A CONDUCTOR’S GUIDE TO PERFORMANCE ISSUES ARISING FROM THE USE OF EIGHTEENTH-CENTURY PITCH LEVELS IN THE PERFORMANCE OF HANDEL’S FOUR CORONATION ANTHEMS

by

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A Document Submitted to the Faculty of the SCHOOL OF MUSIC

In Partial Fulfillment of the Requirements For the Degree of DOCTOR OF MUSICAL ARTS

In the Graduate College

THE UNIVERSITY OF ARIZONA

2008
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SIGNED: Terry Alexander Lee Shawn
ACKNOWLEDGEMENTS

I would like to thank my advisor, Dr. Bruce Chamberlain and the rest of my graduate committee: Dr. John Brobeck, Dr. Elizabeth Schauer, Dr. Josef Knott, Dr. Thomas Cockrell and Dr. Brian Ebie. Special thanks goes to Malcolm Edwards from the University of Calgary, Canada for his inspiration and friendship. Two colleagues from the University of Arizona gave their time, opinions, friendship and support for which I will always be grateful. They are: Dr. Wayne (Sandy) Glass and Dr. Lani Johnson. A note of great appreciation goes to my friends, Dr. Michelle Berry and Dr. Kate Oubre for their proofreading suggestions and Robin Evans for her computer skills. Most especially I would like to thank my friend and mentor, Mr. Lee Morden, without whom I could not have seen the end in sight. Lastly, a special thanks to my family and Monique Henderson for their love and support since I began this journey.
DEDICATION

I would like to dedicate this paper to my mom, Mrs. Lee Dowan, whose love, friendship and support has always been there for me. Thanks Mom.
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ABSTRACT

In this study I attempted to create a historically informed performance of Handel’s *Four Coronation Anthems* at the pitch of $a^1 = 423$, without the benefit of baroque instruments. The issue of lowering the performance pitch from $a^1 = 440$ to $a^1 = 423$ had varying effects on the singers and instrumentalists. Replicating the baroque sound required some modifications to modern instruments and some mental and vocal adjustments for the singers. Several singers experienced vocal relief due to the lowered pitch, while some instrumentalists were faced with re-adjusting their technique to compensate for the modifications made to their instruments. The modifications ranged from exchanging the violin and viola strings from steel to gut to lengthening the oboe reeds and the bassoon’s bocal enough to effectively lower the pitch almost a half step, or .17 Hertz (Hz.).

Through the aid of audio and visual recordings of the performance and the performer’s questionnaires, several discoveries were made about creating a historically informed performance. Primarily, when changing the pitch of a composition, it is better to adjust the pitch in half steps rather than quarter-tone increments. It was further revealed when changing the pitch that some singers experienced difficulty maintaining pitch due to their vocal muscle memory, whereas, some instrumentalists possess varying degrees of individual pitch memory and perception. In order to deal effectively with the

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1 One Hertz is defined as the reciprocal second (Hz. = 1 s⁻¹). One Hertz simply means "one per second" (1/s). The abbreviation of Hz. is accepted as standard abbreviation after numerical quantities. In the text sections of this document Hertz will be used in its unabbreviated form.
issue of maintaining pitch, it was revealed that it is important to have more rehearsal time at the adjusted pitch.

With respect to the modifications made to the instruments, it is vital to the success of the performance to allow the players enough time with modified instruments to be able to maintain consistent tuning within the instrument. The musician’s individual pitch perception and preference have an affect on the performance, and the conductor would be well advised to refer to the discoveries presented in this document.

This study was successful in discovering ways to present a historically informed performance at a pitch other than $a^1 = 440$ and several suggestions for creating further historically informed performances were explored.
INTRODUCTION

In “A Conductor's Guide to Historical Performance Practices for Handel's *Four Coronation Anthems*” I explore how historical English pitch affects baroque performance practice when using modern instruments. One strategy for achieving a historically informed performance of Handel’s anthems is to address the change in performance pitch over time by applying modifications to the modern instruments. Alternatively, the score could be adjusted down a half step to simulate baroque pitch. In order to realize an authentic baroque performance, however, it was necessary to identify and understand the specific elements present in the instrumental and choral ensembles of the University of Arizona, which typify many American colleges and universities.

