However, writes David Landes, “one has the impression that the seconds dial served primarily to tell the user that the watch was going. (This is what it still does today.)” Quoted from *Revolution in Time* (Landes 1983, pp. 129-30). Even though long sermons were the norm in the seventeenth century, the members of the congregation at Tiverton Parish Church were very likely checking their own watches by this point to make sure they were still running!

upon occasion of erecting an organ in a parish church at Tiverton, in the county of Devon, a sermon was preached by one Mr. Newte, which was remarked on in an anonymous pamphlet, entitled 'a letter to a friend in the country concerning the use of instrumental music in the worship of God, 4to. 1698. To this letter the preacher replied in the preface to a treatise by the learned Mr. Dodwell on the lawfulness of instrumental music in holy offices, 8vo. 1700. The preface and the tract that follows it contain a full and decisive vindication of the practice in question, and so far prevailed with some of the more moderate of the Dissenters, that Dr. Edmund Calamy was once heard to say that in his Meeting Place in Long Ditch, Westminster, he should have no objection to the erection of an organ (Hawkins [1776, 1853] 1963, vol. II, p. 689).²⁶⁴

In spite of the Reverend Newte's "full and decisive vindication" of the use of organs in the service of worship in the year 1696, concern over the "lawfulness of instrumental music in holy offices" remained a matter for public dispute until well into the eighteenth century. Nevertheless, the reconstruction continued in cathedrals and parish churches. At the same time, organ builders were paying increasing attention to innovations in organ tuning and design. A notable outcome of Harris' defeat at the Temple Church was his persistence in trying to find new ways to compete with Smith. He was especially interested in solving the problem of temperament. The story of his search for a mathematical foundation for tuning the organ emerges from a series of publications, beginning with a response by John Wallis to a question concerning the division of monochord.

On March 5, 1698, Wallis read before the Royal Society a paper entitled "A Question in Musick lately proposed to Dr. Wallis, concerning the Division of the Monochord, or Section of the Musical Canon: With his Answer to it."²⁶⁵ The question put before Wallis can be expressed as follows: Given that the string of any musical instrument, when divided in half, produces an octave consisting of twelve semitones, and that the frets are geometrically spaced, ranging from closer together at the bridge to

²⁶⁴ Since this footnote is the only reference Hawkins makes to the sermon by "one Mr. Newte," he apparently did not have access to the text. Henry Dodwell was "a notable high-church man" who was probably a personal friend of Newte. His publication was entitled "A treatise concerning the lawfulness of instrumental music." See <<http://www.devon.gov.uk/library/locstudy/bookhist/west37.html>>

²⁶⁵ For the full text of the letter, see *Philosophical Transactions (1683-1775)*, vol. 20, no. 238 (March 1698), pp. 80-84. Wallis sent the original letter back to Pepys after it had been sent to the printer and had been returned to him, along with a copy of the proof, which Wallis was to revise. Wallis kept the original and returned the revised sheet to the printer. Pepys wrote a thank you note to Wallis from Oxford on October 15, 1698.

farther apart at the nut or head, then “How is it possible, from the foresaid Hypothesis, to divide the other 11 Semi-tones, in their due Proportion, and to demonstrate the same.”²⁶⁶ The philosophical predicament at hand concerns the ongoing and controversial issue of temperament. The question of temperament had posed a fundamental problem, unique to Western tonality, at least since the age of the Renaissance, and the solution was long in coming. *The New Grove Dictionary of Music Online* provides a hint of the difficulty faced by a non-musician mathematician such as Wallis:

A casual reading of Renaissance and Baroque treatises will yield misleading clues as to contemporary practices. The prestige of the traditional, neo-Pythagorean concept of music as ‘sounding number’ led quite a few writers who were not musicians - [the list includes Wallis] - to describe theoretical schemes that one should beware of taking as a mirror of contemporary musical norms. Other, more musicianly writers, who may have been alert to very fine nuances of current tuning, were ill-equipped mathematically to describe them in a quantitatively coherent and accurate way.²⁶⁷

This inability to identify a single individual who was trained to understand the mathematical basis of music theory and at the same time could distinguish by ear the “very fine nuances” of contemporary applied music is exactly the problem that had vexed Pepys in his discussions with the composer Birchensha and the organist Hingston.

Wallis, being rather more mathematically than musically equipped to deal with the problem, responded to the reader by first giving his own account of the traditional Pythagorean system of ratios based on whole numbers. An open string, stopped in the middle, produces the octave, with a ratio of 2 to 1. The fifth has the ratio of 3 to 2, and the fourth, 4 to 3. A tone is the difference between a perfect fourth and a perfect fifth. However, when an octave is divided into twelve hemi-tones, or six whole tones, “this is not to be understood according to the utmost Rigour of Mathematical Exactness” because mathematically, six such tones add up to somewhat more than an octave. Although the hemi-tone is slightly greater than one-twelfth of an octave, as Wallis claimed, “the Difference is so little, that the Ear can hardly distinguish it.” This division of the scale is accurate enough for “placing the Frets on the Neck of a Viol, or other Musical

²⁶⁶ There is no name associated with this question to which Wallis is responding.

²⁶⁷ See the article on “Temperaments” in *The New Grove Dictionary of Music Online*.

Instrument; wherein a greater Exactness is thought not necessary.”²⁶⁸ For Wallis, exactness was a matter of concern to the mathematical theoretician, not the applied musician.

This review of commonly understood music theory brought Wallis around to the original question, which was to determine how to find a more exact method for spacing the frets on the fingerboard of a viol in order to achieve just intonation. He produced a series of calculations based on the multiplication and division of ratios, the results of which he thought might be of use for “Chromatick and Enarmonic Musick.”²⁶⁹ However, he concluded that there was no need of them, because with “those Sorts of Musick, having been long since laid aside, there is now no need of these Divisions, as to the Musick now in use.”²⁷⁰ In essence, Wallis believed that mathematical rigor was unnecessary for tuning an instrument because the human ear was not sufficiently sensitive to recognize the finely tuned difference.

In spite of the fact that one of the most intricately contrived mechanical devices of the day appeared to be of marginal interest behind the closed doors of the Royal Society, there were publicly advertised experimental trials being conducted with this instrument elsewhere in London. On April 12, 1698, the following advertisement appeared in the *Post Boy*:

Whereas the Division of half a Note (upon an organ) into 50 Gradual and distinguishable parts has been declar’d by Mr. Smith, as also by the generality of Masters to be impracticable: All Organists, Masters, and Artists of the Faculty, are together with the said Mr. Smith, invited to Mr. Harris’s house in Wine Office Court, Fleet Street, on Easter Monday next at Two of the clock in the Afternoon, to hear and see the same demonstrated (Hopkins and Rimbault [1855, 1870, 1877] 1987, vol. 1, p. 125).

²⁶⁸ For these quotations, see Wallis’ “Answer” in *Philosophical Transactions (1683-1775)*, vol. 20, no. 238 (March 1698), pp. 81-82.

²⁶⁹ The chromatic scale makes use of musical accidentals (sharps and flats). The current standard definition of “enharmonic” refers to the use of different notation, for example F-sharp, E-double-sharp and G-flat, to indicate the same pitch in the tempered scale. However, at the time Wallis was writing, there were slight differences in pitch. These musical terms, derived from the Greek, had been introduced into the English language around 1590-1600. The harmonically curious reader is encouraged to perform a web search on “enharmonic” to hear samples of modern experimental tonalities.

²⁷⁰ From the concluding paragraph to Wallis’ “Answer” in *Philosophical Transactions (1683-1775)*, vol. 20, no. 238 (March 1698), pp. 84.

Harris held high hopes that the entire community of musicians, including his most significant competitor, Mr. Smith, would be present at his workshop to witness the results of his experiment.

According to Harris, his experiment to divide a half note into fifty recognizable segments was well received. Harris was sufficiently encouraged with the results to proceed to the next phase, the division of a half note into one hundred parts. On April 30th, another advertisement appeared in the same paper, inviting all interested parties to witness an experiment whereby a half note would be divided into a hundred parts. With this innovation, Harris was pushing the physical limits of organ design. Significantly, this experiment at his private home would be open to all interested observers, not just the artistic community.²⁷¹ The epistemological authority for the success of this experimental division of the chromatic spectrum was to be the musically trained ear of Harris, not the theoretically informed mathematics of Wallis.

Whereas the Division of half a note (upon an organ) into 50 Gradual and distinguishable parts, was performed by Mr. Harris on Easter Monday to the full satisfaction of the Persons of Quality and Masters that were present: And Whereas the said Mr. Harris intends a further Division of half a Note, viz., into One Hundred parts (and this, as before, not mathematically, but purely by the Ear), all Masters and others of curious and Nice Ears are invited to the said Mr. Harris's House, in Wyne office Court, Fleet Street, on the 10th day May, at Three of the clock in the afternoon, to hear and see the Performance, and to be informed (if any doubt) of its usefulness (Hopkins and Rimbault [1855, 1870, 1877] 1987, vol. 1, p. 125).²⁷²

While Harris publicly claimed that his first experiment was performed “to the full satisfaction” of his witnesses, unfortunately there seems to be no known record of the outcome of this second experiment.

The organ builder's next step was to approach the Royal Society. In July of 1698, *Philosophical Transactions* published an article-length document entitled “*A Letter of Dr. John Wallis to Samuel Pepys Esquire, relating to some supposed Imperfections in an Organ*” (Wallis 1698, pp. 249-256). Although the protocol is not entirely clear from the

²⁷¹ “The showing of experimental phenomena in public spaces to a relevant public of gentlemen witnesses was an obligatory move in that setting for the construction of reliable knowledge” (Dear 1997, p. 304).

²⁷² Rimbault, who wrote the historical portion of the three-volume treatise on *The Organ*, has nothing more to add to the text of these advertisements, except to say, “It would be interesting to know more of these trials, but nothing appears on record, as far as I have discovered.”

historical record, it appears from the text of the first paragraph of this letter that Renuart Harris had made a prior inquiry to the musically-minded Pepys and that Pepys had introduced him to the mathematician. Harris consulted with Wallis concerning the matter of a methodology for tuning the organ in a manner that would overcome the difficulties inherent in the division of the diapason.²⁷³ In other words, the problem was a question of temperament. During their discussion, Wallis found the organ-maker to be quite knowledgeable in the skills of his profession.²⁷⁴ Afterwards, he wrote his response to Pepys from Oxford on June 27, 1698. The only mention of Harris by name occurs in the introductory sentence. The letter begins:

Mr. *Harris* an Organ-maker (whom I find, by the little discourse I had with him, to be very well skilled in his profession) was lately with me, as by direction from you, to ask my opinion about perfecting an Organ, in a point wherein he thinks it yet Imperfect (Wallis 1698).²⁷⁵

With fashionable literary deference, Wallis expressed his appreciation to Pepys for valuing his opinion so highly on a topic about which he claimed to know so little. “‘Tis an honour you please to put upon me, to think my opinion considerable in a thing wherin I am so little acquainted as that of an Organ” (Wallis 1698, p. 249).²⁷⁶ He

²⁷³ The diapason is the organ stop that produces the fundamental tone of the instrument (Audsley [1921] 1978, p. 84). The term can also be used, as it is here, to signify a musical octave. “Organ stop” refers to a graduated set (rank) or sets (ranks) of pipes that produce the same kind or quality of tone. The term also applies to the stop knob or draw knob that is manipulated to control the sounding of the pipes in a stop. Audsley describes the term “diapason” as “the word employed by the early English organ-builders, and commonly qualified by the prefix OPEN, to designate the stop yielding the foundation tone of the Organ; and which has been retained, to the present day” (Audsley [1921] 1978, p. 84). He adds the comment, “As a name for an organ-stop the word does not seem highly appropriate, and we much prefer the more expressive one, PRINCIPAL; but it is not likely that the time-honored word will ever be altogether abandoned” (Audsley [1921] 1978, p. 85). The pipes of the diapason are cylindrical, and “when properly made are of good pipe-metal, of ample thickness to withstand firmly the vibrations of the air within them while speaking” (Audsley [1921] 1978, p. 85).

²⁷⁴ Given the Oxford mathematician’s professional opinion of himself, this statement is indeed praise from Caesar. Mordechai Feingold notes that Wallis’ autobiography reflects “his somewhat arrogant and conceited nature which, by all accounts, led him from one controversy to another throughout his long life” (Feingold 1984, p. 87). Wallis, in his response on behalf of Renuart Harris, does in fact expound upon his professional expertise, but he had been requested to do so. However, his tone of respect for Harris prevents him from appearing to be arrogant or conceited.

²⁷⁵ Since numerous references to music, organs and organists appear in Pepys’ Diary, and he was known to be a music-lover, it is likely that Harris asked Pepys for an introduction to Wallis.

²⁷⁶ Although Wallis invoked a socially appropriate rhetoric in this introductory passage, he was probably speaking the truth with respect his expertise on the organ. His knowledge of music seems to have been purely theoretical, not applied. Wallis came from a Puritan background, having taken degrees from Emmanuel College at Cambridge, a Puritan institution. He also supported the Puritan cause during the Civil War. It is possible that his Puritanism accounted for the fact that he was “so little acquainted” with

continued by explaining to Pepys that the appropriate vocabulary was not well known to him and that he could not speak intelligibly in the language of organists and organ-builders. Therefore, Wallis preferred to avoid the unfamiliar terminology of both the art of organ playing and the craft of organ making and move directly to the point.²⁷⁷

I do not pretend to be perfectly acquainted with the Structure of an Organ, its several Parts, and the Incidens thereunto; Having never had Occasion and Opportunity to inform myself particularly therein. And, for the same reason, many of the Words, Phrases, Forms of Speech, and Terms of Art, which are familiar to Organists and Organ-makers, are not so to me.” Which therefore I shall wave; (For till we perfectly understand one anothers Language, it is not easy to speak intelligibly;) and apply my self directly to what is particularly proposed.²⁷⁸

Renatus Harris had brought up once again the perplexing issue of temperament. Wallis had explained it on March 5, 1698, in his answer to the question concerning the tuning of the monochord, but he reviewed classical Greek harmony again, this time in much more detail. He explained that there were two sects of musicians, the Aristoxenians, whose tuning system depended to some degree on the ear, and the Pythagoreans, who relied not on aural intervals but rather on mathematical proportions. He wrote that later attempts at a proper division of the octave or diapason were made, including those by Euclid and Ptolemy.²⁷⁹ There were many other ways as well, wrote Wallis, but he chose not to trouble the recipient of the letter, Samuel Pepys, Esquire, with any further explanation. However, there remained a difficulty for the organist:

the organ, although this is not necessarily a valid explanation for his expressed ignorance. Being a Puritan was in itself an insufficient cause for his lack of familiarity with the instrument. Many Puritans cultivated music and objected only to the inappropriate use of the organ in worship, not to the instrument itself. A classic example is John Milton, who was an organ lover. For more on the topic of Puritans and music see Scholes (1962).

²⁷⁷ The conceptual categories of the organ maker are incommensurable with those of the mathematician. Very briefly, Wallis enumerates and defines common musical terms as he understands them: pipe, pitch, flatness, sharpness, concord and discord. Then he shifts to a different linguistic paradigm, one more familiar to a classical mathematician. For the remainder of his letter he relies on the conceptual categories that are familiar to him from his theoretical study of Greek music. On the matter of incommensurability, there is a strong similarity between this paragraph and the work of Thomas Kuhn in *The Structure of Scientific Revolutions*, 3rd ed., (Chicago: University of Chicago Press, 1996).

²⁷⁸ Wallis now turns from the organ itself to the theoretical problem at hand. See John Wallis, “A Letter of Dr. John Wallis to Samuel Pepys, Esquire, relating to some supposed Imperfections in an Organ,” *Philosophical Transactions (1683-1775)*, vol. 20 (1698), p. 249; ©2001 JSTOR; <<http://www.jstor.org>>.

²⁷⁹ Burney writes of Ptolemy: “Some parts of his disputes and doctrines are now become unintelligible, notwithstanding all the pains that our learned countryman Wallis bestowed on him near 100 years ago ...”, adding that Ptolemy “seems to have been possessed with an unbounded rage for constructing new scales, and correcting those of former times.” See Burney [1776-1789, 1935] 1957, vol. 1, pp. 355-356).