Such limitations have important ramifications when performing Handel’s anthems with college and university ensembles. Very few universities and colleges have access to baroque instruments (such as gut-stringed violins, period oboes, flutes, and organs), vocal specialists in the performance practices of the late Baroque, or ensembles that number in the hundreds. Although amassing an ensemble of large numbers is often done in many secondary institutions, it is not always possible to assemble an ensemble of the same proportions that were used on October 27, 1727 for the coronation ceremonies of King George II. Given these constraints, it is relevant to ask how modern performers can most effectively present Handel’s *Four Coronation Anthems* and similar works and be faithful to the original spirit of the composition.

To determine the number of musicians necessary, I referred to the records of the account of King George II’s 1727 coronation, and also to the typical size of Handel’s
performing ensembles when he was working for the Duke of Chandos in the 1710s. I also investigated Handel’s performing forces for the London performances of Messiah in the 1740s and 1750s. The number of musicians retained for this study was similar to that used in the London theatre performances of Handel's Messiah. Handel generally employed three singers on a part plus one or two soloists, equaling four or five on a part. I used five or six on a part since that was the available complement in the choral ensemble I used for my lecture recital, The Collegium Musicum of The University of Arizona. Table 1 illustrates Handel’s instrumental ensembles of the 1700s and the ensemble used for this study.
Table 1. Comparison of Performing Forces

* Exact numbers not known.

<table>
<thead>
<tr>
<th>PERFORMING FORCES</th>
<th>CORONATION 2</th>
<th>MESSIAH</th>
<th>CHANDOS 3</th>
<th>APRIL 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Violin</td>
<td>*</td>
<td>12</td>
<td>4/6</td>
<td>5</td>
</tr>
<tr>
<td>Viola</td>
<td>*</td>
<td>3</td>
<td>0/1</td>
<td>2</td>
</tr>
<tr>
<td>Cello</td>
<td>*</td>
<td>3</td>
<td>2/1</td>
<td>1</td>
</tr>
<tr>
<td>Double Bass</td>
<td>*</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Oboe</td>
<td>*</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Bassoon</td>
<td>*</td>
<td>2</td>
<td>½</td>
<td>2</td>
</tr>
<tr>
<td>Trumpet</td>
<td>*</td>
<td>2</td>
<td>0/1</td>
<td>3</td>
</tr>
<tr>
<td>Horn</td>
<td>*</td>
<td>2</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Flute</td>
<td>*</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Recorder</td>
<td>*</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Harpsichord/ Organ continuo</td>
<td>*</td>
<td>1 Keyboard continuo</td>
<td>1 Harpsichord/ Organ continuo</td>
<td>1 Synthesized Organ</td>
</tr>
<tr>
<td>Timpani</td>
<td>*</td>
<td>1</td>
<td>*</td>
<td>1</td>
</tr>
<tr>
<td>Total Instruments</td>
<td>160 estimated</td>
<td>30</td>
<td>*</td>
<td>19</td>
</tr>
<tr>
<td>Singers</td>
<td>40 estimated</td>
<td>22</td>
<td>8</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>200 estimated</td>
<td>52</td>
<td>20 – 24</td>
<td>61</td>
</tr>
</tbody>
</table>

When performing *Messiah* in London, Handel generally employed 12 violins, 3 violas, 3 celli, 2 double basses, 1 keyboard player for the continuo, 2 oboes, 2 bassoons, 2 trumpets, 2 horns (doubling the trumpet line) and timpani. To reduce balance problems caused by the greater volume of modern winds and strings, I employed a somewhat smaller instrumental ensemble consisting of 5 violins, 2 violas, 1 cello, 1 double bass, 2 oboes, 2 bassoons, 3 trumpets, 1 harpsichord, 1 organ and 1 timpanist.