Whereby it comes to pass, that each Pipe doth not express its proper Sound, but very near it, yet somewhat varying from it, Which they call *Bearing*. Which is somewhat of Imperfection in this Noble Instrument, the Top of all (Wallis 1698, p. 253).²⁸⁰

The significant question was the following: “Why may not the Pipes be so ordered, as to have their Sounds in just Proportion, as well as thus *Bearing*?” (Wallis 1698, p. 254).²⁸¹ Wallis answered, “It might very well be so, if all Musick were Composed to the same *Key*, or (as the Greeks call it) the same *Mode*.” If that were the case, he explained, then “the Pipes might be ordered in such proportions as I have now designed” (Wallis 1698, p. 254. However, the difficulty was that musical compositions were being written in a number of different and distinct *Modes* or keys, the tonalities of which varied from one to another. “Whence it is, that the same Tune sounds better at one Key than at another” (Wallis 1698, p. 254).²⁸²

The next appropriate question to ask was, “Whether this may not be remedied; by interposing more Pipes; and thereby dividing a Note, not only (as now) into *Half-notes*, but into *Quarter-notes* or *Half-quarter-notes*, &c.” In essence, Wallis’ response was that the imperfection was destined to remain:

It may be thus remedied in part; (that is, the Imperfection might thus be somewhat Less, and the Sounds somewhat nearer to the just Proportions:) but it can never be exactly true, so long as their Sounds (be they never so many) be in continual proportion; that is, each to the next subsequent in the same Proportion (Wallis 1698, pp. 254-255).

Wallis’ conclusion was that first of all, from a mathematical perspective, the theoretical project Harris proposed could never work. Secondly, from a practical point of view, the instrument would be much too expensive, because the

vast number of Pipes (for every Octave) would vastly increase the Charge. And (when all is done) make the whole impracticable” (Wallis 1698, pp. 254-255).

With his extensive mathematical explanation accomplished and his conclusion reached, Wallis apologized for the length of the letter. However, he thought it necessary to continue writing in order “to give a little intimation of the Ancient Greek Musick

²⁸⁰ *Bearing* is the variance from the true pitch of a note that has been tuned to conform to temperament.

²⁸¹ Thus the question is, can the organ pipes be tuned so that *bearing* is commensurate with *just intonation*.

²⁸² Equal temperament ultimately solved, to the extent possible, this tuning predicament.

compared with what is now in practise ...” (Wallis 1698, p. 255). He noted that in vocal music, the ear directs the voice to the appropriate pitch. In string music, “straining and slackening the Strings or moving the Frets” can accomplish the same effect. “But, in Wind Musick, the Pipes are not capable of such corrections; and therefore we must be content with some little irregularity therein ...” in order to accommodate compositions in different keys (Wallis 1698, p. 256). The final paragraph summarized both the question and the answer:

Now the Design of Mr. *Harris* seems to be this; either (by multiplying intermediate Pipes) to bring the Organ to a just Perfection: Or else (if that cannot be done) to rest content with the little Imperfection that is; which though, by more Pipes, it may be somewhat abated, yet cannot be perfectly remedied. And in this I think we must acquiesce (Wallis 1698, p. 256).

Even the founding fathers of acoustics had been unsuccessful in attaining such harmonic perfection with their mathematical doctrine of musicology. It is likely that long before the time of Pythagoras, the octave, fifth, and fourth were already recognized as musical consonances. In his early work, Pythagoras is believed to have performed experiments based on auditory judgment for determining consonance. He is thought to have used this sensory data as an observational guide for establishing a system of corresponding ratios. This identification of the known consonances with a set of ratios based on whole numbers was his major contribution to music theory. In later years, however, the Pythagorean philosophers “lost faith in the evidence of the senses as a criterion of judgment and sought to interpret all phenomena as manifestations of mathematics” (Hunt 1978, pp. 10-11).²⁸³ This “dualistic interplay between numerical relations and auditory sensations,” which Pythagoras had relied on in the early days of the science of music, was abandoned in favor of a purely rational system of mathematics (Hunt 1978, p. 28).

For Plato as well, “harmonics” or “canonics” meant nothing more than a branch of mathematics. Both Aristotle and Euclid continued to locate music within the mathematical tradition. It remained for Aristoxenus, a pupil of Aristotle, to “cast himself

²⁸³ For an account of “The Arithmetic of Consonance” in the early history of acoustics, see Hunt (1978, pp. 10-18).

in the role of a musical reactionary” (Hunt 1978, pp. 28-29).²⁸⁴ He believed that music theory required a certain amount of subjective dependency upon the sense perception of an auditory stimulus. Mathematics alone was insufficient. Burney wrote that music was indebted to Aristoxenus

for the invention of a method which it must be allowed left every thing to the guidance of the ear, uncertain as it may be, than to those mathematical speculators who furnished it with so many accurate and demonstrable rules for being *infallibly* out of tune (Burney [1776-1789, 1935] 1957, vol. II, p. 357).

Indeed,” continued Burney in a footnote, “it is probable, that among the ancients, as well as the moderns, many such untuneable divisions, served more to amuse Theorists, than to guide practical Musicians” (Burney [1776-1789, 1935] 1957, vol. II, p. 357).

As Wallis explained, the “ordinary practical Musicians” spoke of notes and half-notes, just as Aristoxenus did, as if the whole notes had equal value and the half-notes were exactly half of the whole notes:

The two Eminent Sects amongst them, the *Aristoxenian* and the *Pythagorian*, differ much at the same rate as doth the Language of our ordinary practical Musicians, and that of those who treat of it in a more Speculative way” (Wallis 1698, p. 255).

The Pythagorean approach had more appeal to “speculative” mathematical philosophers, who “changed the notion of *Equal* Intervals into that of *due* Proportions.” In this group he included Zarlino, Kepler, Descartes, and others who would “declare themselves to be understood more nicely” than those ordinary musicians who spoke only in terms of whole and half-notes. Wallis clearly positioned himself in the “speculative” category. Wallis ultimately concluded that the mathematical precision Harris sought for the tuning of the organ could not be achieved within the realm of practicality.

Some years later, Harris presented himself to the public again, this time taking advantage of a new literary medium. The *Spectator* was an innovative and highly influential periodical published by Joseph Addison and Richard Steele during the years

²⁸⁴ Like Pythagoras, Aristoxenus originally believed that “both auditory judgment and numerical ratios should be considered in musical theory” (Hunt 1978, p. 28-29). However, he found it difficult to sustain the classical golden mean in this matter.

from 1711 until 1714. On December 3, 1712, the *Spectator* published the following proposal, which had been submitted for publication by Mr. Renuus Harris, organ-builder:

The ambition of this artificer is to erect an organ in St. Paul's cathedral, over the west door, at the entrance into the body of the church, which in art and magnificence shall transcend any work of that kind ever before invented. The proposal in perspicuous language sets forth the honour and advantage such a performance wou'd be to the British name, as well that it would apply the power of sounds in a manner more amazingly forcible than perhaps has yet been known, and I am sure to an end much more worthy. Had the vast sums which have been laid out upon operas without skill or conduct, and to no other purpose but to suspend or vitiate our understandings, been disposed this way, we should now perhaps have an engine so formed, as to strike the minds of half a people at once in a place of worship with a forgetfulness of present care and calamity, and a hope of endless rapture, joy, and Hallelujah hereafter (Hawkins [1776, 1853] 1963, vol. II, p 692).²⁸⁵

Harris had in mind a truly innovative design. Knowledge of this monumental project comes from an undated proposal that he submitted to St. Paul's Cathedral, probably sometime shortly before this advertisement appeared in the *Spectator*. It was his intention to erect an organ over the West Door, at the entrance into the Church:

This ORGAN shall contain a double double Diapason, the Profundity of which will comprehend the utmost Notes of Sound. In this Stop shall be Pipes forty Foot long, and above two Foot Diameter; which will render this Organ vastly superior in Worth and Value to the other Diapason Organs; and that the rest of the Work may bear a due Proportion, it shall consist of six entire Sets of Keys for the Hands, besides Pedals for the Feet.²⁸⁶

The proposal describes each of the six sets of keys. The first manual would constitute a "grand Chorus," the strongest and firmest ever made. The second and third would encompass the sounds of all of the musical instruments. The fourth would likely have the pipes enclosed in a wooden box to "express the Eccho's." The fifth would be a Chair or small Organ, but even so would "contain more Pipes, and a greater Number of Stops, than the biggest Organ in *England* has at present." Finally, the sixth would "express Passion by swelling any Note, as if inspir'd by Human Breath." Harris intended to

²⁸⁵ Hawkins quotes this text from the *Spectator*, No. 552, December 3, 1712.

²⁸⁶ The text of the Harris Proposal for St. Paul's Cathedral, with annotations and suggested stop lists provided by Stephen Bicknell, is available at <<http://www.users.dircon.co.uk/~oneskull/3.6.17.htm>>. See also Bicknell ([1996] 1998, pp. 148-151). The only known copy is in St. Paul's Cathedral Library.

incorporate a swell mechanism, which had only recently appeared in England. “Sounds will come surprizing and harmoniously, as from the Clouds, or distant Parts, pass, and return again, as quick or slow as Fancy can suggest; and be in Tune in all Degrees of Loudness & Softness.” No stop list survives for this six-manual and pedal organ.²⁸⁷

When Harris decided to make publicly available the news of his great ambition, he did so with the calculated intent of seeking support from a wide audience of readers whose interests reflected a diversity of cultural activities. Apparently, he failed in this attempt. His imaginative design was never implemented. Nevertheless, it was a grand and glorious scheme. “Almost more important that what Harris actually achieved are the things he wanted to do, but was never able to accomplish, at any rate beyond the experimental stage” (Clutton and Niland 1963, p. 79).

The story of Renatus Harris is not complete without mention of one particular event from the last chapter of his life – a rather unhappy final note to a turbulent but highly successful professional career. Renatus, with the assistance of his son John Harris (c.1677-1743), completed an organ at St. Dionis Backchurch in London during the year 1724 (Clutton and Niland 1963, p. 218). This was the last instrument Renatus built. The son seems to have experienced financial difficulties resulting from working with his father. It appears that John was not properly reimbursed for his part of the work. On August 11, 1724, he sought recourse in a letter to the “Gentlemen of St. Dionis Backchurch.”²⁸⁸ As John explains the situation, there had a prior disagreement between father and son, although the exact circumstances of that incident are not revealed in the letter. He is especially worried that his father will dispute his claim:

Being apprehensive that when you acquaint my Father, with my Bequest to you, he will pretend he is not in my Debt, because of an affair between us ...

Here John refers briefly to an undisclosed difficulty related to his work with his father on an earlier occasion. He then addresses the matter at hand. “I beg leave to sett it

²⁸⁷ Christopher Dearnley observes that this is the first suggestion of the use of pedals in an English organ Dearnley (1970, p. 167). The first authentic use of pedals occurred with the Harris and Byfield organ built for St. Mary Redcliffe, Bristol, in 1726. (This instrument would have been built by John Harris.)

²⁸⁸ See Harris, “Letter from John Harris to the Gentlemen of St. Dionis Backchurch, August 11, 1724” (Guildhall Library MS 11, 276A). According to a statement made by the library archivist in June of 2001, the Guildhall Library had just recently received this letter. There is no reference to this debt in any of the other materials listed in the Bibliography.

in a true light,” John writes, petitioning for payment of at least “fifty pounds, toward discharging the Debts due to me, from my Father; Otherwise, I shall suffer the greatest hardship imaginable ...”. John writes persuasively of his plight. His immediate concern is that his wife is with child and has not been at all well. Describing the details of this unfortunate situation to the Gentlemen of the Church, John writes “alsoe of the Dangerous condition of my spouce, who has been long ill, and is very near her Lying Inn.”

Apparently, the letter was sympathetically received. A little more than a month later, John was paid not only for “some additions” to the organ but also for providing maintenance over the next five years. A footnote in Hopkins and Rimbault indicates that according to the parish ledger, on September 18th, 1724, the sum of £52 10s. was paid to “Jno. Harris for some additions and to take care of it for five years” (Hopkins and Rimbault [1855, 1870, 1877] 1987, vol. I, p. 134). It is not quite clear whether these “additions” refer to the work for which payment was requested or imply newly contracted work, but in any case it is obvious that the Gentlemen of the Church were responsive to Harris’ plea and that his petition soon yielded financial reward. This poignant letter confirms the opinion long held by organ historians concerning the complex, egocentric personality of Rhenatus Harris. It also indicates that near the end of his life, Harris was unwilling to meet his financial obligations to his son, although there is no implication in the letter that he could not afford to do so.

Although Hopkins and Rimbault note that “Rhenatus Harris died in or about the year 1715; and his latest organ seems to have been that in St. Mary’s Church; Whitechapel” (Hopkins and Rimbault [1855, 1870, 1877] 1987, p. 127), this date is nine years premature. Harris died in 1724 (Bicknell [1996] 1998, p. 158). The son’s letter proves that the father was alive and at least well enough to be cantankerous as late as August of that year. John Harris “seems to have been much involved in the construction of the St Dionis Backchurch organ” (Bicknell [1996] 1998, p. 158).²⁸⁹ His petition to the Gentlemen of the Church proves that this was indeed the case.

²⁸⁹ According to Bicknell ([1996] 1998, p. 142), John Harris may have been responsible for making some of the pipes that have been preserved from this instrument. They are crafted in eighteenth-century style. These particular pipes remain in storage at the workshops of Noel P. Mander, Ltd.

The death of Renatus Harris, which coincided with the construction of his last instrument at St. Dionis Backchurch, brings to a close this case study of the ecclesiastical organ's symbolic and physical struggle for survival in the competing social systems of early modern England.

Chapter 5 – Summary and Conclusions

From the age of Classical Antiquity until the onset of the Industrial Revolution, the pipe organ could claim recognition as one of humanity's most sophisticated mechanical achievements. However, during the era of the Protestant Reformation in early modern England, this musical instrument suffered from a lengthy period of religious and political persecution. Because it symbolized much that was despised in the ritual of the Roman Catholic Church, when the Reformers abolished the superstitious trappings of Catholicism, they demolished the ecclesiastical organ as well. Furthermore, not only was the organ identified with popery, it was also associated with paganism. The organ's heathen ancestry played a significant role in the Puritan perception that this pagan artifact should not be incorporated into the service of Christian worship.

In the first chapter, I have described the pre-Christian social context out of which the King of Instruments emerged. Ctesibius' invention of the hydraulis exemplified the integration of philosophy, technology and artistic craftsmanship in a society that placed a significant value on all three of these disciplines. The early pipe organ was not only a highly sophisticated musical mechanism; it was also one of the most intricately conceived technological achievements of antiquity. While earlier historians, especially Vitruvius and Hero of Alexandria, left detailed accounts of the mechanics of the hydraulic organ, more recent historians have paid little attention to this complex technology. The first chapter concludes with an overview of the documentary evidence that illustrates the extent to which this ancient artifact has been addressed in some of the standard histories of technology.

In the next three chapters, I have shed new light on the social status of the ecclesiastical organ in England during the two centuries that spanned the historical eras of the Reformation, the Civil War, the Commonwealth, the Restoration of the Monarchy, and the Glorious Revolution. These chapters give extensive support to my claim that in the hearts and minds of English Protestant Reformers, the pipe organ was both visually and vocally a symbol of Roman Catholicism. As a result of this figurative association,

this instrument literally encountered destruction and restoration and metaphorically experienced death and resurrection.

My dissertation is a work of synthesis in which the primary source materials of the sixteenth and seventeenth centuries have been assembled and given voice to speak for themselves. Many of these works could be classified as documents of social discontent. The following synopsis of these resources traces step-by-step the consequence of the various acts of aggression against this old and stable technology in the context of the unstable social systems of early modern England.

In 1534, the first Act of Supremacy recognized Henry VIII as Supreme Head of the Church of England. This Act set aside the supremacy of the Pope. One effect of the statute was to separate England from the “suspicious” rites and rituals of the Catholic Church. Like the medieval stained-glass window, the organ with its imposing ranks of pipes and ornately carved casework symbolized the visual embodiment of Roman Catholicism.²⁹⁰ Unlike the stained-glass window, however, the pipe organ was aurally emblematic as well. The penetrating power of its voice and its performance of the polyphonic music of Rome made it so.

In 1536, Henry VIII began the dissolution of the monasteries. In the process, he dismantled much of the technological infrastructure that had supported the ecclesiastical organ in England. For centuries, the monks had been the craftsmen who had built and maintained these instruments. At the same time, the organ lost the financial patronage of the Roman Catholic Church.