4 Ibid.
This project was designed to be a controlled experiment that would enable me to judge the effect of using the English baroque pitch of $a^1 = 423$ on a collegiate choral and orchestral ensemble. It was my belief that there might be significant variations in intonation, tuning, pitch perception and articulation between the two performances. I further believed and attempted to demonstrate that the differences were sufficient to warrant the additional effort it would take to re-adjust modern pitch to baroque pitch.

I investigated the question of whether a historically informed performance could be created without the use of period instruments while maintaining the musical integrity of the composition. The investigation was conducted through rehearsals, performances, interviews and questionnaires. Further evaluation by five professional conductors from the University of Arizona assessed whether differences could be discerned between the performance at $a^1 = 423$ and that at $a^1 = 440$. The results of the various mechanisms for evaluation are discussed and compared to ascertain the success of the replication of a baroque performance.

It should be noted that throughout this study the issue of temperaments such as mean-tone\(^5\) or just intonation\(^6\) were not considered. I employed exclusive use of equal temperament.\(^7\)

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\(^5\) “Mean tone is a system of temperament or a tuning of the scale, particularly on instruments lacking any capacity for flexibility of intonation during performance.” *Grove Music Online*, s.v. “mean-tone,” (by Mark Lindley), http://www.grovemusic.com (accessed July 24, 2006).

\(^6\) “Just intonation is the consistent use of harmonic intervals tuned so purely that they do not beat, and of melodic intervals derived from such an arrangement, including more than one size of whole tone.” *Grove Music Online*, s.v. “mean-tone,” (by Mark Lindley), http://www.grovemusic.com (accessed July 24, 2006).

\(^7\) “Equal temperament: a tuning of the scale based on a cycle of 12 identical 5ths and with the octave divided into 12 equal semitones, and consequently with 3rds and 6ths tempered, uniformly, much more than 5ths and 4ths. Equal temperament is now widely regarded as the normal tuning of the Western,
How would performing at $a^1 = 423$ affect modern collegiate musicians? When the pitch of a composition deviates from where it was originally conceived, it changes the tessitura of the voice. This adjustment in pitch may affect not only the quality of the voice but may greatly affect its *passaggio*\(^8\), possibly causing the voice to tire prematurely, or stressing it.\(^9\) Figure 1 is an excerpt from *Zadok the Priest* that employs a soprano line which hovers between $e^2$, $d^2$, and $e^\#2$ (refer to Appendix A). These particular notes can fatigue a soprano voice after prolonged singing because they typically lie in the *passaggio* of most sopranos. Further, the change in pitch can also affect vocal comfort for those with good pitch and muscle memory.\(^10\)

The soprano voice is more affected by the pitch change than other voice types because the higher the note, the faster the vocal cords must vibrate. For example, if $a^1$ vibrates at 440 times per second, $a^2$ (an octave above) will vibrate at 880 vibrations per second. The faster the vocal cords vibrate the more quickly the singer suffers vocal fatigue.\(^11\)

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9 Ibid.
10 Ibid.
11 Ibid.
The effect on the male voice is less dramatic, but if the parts already are fairly low, a lower pitch may place the line beyond the typical bass range. According to Bruce Haynes “when the pitch is 445 Hertz …the vocal chords [sic] of a bass vibrate at an average of 41 times faster over the entire range…than when the pitch is 440 Hz.; by contrast, a soprano’s vocal chords [sic] vibrate 160 times faster.”¹³ This statement certainly leads one to consider the impact of pitch changes on the choral voices. The high tessitura of Zadok the Priest challenges singers when sung at a¹ = 440, as evidenced in the excerpt shown in Figure 2.

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¹² George Frideric Handel, Four Coronation Anthems, ed. F. Chrysander (Mineola, New York: Dover Publications, Inc., 1999), 13-15. All subsequent references to Zadok the Priest are from this source.

Figure 2: *Zadok the Priest* soprano I and II mm. 23-30
CHAPTER 1: THE HISTORY AND DEVELOPMENT OF THE ENGLISH ANTHEM

The anthem originated in England and was basically the Protestant counterpart to the Roman Catholic motet. It is defined as a choral composition sung in English, which is set to a biblical or religious text. Although the Reformation is credited with the birth of the anthem as we know it, “the term ‘anthem’ was in use by the early eleventh century, being derived from and largely synonymous with Antiphon.”