In 1539, Henry VIII authorized a new version of the English Bible, based on William Tyndale’s translations. Thereafter, individual readers could interpret the text in their own way. For the organ, this significant social change meant that arguments both for and against the use of music and the organ in the worship service could be debated on the basis of Scriptural reference.

In 1544, a new version of the English Litany, or the English Procession, was published. Archbishop Cranmer wrote that there should be one syllable corresponding to each note. As a result, polyphony increasingly came to be considered counterproductive

²⁹⁰ I am indebted to my dear friend H.D. Luck, M.D. for pointing out to me that the phallic symbolism of the organ pipes very likely contributed to the Puritans’ attitude of suspicion toward this instrument.

to an understanding of the Biblical text. Polyphony was also symbolically associated with the Italian Renaissance and thus tinged with the evils of popery. At this point in time, the ecclesiastical organ still remained a viable technology, but its role in the service of worship was politically conditioned.

In 1545, the Council of Trent convened to begin the task of responding to the Protestant Reformation movement. The Council addressed various accusations that were being made against the Catholic Church. At this point, the effect on the pipe organ was still unclear.

In 1549, the First Act of Uniformity was ratified by parliament. This act required the use of “The Book of Common Prayer.” Significantly, the text was written in English. However, it provided no guidance at all for organists. Nevertheless, the effect was such that the organ began to be generally frowned upon and even prohibited in some places, including St. Paul’s Cathedral. Most church organs were dismantled and stored or sold. The pipes could be salvaged for the metal. The fact that some of these instruments were removed intact implies that there were other places besides churches where they could be used. A curious facet of the relationship between technology and society in early modern England is the fact that there was no prohibition against domestic use of the organ. Nevertheless, by the mid-sixteenth century, this emblematic technology had become a tangible target of the Reformation movement. It remained more or less at risk throughout the century that followed

In 1552, Parliament passed a second Act of Uniformity. The Book of Common Prayer was revised and Communion Service was modified to become a service of commemoration. The mystery of consubstantiation was removed. As a result of this act, the mystical, liturgical ornament of music was even further restricted.

Under the Catholic Queen Mary (1553-58), the Act of Uniformity was repealed, all antipapal legislation was reversed, the Church of England was reconciled with Rome and papal supremacy was restored. Polyphony returned to the worship service. In this favorable religious and political climate, the symbolic association between the pipe organ and the revived Catholic Church was once again favorable as well. As evidence, for example, the instrument at Canterbury Cathedral was repaired and returned to service.

However, this respite for the organ was short-lived. There was a sense of ambivalence during the reign of Queen Elizabeth I (1558-1603), who kept the popish trappings at the Chapel Royal, but ordered them to be destroyed elsewhere. Conflicting social systems – in this case, the church and the court – had opposing agendas for the organ. While music flourished in the confines of the court, the ecclesiastical organs suffered from abuse and neglect across the land.

In 1562, a single statement issued during the twenty-second session of the Council of Trent decreed that all organ music (or singing) that contained anything “lascivious or impure” should be banished. In effect, the organ was put on notice that it should remain on its best behavior or be banished entirely. This declaration carried the full weight of the Roman Catholic Church throughout Christendom.

In 1563, the Vestiarian Controversy – so named because of the debate over the donning of ecclesiastical caps and gowns for daily wear and surplices for worship services – resulted in an extensive debate between the Puritan sects and the Anglican (or Episcopal) Church. Anglican music was highly criticized in the debate, which escalated in the public media and came to be known as the Admonition Controversy.

In 1572, an *Admonition to the Parliament A View of Popish Abuses* was published to draw public attention to abuses in the religious establishments. The debate had entered the public arena. The effect of this dispute was to carve out the Puritan ideal of a return to the primitive church without any of the embellishments or remnants of Catholicism in the Anglican Church – including, of course, the pipe organ.

By the end of the sixteenth century, three competing religious factions – the Roman Catholic Church, the Anglican Church, and the various Puritan sects – were acting in opposition to each other. One of the problems was the appropriate use of the ecclesiastical organ in the service of worship. Meanwhile, the organ was still accepted in social settings outside of the church. It found sanctuary at the Chapel Royal, at the universities and in private residences.²⁹¹ By the end of the Elizabethan era, most of the institutional structures were involved in the dispute that was caused by conflicting claims concerning the symbolic role of technology in society.

²⁹¹ The work of investigating the social context for the use of pipe organs in the universities, along with the taverns, theatres, and other venues for entertainment, as well as private residences, remains to be done.

The Elizabethan Era came to an end in 1603. Under King James I, the Hampton Court Conference of 1604 denied the Puritans' requests for liturgical reform and changes in church government, with the result that the conflict which had persisted throughout the sixteenth century continued unabated.

In 1611, the King James Bible appeared. The effect of this newly revised edition of the English Bible on the public perception of the proper role of the organ became apparent in the ongoing debates during the course of the seventeenth century. Arguments pro and con could now be based on personal interpretations of this widely available text.

In 1622, Henry Peacham published *The Compleat Gentleman*. Following the Renaissance ideal, Peacham popularized his opinion that music appropriately rendered thanks to God. He argued, on the basis of his personal understanding of the Scriptures, that the use of musical instruments in worship was consistent with the ancient purity of the church.

In 1642, Oliver Cromwell's army and the local populace physically attacked church organs during the Great Rebellion. For the English Puritan, the pipe organ was the visual and vocal representation of popery and superstition. It was the symbolic incarnation of Roman Catholicism. At the same time, the organ in the church was a defenseless material artifact that could easily be assaulted by a mob and quickly put out of service. As an added advantage, the wooden casework, the keyboard, and the pipework could be subjected to repeated acts of violence. In contrast, the self-righteous satisfaction derived from the single act of smashing a stained-glass window was only a transitory victory.

Also in 1642, debates were published that reflected the opinion of the man in the street. One dialogue of disagreement between two "Church-Quarrellers" – a Catholic and a Protestant – recapitulated the popular argument over the innate sinfulness of the organ in the church. Another dialogue, *The Organs Funerall*, related the concerns of a chorister and an organist over the likelihood that the organ would soon go the way of the forbidden formal ceremonies of the church.

In 1643, after having sent a letter of warning, Cromwell personally disrupted the worship service at Ely Cathedral, effectively putting an end to the offensive choral

service there. The harsh reality of this situation meant that violators were henceforth subject to suppression by military force.

Also in 1643, a plea for the restoration of *The Holy Harmony* in the service of worship escalated the rhetoric in favor of the purification of the church. The Puritan interpretation of the Holy Scriptures had the effect of providing vindication for acts of violence against the pipe organ.

These various documents from 1642 and 1643 delineated the conflicting social perspectives of the Catholic, the Protestant, the chorister, the organist, the military leader, and the minister. Each man was outspoken in his opinion on the issues that threatened the immediate survival of the ecclesiastical organ.

In 1643, the first of two Ordinances of Parliament accomplished the task of eliminating the symbolic monuments of superstition and idolatry from the church, all except for the organ. Curiously, whether by design or by oversight, the first of these Ordinances left it untouched, but not for long. The Ordinance of 1644 added pipe organs to the list, specifically requiring that these instruments be taken away, utterly defaced, and not replaced. They were to be removed from all of the cathedrals, the chapels and parish churches, the universities, and the Inns of Court. Ironically, Oliver Cromwell kept one for himself.

In 1644, *The Souldiers Catechisme* provided a set of military rules, requirements, regulations and directions for the Parliamentary soldier, granting him moral authority to carry out these Ordinances and to demolish church property, including the organs. The official ban and the destruction by Oliver Cromwell's army effectively brought to a halt any further building and development of these instruments in England during the Commonwealth Era.

Following the Restoration of the Monarchy in 1660, the organ emerged from its long period of silence. At this point in history, the relationship between technology and society experienced a positive change in favor of the organ. It no longer suffered as a result of its symbolic role in society. After the formal liturgy and the choral service were reestablished in the church, organs were once again in demand in the cathedrals and parish churches. Employment opportunities were now available for musicians and organ

makers. Families of organ builders began to arrive in England, bringing along innovative concepts that would gradually be implemented into English pipe organ design.