Previous to the Reformation, the anthem was known as antifones or antempnes, terms which may have referred to antiphons used within the English mass. By 1549 the English anthem emerged as an identifiable form in an “idiom that would ensure the maximum clarity of diction while at the same time allowing for some interesting variation in musical textures.”

It is important to note that the function of the anthem was to amplify the text of the daily scripture. Also, during this period it became clear that the difference in the language employed was one of the prime distinctions between the motet and the anthem. After the time of the Reformation and the establishment of English as the liturgical language of England through the First Act of Uniformity in January, 1549, the development of the anthem had become completely independent from that of the Roman Catholic motet and was considered solely an English genre.

According to Grove Music Online, there were initially three developmental periods of the anthem: the first period, 1549-1565; the second, 1565-1644; and the third,

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15 Ibid.
1660-1770.\textsuperscript{16} The first period was also the time of the British Civil Wars and the Commonwealth and Protectorate, which was Britain’s first attempt to unite England, Scotland, and Ireland under a single government. Also, Puritan austerity profoundly affected the religious, political, and cultural life of England. In order to escape the conflict between the Presbyterian system of church government and the Episcopacy of the Church of England, several composers took refuge in Europe, which ultimately influenced their compositional styles to reflect French and Italian influences.\textsuperscript{17}

The early anthem of the first period was written in four parts with predominantly imitative texture and syllabic note-against-note counterpoint. Some of these early works were merely “Latin motets adapted to English text (contrafacta).”\textsuperscript{18} As stated previously, the primary focus was clarity of diction. A representative example of an early period anthem is Thomas Tallis’s (c. 1505–1585) \textit{Hear the Voice and Prayer}.

By 1565 two types of anthems had developed, the verse anthem and the full anthem. The verse anthem consisted of “verses for solo voices and instrumental accompaniment (normally organ) alternat[ing] with passages for full choir.”\textsuperscript{19} In the full anthem the chorus sang the entire composition from beginning to end. During this period, the most significant development was the creation of the verse style. One of the earliest examples of the verse anthem is Thomas Morley’s (c. 1557–c. 1602) \textit{Out of the Deep}, which was written for tenor soloist and five-voice chorus. In it the soloist and the chorus alternate.

\textsuperscript{17} Ibid.
\textsuperscript{18} Ibid.
\textsuperscript{19} Ibid.
Aspects of the anthem’s development included the following: single homophonic, imitative, and note-against-note counterpoint, which was characterized in Christopher Tye’s (c. 1505–c. 1572) and Thomas Tallis’s music. Tallis’s compositions were mostly short, concise works, which employed some counterpoint. Although his compositional method remained essentially conservative, he preferred a more simplified style with chordal texture and syllabic settings of the English text. The typical form of his anthems was ABB. This form was established as the basic structure of the full anthem and has continued past Handel’s era into the present.

After Elizabeth I assumed the throne in 1558 and restored the Church of England in 1559, composers had to write more anthems for the Anglican service. The Elizabethan era was noted as a prolific period for the composition of unaccompanied anthems. Most composers at this time composed both Latin sacred pieces and English anthems, depending on the ruling influence of the day. Some composers even converted to the religion of the reigning monarch.

In the second period composers wrote more verse anthems than full anthems. In the verse anthem, words were more audible and distinguishable. A defining aspect of the verse anthem was alternating sections sung by a solo singer or a full choir, both with instrumental accompaniment. An influential event in 1575 occurred when Elizabeth I granted a twenty-one year patent to William Byrd (1540-1623) and Thomas Tallis to publish music. This edict gave Byrd and Tallis control of the market which lasted for many years and enabled Tallis to publish a sizable body of work.
Orlando Gibbons (1583-1625), Thomas Tomkins (1572-1656), Thomas Weelkes (1576-1623), and William Byrd were the primary composers in the next generation of the development of the anthem. It was Gibbons, sometimes referred to as the father of Anglican church music, who composed the well-known verse anthem, *This is the Record of John*. This anthem became a link between the late Renaissance and the early Baroque, since he was “successful in conveying the declamatory shape of a text.” Gibbons, Tomkins and Weelkes used more contrasting textures, expanded the harmonic and melodic rhythms, employed motivic recapitulation and redevelopment, and explored ways to integrate structural aspects of the form. After the British Civil War, choral services were eventually reinstated in 1660. With the return of a monarchic government, the Anglican Church was re-established and music flourished, as a result, musicians and organ builders prospered throughout England.