From 1660 until 1669, Samuel Pepys recorded the daily events of his life in his Diary. The entries reflected his amateur interest in the organ in the various venues where one could be heard – the court, the cathedral, the parish church, and the home. He described his music lessons with John Birchensha, a composer who presented papers on music theory to the Royal Society. Pepys provided a unique picture of the diversity of roles played by the organ in seventeenth century English society. Particularly interesting was his desire to buy one for his personal use, not only because of his interest in music, but very likely as a status symbol as well. However, the instrument he had originally planned to purchase turned out to be too large for his home and not quite fashionable enough to suit his taste.

From 1683 to 1690, the minutes of the Inner Temple and the Middle Temple recorded some of the details concerning the competition between Renatus Harris and Bernard Smith that became known as the “Battle of the Organs.” Dr. Tudway, whose letter to his son was quoted by music historians Sir John Hawkins and Dr. Charles Burney, provided additional information about the intense rivalry between the England’s most well known organ builders of the time. Smith eventually won the contract. The outcome of this prolonged contest affected organ technology even into the next generation. Harris, as a result of his defeat, became increasingly competitive. He turned to the Royal Society and to the public to draw attention to his experimental technology.

In 1696, the Reverend John Newte delivered a sermon on the occasion of the dedication of a new organ at Tiverton. A public advertisement had solicited contributions for this instrument. The text of this sermon on “The Lawfulness and Use of Organs in the Christian Church” recapitulated the turbulent history of the organ in early modern England and provided an extensive Biblical, philosophical, and logical justification for the use of the organ in church. The necessity for such a lengthy and thorough vindication indicated that the symbolic role of the instrument remained to some extent unsettled even at the end of the seventeenth century. Nevertheless, by this point in time, the pipe organ had come full circle. Formerly a well-respected ecclesiastical artifact, over the course of

almost two centuries it had been accused, tried, found guilty, punished, pardoned, and at last rehabilitated into society.

While many of these documents have previously appeared as snippets in the linear progression of histories of music in general and the pipe organ in particular, they have previously been permitted to speak only through abbreviated quotations, short paragraphs and assorted footnotes scattered throughout the various texts. In this dissertation they have been drawn out, connected and placed into a social context. Some are documents of dissent, while others are documents of persuasion. All reflect the complexity of the role played (or not played) by the pipe organ in the diverse social structures of early modern England.

One of the complexities emerging from the assimilation of these documents involves the nature of the relationship between Renatus Harris, Samuel Pepys, and John Wallis. Nothing else seems to be known about the connection between Harris and the two members of the Royal Society except for the evidence that Harris had at least one conversation with Pepys, followed by one discussion with Wallis. The inquiry that Harris made to Pepys provided him with an introduction to Wallis and an entrée to the Society. The subsequent discourse between Harris and Wallis was much more than a hypothetical discussion of tuning theories. By the time this meeting took place, Harris had already demonstrated his experimental technology. He hoped that his consultation with Wallis would result in the successful “enrollment” of the mathematician as an ally.²⁹² Harris was keen to call on Wallis to serve as an authoritative witness to his experimental work, and for good reason. In the process, he was attempting to enlist the patronage of the Fellows of the Royal Society and the authority of the Science of Mathematics in support of his innovative design.

In fact, the meeting did produce a series of significant results. First of all, Harris gained Wallis’ professional respect during the course of their conversation.²⁹³ Next, on July 20, 1698, Wallis’ letter of response to Pepys was read before the members of the

²⁹² According to Bruno Latour, “We need others to help us transform a claim into a matter of fact.” The process of fact-building requires that we “*enrol others*” and “*control their behaviour*.” For an explanation of Latour’s network theory and the role played by the process of enrolling and enlisting others in support of a scientific fact or technological artifact, see Latour (1987), especially page 108.

²⁹³ Wallis had written to Pepys that he found Harris “to be very well skilled in his profession” (Wallis 1698). The fact that Wallis used the term “profession” rather than “trade” or “craft” indicates that he held the occupation of organ-builder in high regard.

Royal Society. By this means, Harris essentially enlisted or enrolled the full membership of the Royal Society as witnesses to the result of his experiment.²⁹⁴ Finally, and most importantly, when the letter was published in *Philosophical Transactions*, Harris effectively enrolled as virtual witnesses not only the entire scientific community of the English-speaking world, but all other interested readers as well. Derek J. De Solla Price describes the role of this emerging methodology for disseminating scientific information in *Little Science, Big Science*:

Developing in time and spirit together with the newspaper, such publications as the *Philosophical Transactions of the Royal Society* had the stated function of digesting the books and doings of the learned all over Europe. Through them the casual reader might inform himself without the network of personal correspondence, private rumor, and browsing in Europe's bookstores, formerly essential (Price, 1963, p. 63).

The establishment of this extensive intellectual network constituted a remarkable achievement in Western society. This linguistic technique for expanding the number of witnesses to an experiment is also discussed by Steven Shapin and Simon Schaffer in *Leviathan and the Air-Pump*:

The technology of virtual witnessing involves the production in a *reader's* mind of such an image of an experimental scene as obviates the necessity for either direct witness or replication. Through virtual witnessing the multiplication of witnesses could be, in principle, unlimited. It was therefore the most powerful technology for constituting matters of fact (Shapin and Schaffer [1985] 1989, p. 60).²⁹⁵

The literary technology of virtual witnessing was considered reliable and effective because the printed word of the Royal Society was imbued with trust.²⁹⁶ The act of disseminating to the public the letters, reviews, and proceedings of the Society obviated the necessity to provide for eyewitness confirmation or replication of an experiment. In the seventeenth-century life of the Royal Society, the publication of "matters of fact" in

²⁹⁴ Again, the notions of "enlisting" and "enrolling" follow the usage of Latour (1987, p. 108).

²⁹⁵ The technology of virtual witnessing is considered to be a technology of trust.

²⁹⁶ For a sociological study of the generation and acceptance of truth claims and the establishment of trust among the gentlemen-philosophers of the Royal Society, see Shapin (1994).

Philosophical Transactions served to transform an experimental setting from a small private space into a vast public space.²⁹⁷

Why had Harris brought his question to Wallis in the first place, and what had he planned to do about his problem if he received a negative response? Was he taking a professional risk by exposing his innovative idea to the Royal Society, with the possibility that he would only be rebuffed?²⁹⁸ He should have been aware from the letter Wallis had published only two months earlier that the mathematician did not claim to have a musician's ear, nor did he have more than a theoretical or "speculative" interest in fine-tuning the scale. Was Harris in fact seeking and expecting to receive theoretical support for his applied technology? Surely he had not seriously anticipated that Wallis, who was then in his eighty-first year, would have concurred with this far-fetched technological proposal. Harris must have had something else in mind. And indeed that seems to have been the case.

Most likely, Harris intended to publicize a project that would be perceived as a challenge. Although his innovative technology was already a *fait accompli*, he would no doubt have been delighted to receive authoritative affirmation that the Royal Society sanctioned his work. Ultimately, however, mathematical verification would not have made any difference. Aristoxenus was right. Cutting and tuning the pipes to such a level of mathematical precision would have been impossible without the use of his ear to guide him. Even if Harris could have made the public claim that his instrument had received recognition from the Royal Society, it still would have been necessary for him to tune the pipes in accordance with his own aural judgment, no matter how many pipes there were. He would have had no finely calibrated acoustical equipment to assist him.²⁹⁹

The important point is that the published letter from Wallis to Pepys served very effectively as an advertisement to call attention to himself. With his name now permanently inscribed in the public records of the Royal Society, Harris had successfully accomplished his mission to make his name known to the scientific community and to the

²⁹⁷ For contrasting perceptions of the laboratory as a public or private space, see Shapin and Schaffer ([1985] 1989).

²⁹⁸ If Feingold is correct in his assessment of the mathematician's "somewhat arrogant and conceited nature" and his propensity for controversy, then Harris might have been risking his professional reputation by approaching Wallis (Feingold 1984, pp. 87).