The Restoration period, 1660-1770, precipitated the next developmental phase of the English anthem. Verse anthems continued to be popular in England during King Charles II’s reign (1630-1685), since he had a preference for solo singing with orchestral accompaniment. The character of the English anthem began to reflect Charles II’s musical tastes with the inclusion of French musical nuances. Elwyn A. Wienandt and Robert H. Young describe Charles II’s musical preferences in the following quote:

23 Ibid, 45.
It was inevitable that the King’s taste should bring about a great change in the style of music which had heretofore been confined to full anthems with *colla parte* organ accompaniment, and verse anthems with organ-accompanied solo sections, brief introductory and bridge passages for organ, and chorus settings *colla parte*. His organization of a string orchestra, after the French fashion, for entertainment, and the expansion of its functions as part of his churchgoing entertainment was simply a reflection of what he had experienced in France, where the *vingt-quatre violins* served also as instrumental support for the grand motets in the Chappelle Royale.

The basic anthem texture of the Restoration was homophonic. The structure of the anthem evolved into a “succession of contrasting verses, interspersed with an occasional chorus” and featured a more tonal harmonic language.  

Henry Purcell (1659-1695) and John Blow (1649-1708) were prominent composers during the Restoration. The most prolific composer of this period was John Blow, who wrote the orchestral anthem, *God Spake Sometimes in Visions* for James II’s coronation in 1685. Purcell, a student of Blow, successfully synthesized and developed compositional procedures from his predecessor’s anthems. Further, he was instrumental in expanding the form of the anthem into several movements with arias, duets, and quartets interspersed with choral movements, which consequently extended the anthem’s length. Purcell’s anthems had orchestral interludes between sections, verses, or movements. Because these interludes did not adapt well to being played on the organ during the Anglican service, they were generally omitted. In spite of this limitation, the practice of writing anthems with orchestral accompaniment continued past Purcell’s time.

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and became a tradition for anthems written in celebration of a military victory, a peace settlement, or the coronation of a new monarch. A characteristic feature of some anthems was a short, concluding hallelujah chorus.26

The later anthems, like Handel’s Chandos Anthems and Four Coronation Anthems, followed the same basic structure as Purcell’s anthems, including instrumental interludes between sections. Handel’s innovations in anthem development were more instrumental than structural; he added trumpets and timpani, standard instrumentation of the baroque festival orchestra. He also introduced fugal treatment in the concluding chorus, which later became an eighteenth-century convention.27

The history and style of Handel’s anthems, oratorios, operas and instrumental works have been widely researched. Within this body of scholarly writings, authors have explored Handel’s compositional techniques, his treatment of melody, harmony and ornamentation, and his unique blend of international compositional styles. These appealing characteristics are some of the elements that have made Handel’s compositions popular for almost two hundred and fifty years. Since 1727, however, many aspects of performance have changed. Technological advancements in instrumental construction and materials, the decline and extinction of the castrati, and the inclusion of female voices in the choir make necessary a number of changes to the performance of Handel’s works. Moreover, few modern performances can accommodate the number of performers Handel used at the royal coronation of 1727. According to Donald Burrows,

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27 Ibid.
a foremost authority on the life and works of Handel it is estimated that one hundred and sixty musicians (60 singers and 100 instrumentalists) performed on October 11, 1727 at the coronation of King George and Queen Caroline. The performers included members of the choirs and orchestras of the Chapel Royal, St. James Cathedral, St. Paul’s Cathedral, Windsor Castle, and Westminster Abbey. Handel’s renewed popularity from the successes of his biblical oratorios, and the favor of the King in the 1720s were significant contributing factors in the invitation to compose the coronation music.