²⁹⁹ Even today an organ is tuned by ear, although an initial pitch is sometimes set with a tuning fork or electronic tuning device.

general public as well. Curiously, historians have not been supportive of Harris in his attempts to gain recognition. Bicknell accuses him of “self-promotion” and a “tendency to wild claims” (Bicknell [1996] 1998, p. 151). The article on Renatus Harris in *The New Grove Dictionary of Music Online* offers a similar assessment of his intentions. This entry reads, “He had a flair for publicity, and never shrank from the opportunity to recommend himself for work ...”.³⁰⁰

Social position played a significant role in the organ-building profession. Father Smith certainly seems to have been the more favored builder. He was a Protestant, he moved in the appropriate social circles, and he received important royal patronage. As Andrew Freeman notes, “Smith had things pretty much his own way” (Freeman 1922, pp. 194-195). At the time of the Battle of the Organs, he was recognized as an organ maker of merit, but had not yet become pre-eminent. Smith began working at Cambridge during the years of the Temple Church competition. Before that time, there appear to have been other competent builders already on site in the university town. After a vacancy occurred, Smith was engaged and his connection at Cambridge lasted twenty-two years. According to Freeman, he furnished the university with as many as six instruments, either building them or repairing them. Again according to Freeman, Smith was active as an organ builder until the day he died.

Father Smith’s instruments were especially well known for their sweetness of tone. In general, his approach to organ building reflected his acquaintance with the seventeenth-century style of the northern Netherlands and Friesland.³⁰¹ In order to allow D# - Eb and G# - Ab, to sound as different notes, he adopted the use of split accidentals, adding two additional raised keys for each octave.³⁰² Smith made use of this quarter-tone keyboard technology only twice, first for the Temple Organ and then later for his instrument at Durham Cathedral.³⁰³ In addition, it “seems certain” that Smith introduced

³⁰⁰ Harris has also been considered “the most flamboyant English organ builder of his time ...”. See “Renatus [René] Harris” in *The New Grove Dictionary of Music Online*.

³⁰¹ In particular, his use of the Great and Chayre, Great and Eccho, and Great and Choir paralleled the northern influence of the *Hauptwerk* and *Rückpositiv*, *Hauptwerk* and *Brustwerk*, and *Hauptwerk* and *Hinterwerk*. See “Bernard Smith” in *The New Grove Dictionary of Music Online*.

³⁰² See references to split accidentals in Williams (1966, p.105) and Bicknell ([1996] 1998, p. 131). Smith’s use of split accidentals was not a new idea. Mersenne had described this technology in his *Harmonie Universelle* and organ builders outside of England had been using these extra keys in an attempt to solve tuning problems.

³⁰³ This tuning scheme remained in use at the Temple Church until 1879. See Thistlethwaite (1990, p. 47).

a stop called the “cornet” to the English organ (Clutton and Niland 1963, p. 71). This was a fairly common stop in Holland. “It was usually formed of three, four, or five ranks of large-scaled pipes voiced to yield powerful and dominating tones” (Audsley, [1921] 1978, p. 74). Seidel makes the relevant point that the cornet was a useful stop for “lining out” the melody to assist the congregation in singing an unfamiliar tune:

It has a strong intonation, and a horn-like tone, which is well adapted for filling out. Sometimes, when hymns are to be sung with a melody which is not familiar to the congregation, this register will be found very efficient for the purpose of making the melody prominent, since the right hand plays the melody upon that manual which contains a cornet, whilst the left hand plays the accompaniment upon some other manual, for which weak registers are drawn” Seidel ([1855] 1982).³⁰⁴

The addition of the cornet provided a new symbolic role for the organ, allowing it to assume the task of the song leader by lining out the melody of the Protestant congregational hymns. This melodic musical style, played with a soft accompaniment, was a desirable contrast to the polyphonic style so despised during the Reformation. The cornet greatly assisted in providing the organ with an acceptable ecclesiastical role in the worship service. It is no coincidence that it was the Protestant organ builder Bernard Smith who provided it.

Father Smith died in 1708. The craftsmanship of his nephews Gerard and Christian does not seem to have equaled that of their uncle.³⁰⁵ In fact, it was neither Gerard nor Christian but Christopher Shrider, who was Smith’s foreman, probably his son-in-law, and certainly his successor, who continued his organ-building business. Shrider subsequently became the organ maker to the royal family. There had apparently been a rift between Smith and his nephews. Smith’s will, dated 1699, stipulated that Gerard and Christian were to receive one shilling each (Bicknell [1996] 1998, p. 146).³⁰⁶ Shrider appears to have carried the banner for the Smith school of organ building until his death in 1751. In many instances it has been difficult to determine which man was responsible for some of the components of the extant instruments.

Ultimately, however, the fine craftsmanship of Father Smith was less influential than the legacy of Renatus Harris. Even while Shrider was still at work, the descendants

³⁰⁴ Seidel adds additional technical information to this description.

³⁰⁵ See “Bernard Smith” in *The New Grove Dictionary of Music Online*. See also Bicknell ([1996] 1998, p. 146).

³⁰⁶ Each of Smith’s nephews had started his own business a decade earlier.

of Harris were producing the most innovative and dynamic technology of the day (Bicknell [1996] 1998, p. 154). As Bicknell points out, “Two organs from the 1720’s confirm the success of the Harris school, and announce some important themes of the Georgian age” (Bicknell [1996] 1998, p. 157).

Renatus Harris had begun his career in England as an apprentice to his father, who was himself the son of an organ builder. He was talented and ambitious. He was impetuous and perhaps a bit rude in a culture that placed a high value on courtesy. He brought French influence into English society. He was a Catholic among Protestants. Harris was the outsider. While Father Smith found patronage in the proper clubs and the royal courts, Harris had to look for ways to gain attention. He advertised in the current publications. He turned to the Royal Society for mathematical expertise. He appealed to the public for financial support for a proposed organ for St Paul’s Cathedral. Finally, amidst the ambience of the Scientific Revolution, he gained public attention by using the pipe organ as an instrument of experimentation.

On the basis of Harris’ later work and his influence on organ design, historians have declared him to be the ultimate winner. Hawkins, assuming the role of judge in this matter, renders a decisive verdict in favor of Harris: “Renatus was a young man of ingenuity and spirit, and succeeded so well in his endeavours to rival Smith, that at length he got the better of him” (Hawkins [1776, 1853] 1963, vol. II, p. 691).³⁰⁷ Other historians have acquiesced to this opinion as well. According to Andrew Freeman, Smith’s instruments were

by no means mechanically perfect; indeed in this respect they were probably surpassed by those of his clever and versatile rival, Renatus Harris. Smith was certainly a great artist as a voicer; though here again, Harris was a close second, and in regard to reed stops quite possibly his equal (Freeman 1926, p. 134).³⁰⁸

The last instrument built by the hand of Renatus Harris and his son was the organ at St. Dionis Backchurch. It was influential in the history of English organ technology.

³⁰⁷ Even organ historians have taken sides in the rivalry. This is not Sir John Hawkins’ final judgment in the matter. Here he acknowledges the technical accomplishments of Harris, but his preference lies with Father Smith, who was brought to England “for his excellence in his art” and who “deserves to live in the remembrance of all such as are friends to it (Hawkins [1776, 1853] 1963, vol. II, p 691).

³⁰⁸ Andrew Freeman gives credit to Father Smith for setting a high standard for his organs that they were not altogether unsuccessful in reaching. He believes this accounts for the reason that a Father Smith organ was first an ideal and eventually became a tradition.

As Bicknell notes, “features of its design were copied in other instruments and similar cases were made by several builders, confirming the success of the Harris school in dominating English organ building in the first half of the eighteenth century” (Bicknell [1996] 1998, p. 159).³⁰⁹ It was approved a board of experts that included George Frideric Handel. It set a new standard for organs built for wealthy parish churches. This instrument reflected Harris’ French influence, especially in “the proliferation and variety of the reeds (Bicknell [1996] 1998, p. 157). These reed pipes were designed to imitate the natural sound of various reed instruments as well as human voice. The second organ that followed the Harris tradition was the instrument built by his son John in partnership with John Byfield at St. Mary Redcliffe, Bristol in 1726. Although pedals were commonly used on the European Continent, this was the first authentic use of pedals in England.

Harris was especially noted by organ historians of the nineteenth century for his skill in reed voicing. Furthermore, as an organ technician, he seems to have been more talented than Smith. “His action work was generally considered superior to Smith's, and the judgment of history may well be that he was the better builder.”³¹⁰ Placing Bicknell’s comment about Harris’ “wild claims” into a broader context, the full quotation reads: “Whether because of or in spite of Renatus Harris’ self-promotion and tendency to wild claims, it was indeed the Harris school which was to succeed to the major spoils of the eighteenth century” (Bicknell [1996] 1998, p. 151).