Between the eleventh and the seventeenth centuries, certain anthems were sung at specific points during the coronation service. Traditionally, the liturgical text of Zadok the Priest was sung during the anointing, the most sacred part of the coronation service, and Let Thy Hand Be Strengthened was sung during the reception. For the coronation service of James II of 1685, Henry Purcell added My Heart Is Inditing during the Queen’s part of the coronation. These portions of text were three of the four sections that Handel used for his coronation anthems and hence the ones used in this study. Handel’s compositions have survived as the most frequently performed pieces at a coronation since 1727.

The four anthems mentioned above are ideal pieces to use in creating a historically informed performance due to the uniqueness in the original numbers of performers, performance venue, and variables with respect to the instruments and singers. In order to effectively perform these anthems, it was necessary to investigate the

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historical and physical environment of the premiere of these works at King George II’s
coronation. Further research also was required to identify the differences between the
baroque instruments and their twenty-first-century counterparts.
CHAPTER 2: THE 1727 CORONATION

Coronation ceremonies were developed both to reflect the traditions of previous coronations and to make the service distinctive for the new monarch. It was customary for the organist from the Chapel Royal to compose the music for the service. “In 1727 the organist at the Chapel Royal and at Westminster Abbey was William Croft, but Croft died just before the coronation and the King asked Handel to do the job in preference to Croft’s successor at the Chapel Royal, Maurice Greene.” Handel eagerly pursued the project and based his work on the form of service previously used for the coronation of James II in 1685. The Bishop of London and the Archbishop of Canterbury, however, who were jointly responsible for the coronation liturgy, had already decided to employ the same form of service which was used in 1714 for George I’s coronation. Within a month, Handel composed and presented his completed compositions, The Four Coronation Anthems, to the church authorities and this, in turn, left no choice but for the committee to accept Handel’s offering. Unfortunately, this did not stop William Wake, the Archbishop of Canterbury, from exchanging some tense and inflammatory words with Handel over his choice to disregard the coronation liturgy that the bishops had agreed to follow. Regardless, the Four Coronation Anthems were performed as Handel had originally intended. The Archbishop of Canterbury was thoroughly disgruntled with the performance and wrote in his notes, “The anthems in confusion: all irregular in the

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music.” The Archbishop’s complaint was due to the fact that some of the elements of the performance were out of their intended order. The problem that actually occurred during the coronation service was due in part to the fact that the choirs were divided into separate galleries and the instrumentalists also were separated from the choirs, which impaired communication between the musicians. Figure 3 shows the view of Westminster Abbey from the quire to the east end within the hall.

Donald Burrows asserts that “some musicians (following the printed order) may have begun The King Shall Rejoice while others commenced Let Thy Hand Be Strengthened, which would explain Wake’s comments about ‘confusion’ and ‘irregularity’.” The probability of this having occurred is very high, given that the actual distance between the different groups of performers was anywhere from sixty to one hundred and twenty feet (refer to Appendix B for the Documentary Evidence for the Music of the 1727 Coronation).

Since there are no written accounts about the exact position of the performers for the 1727 coronation, it is helpful to turn to Francis Sandford’s documentation of the coronation of James II in 1685 to determine the likely placement of people. Figures 4 and 5 illustrate the location of the participants, while Figure 6 displays the ground-plot, or layout of Westminster Abbey. It is clear that the distance between performers is large enough to be a major contributing factor to the miscommunication between the different groups. These schematics and drawings from Sandford are the only evidence found that

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32 Ibid.
33 Ibid., 264.
indicates the layout of the Abbey for performers and dignitaries during special events in the early eighteenth century.
Figure 3. “A Perspective of Westminster-Abbey” (from the quire to the east end)  

34 Francis Sandford, The History of the Coronation of the Most High, Most Mighty and Most Excellent Monarch, James II... and of His Royal Consort Queen Mary: Solemnized in the Collegiate Church of St. Peter in the City of Westminster on Thursday the 23rd of April, ...in the Year of Our Lord 1685 (London, 1687), http://www.octava.com/editions/sfdckj/index.html (accessed November 8, 2007).
Figure 4. “The Inthronization” (viewed from the west) 

Figure 5. “A Prospect of the Inside” (viewed from the east)\textsuperscript{36}

\textsuperscript{36} Francis Sandford. The History of the Coronation of the Most High, Most Mighty and Most Excellent Monarch, James II... and of His Royal Consort Queen Mary: Solemnized in the Collegiate Church of St. Peter in the City of Westminster on Thursday the 23rd of April, ...in the Year of Our Lord 1685. London, 1687. http://www.octava.com/editions/sfdckj/index.html (November 8, 2007).
Figure 6. “A Ground-Plot of the Collegiate Church”

37 Francis Sandford. The History of the Coronation of the Most High, Most Mighty and Most Excellent Monarch, James II... and of His Royal Consort Queen Mary: Solemnized in the Collegiate Church of St. Peter in the City of Westminster on Thursday the 23rd of April, ...in the Year of Our Lord 1685. London, 1687. http://www.octava.com/editions/sfdckj/index.html (November 8, 2007).
The singers and instrumentalists were located in several specially constructed galleries throughout the Abbey. The Westminster Abbey choir was in a gallery just west of the crossing on the north wall. The trumpeters and timpani were placed above the west entrance. The rest of the musicians were placed east of the crossing in two groups and were positioned on each side of the altar. The total distance between these groups was approximately 120 feet. Unfortunately, this arrangement resulted in separating the trumpeters and timpanist from the remaining instrumentalists, and was the major reason for the lack of communication between performers. The coronation of George II was the first time in recorded English history that over 200 performers had been assembled for any single performance or event. By today’s standards, the ratio of instrumentalists to singers is overbalanced at 3.4:1 or 160 instrumentalists to 47 singers. It is significant to note that the instruments of the baroque period did not have the same power or resonance as modern instruments and would have been limited in their ability to carry to the back of the hall. In addition, all of the musicians employed to perform that day were the best and most accomplished musicians in all of England. As previously mentioned, they were hired from the Royal Musicians of the Chapel Royal, St. James Cathedral, St. Paul’s Cathedral, Windsor Castle and Westminster Abbey.

The mass choir drew from four London choirs. The treble voices were from the Westminster Abbey boy’s choir. These boys from the Abbey School were highly trained and their musical education was highly respected in England. The Chapel Royal singers included only the elite of England and several of them had even been brought over from
Italy to join the Chapel Royal.38 The other two choirs were from Westminster Abbey and St. Paul’s Cathedral, which were the two largest churches in London and usually employed the best singers in the country. It should be noted that many of the Chapel Royal gentlemen also performed at Westminster Abbey and/or St. Paul’s Cathedral, so there was some overlap in personnel. Records from the exchequer’s account39 include information about which singers were involved in the coronation and which overlapped in membership in the various organizations. George II’s coronation unequivocally employed the best singers and instrumentalists available in England at that date.

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39 Ibid.
CHAPTER 3: HISTORY OF THE ORGAN IN WESTMINSTER ABBEY

Bernard Smith was considered England’s best master organ builder. He was responsible for building more than ten pipe organs between the years of 1673 and 1708, one of which was the small organ used in 1685 for James II’s coronation. Organ-building was a family trade also practiced by Smith’s two nephews and his son-in-law, Christopher Schrider. After Bernard Smith died in 1708, the family business continued through Christopher Schrider, who was Westminster Abbey’s organ builder. In my search for documentation regarding Schrider’s specially constructed organ, I consulted a manuscript from the private library of Westminster Abbey: *The Organs of Westminster Abbey and Their Music*, written by David Stanley Knight in 2001. Dr. Knight presented the following brief description of Christopher Schrider’s role as the organ builder as well as the modifications made to the Abbey’s pipe organ during the early 1700s.