The documents gathered together here offer a number of points of departure for further research. A more comprehensive integration of these materials within the broader social context in which they appeared could contribute toward a greater understanding of the symbolic and diverse social roles associated with the pipe organ in early modern England. In addition, all of these documents – along with numerous other contemporary broadsides, sermons, journals, diaries, letters, newspapers, court records, contracts and acts of Parliament related to the organ – would be of immense value if these materials were to be compiled into a single annotated collection.

³⁰⁹ For a picture (c. 1870) of the Harris case at St. Dionis Backchurch, see Bicknell ([1996] 1996, p. 159).

³¹⁰ See “Renatus Harris” in *The New Grove Dictionary of Music Online*.

This research leaves the door open for additional work in several related areas. For example, my dissertation has been especially concerned with the effects of the Reformation and the Restoration on the symbolic role of the pipe organ in England. A similar analysis might compare and contrast the social influences that affected the organ on the European Continent during the Protestant Reformation and the Catholic Counter-Reformation.

There are other research topics that would link the pipe organ with different facets of society. One aspect in particular would involve the tangential activities associated with organ construction in early modern England. For example, the whole question of the nature of organ workshops presents an area of activity that is much in need of further investigation. Robert Hooke addresses this topic in his treatise on *The Method of Improving Natural Philosophy* when he proposes that, “It will be requisite to take notice of, and enumerate all the Trades, Arts, Manufactures, and Operations, about which Men are employed, especially such as either contain some Physical Operation, or some extraordinary Mechanical Contrivance, for such as these will very much enrich a Philosophical Treasury” (Hooke [1705] 1969, pp. 24-26). Although organ building appears to have been for the most part a family enterprise, there is still much more to be discovered about the peripheral requirements for metal workers, leather craftsmen, wood carvers and even curtain makers. All of these assisted the builders by providing labor and materials for the construction and installation of the instrument.

Another fascinating aspect related to organ building would be an analysis of the relevant legal documentation. Many of the original contracts have been preserved. These offer an excellent opportunity for further research. In addition to the technical aspects of the instrument, especially the lists of proposed stops, these documents also provide insight into the legal ramifications of the relationship between the builder and the buyer. As an example, the contract drawn up between Renatus Harris and the representatives of St. Dionis Backchurch spells out very specifically the terms and conditions for the completion of the new organ (Guildhall Library MS 11, 276A). It includes a guarantee of full satisfaction on the part of the purchasing parties, with a promise that Harris shall remove the instrument at his own expense if it is judged, by due process, to be unsuitable. The contract also provides for a down payment and specifies

the terms of an installment plan for the balance due. This elegantly penned document is properly signed by the appropriate parties and sealed with red wax. Further examination of organ contracts – along with other related cathedral and parish church records, letters, diaries and manuscripts – would reveal more about the individuals who signed and witnessed these documents. These historical records reflect the process of social negotiation and the legal obligations and expectations of each of the parties involved in the building and installation of a pipe organ.

Finally, in terms of further research, there are many uncertainties about Harris' intentions at the time he made his experimental technology known to the Royal Society and to the public. Bicknell, in his comprehensive *History of the English Organ*, is concerned to reassess the work of Bernard Smith and Renatus Harris and “their position relative to each other” (Bicknell [1996] 1998, p. xix). Most of the previous assessments of Smith and Harris have been made with their contrasting religious and social positions in mind. By raising questions involving the connection between Harris and the social milieu of experimental philosophy, this dissertation adds another dimension to Bicknell's study.

On a theoretical note, the social construction of technological artifacts has been a topic of primary concern to philosophers, historians, and sociologists of technology. In the classic literature of the field, academic attention has often been focused on artifacts that are categorized by concepts of technological novelty, growth, progress, change, and revolution.³¹¹ This case study of technology in society has illustrated that these conceptual categories fail to accommodate the complexity of the symbolic relationship that existed between the ecclesiastical organ and the social institutions of early modern England. Thinking about technology along traditional lines has unquestionably been philosophically rewarding. However, in the course of the analytical process, care must be taken to ensure that our interpretative taxonomy does not impose unnecessary restrictions on our understanding of the richness and complexity of the diversity of relationships between technology and society.

³¹¹Several theoretical methodologies for the analysis of technological systems are analyzed in Bijker, Hughes and Pinch ([1987] 1993). Among these are the “social constructivist” approach, the “systems” concept, and the “actor network” theory. A general theme of these various methodologies is a concern to account for the successful launching of an innovative technology and the subsequent changes in society.

In the first place, as this study has shown, the English pipe organ could hardly be considered a novel artifact. At the beginning of the sixteenth century, it was already a well-established technology with a history dating back almost two thousand years. Then in the course of the next two hundred years, this ancient instrument was forced to withstand the pressures imposed upon it by drastic changes in the religious and political systems that had previously provided it with long-term patronage and support. These highly structured social systems included the royal courts, the monasteries, and the hierarchy of the Catholic Church. The history of early modern England is a history of dissension between these diverse social structures. Because of its symbolic role, the pipe organ became a focal point in an ongoing struggle for power. For this particular technology, growth and progress were out of the question for well over a century. Not until the Restoration of the Monarchy did change gradually begin to occur, but even then the technological progress of the late seventeenth century was hardly significant relative to the long life span of the instrument. Clearly, there was nothing about the English pipe organ that could be considered novel or revolutionary during this period of time.³¹²

However, there is at least important theoretical approach that does have particular relevance to this case study. Working in the context of evolving technological systems, Thomas Hughes has identified a “reverse salient” as a component of a system that “does not march along harmoniously with other components” (Hughes 1983, p. 79). A reverse salient is defined as a set of critical problems that must be addressed and solved in order to bring the whole system back into line.³¹³ The ecclesiastical organ in early modern England was obviously not “marching along harmoniously” with the other liturgical components of Reformed Protestant theology. Critical problems had to be overcome in order for this instrument to maintain technological momentum within the religious and political structures of the English Reformation.³¹⁴ These problems included the playing

³¹² The argument could be made that there was nothing truly revolutionary about the organ until the advent of the electric motor, at which point for the first time in over two millennia, the wind supply no longer depended upon a human-powered bellows.

³¹³ Ironically for this case study, Hughes refers to the dispute over polyphase versus direct current as “the battle of the systems” (Hughes 1988, p. 120). He also notes that the conflict between electrical systems “revealed that the technical problems are sometimes in essence institutional and value conflicts (Hughes 1988, p. 462).

³¹⁴ See Hughes for an explanation of the concepts of mass, velocity, and direction that are involved in his description of technological momentum (Hughes 1988, p. 15).

of polyphonic music and the organ's symbolic association with the Roman Catholic Church. Eventually, of course, the reverse salient was the Parliamentary ban prohibiting not only the ecclesiastical use of the instrument, but even its physical presence in the cathedrals and parish churches. This critical problem required a radical political solution. Ultimately, it was the Restoration of the Monarchy that enabled the restoration of the organ.

When the political problem was resolved, technological momentum resumed. By the beginning of the eighteenth century, the English pipe organ had overcome the reverse salient of severe social repression and had achieved a number of significant accomplishments. First, it had recovered from an extended period of devastating religious and political persecution resulting from its role as the emblematic embodiment of the Roman Catholic Church. Second, as a result of a sudden reversal in the political and religious power structure, it had regained its former status as a valued participant in the service of worship. At this point in history, it no longer bore the symbolic stigma of Catholicism. Third, at the hands of organ builders Bernard Smith and Renatus Harris, it had profited from intense professional rivalry. Fourth, it had benefited from the influence of foreign technology. Finally, it had performed as an instrument for experimentation during the Scientific Revolution.

As my research has shown, an analytical interpretation that plays an important role in understanding the history of the organ in early modern England is the concept of technology as symbol. For the pipe organ during this period, it was the symbolism that was socially constructed, not the artifact itself. So long as the ecclesiastical organ personified the Roman Catholic Church, it was persecuted. As soon as the balance of power shifted, this symbolism was no longer significant and the King of Instruments was restored to its long-accustomed place in the service of worship in English society.

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