In 1710 the organ builder Christopher Schrider rebuilt the organ. He lowered the pitch by a semitone and added the notes BB and BBb at the bottom of the compass. The notes C# and D# would have been added at this time also, the new low keys implying a change to a long compass. By 1727, Christopher Schrider had been the Abbey’s organ builder for seventeen years, and for all that time he had been responsible for the maintenance and occasional rebuilding of the instrument which had, in various forms, been in the Abbey since before the Restoration.40

It was in 1727 for the coronation of George II that “Schrider was commissioned to build a new organ which was erected … on temporary scaffolding over the Chapel of Edward the Confessor behind the altar. It was a magnificent instrument which cost

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40 David Stanley Knight, “The Organs of Westminster Abbey and their Music” (PhD diss., King’s College, University of London, 2001), 58.
£1,000 and after the coronation, the King presented it to the Abbey.” Donald Burrows asserts that “[a] special organ that would have matched the pitch of the orchestral instruments was provided by Christopher Schrider for the coronation.” As noted before, the orchestral instruments were of French origin, having a pitch standard as much as a minor third below a\(^1\) = 440.

The new small organ was built because the existing Abbey organ was considered to be located too far away from the performers during the coronation. Donald Burrows, a leading authority on Handel, believes that at the coronation service of 1727, the Chapel Royal Organist, Maurice Greene, played the Schrider organ for Handel’s anthems and the Abbey’s organist, John Robinson, played all other coronation music and hymns on the Abbey’s extant organ. Schrider’s organ was constructed to match the pitch of the orchestral instruments, which were mostly of French origin. It should be noted that because of the pitch differences, the two organs never played simultaneously. “The fine organ made by Mr. Schrider which was set in Westminster Abbey, and used on the day of the coronation, has been presented to the said Abbey by His Majesty. It is accounted [as] one of the best performances of that maker.”

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CHAPTER 4: HISTORY OF BAROQUE INSTRUMENTS

VIOLIN

The Amati and Stradivarius families brought the baroque era violin to the height of its development during the eighteenth century. They were regarded as the master violin makers of the day. The development began with Andrea Amati (1505-1577) of Cremona, who became the first violin maker to design and construct the violin that became the blueprint for the violin craftsmen of today. Amati’s grandson, Nicolo, made further refinements and developments to Andrea’s blueprint, which resulted in strengthening “the appearance of the instrument and experiment[ing] with new arching shapes.”

Figure 7. Examples of baroque violins by Amati

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When the plague devastated Europe in 1685, Nicolo Amati (who lost several workers to the contagion) took on several apprentices, one of whom was Antonio Stradivarius (1670-1705).

[Stradivarius’s] most important innovations were the flatter and more powerful archings he evolved, and his new system of thicknessing. The most striking difference in appearance is the “C” bout, which is straighter and stronger than the deeply incurving form of Amati. The F holes are longer and less curved and the scroll is more substantial.46

Stradivarius also changed the formula of the varnish, which produced a “stronger red pigment” and gave the appearance of a “seemingly bottomless depth of color.”47

The Italian dominance in the field of violin-making continued for several decades, extending into the nineteenth century with the Guarini family. One of the major differences between the baroque violin and the modern day instrument is a change in the tone resulting from replacing gut strings with metal strings. Some other dramatic differences come from the angle of the neck, the thickness and length of the neck, the curve of the bridge, and finally “the heart of the violin,”48 the bow.

A major consideration in the performance of a baroque composition is the sound produced by the baroque violin compared to that of the twenty-first century violin. Certainly the gut strings of the baroque violin produced a much warmer, mellower sound than the modern violin. For this reason alone, the sound produced by the instruments was softer and more muted.

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47 Ibid.
48 Ibid.
The usual baroque performance venues were typically smaller than modern ones. The Abbey and other churches and halls were limited in size and configuration by the architectural techniques and materials available and were not of the larger dimensions of today’s concert halls. As concert halls and performance venues increased in size, innovations in the design of the instruments were required to increase the volume of the sound they produced. In my opinion, when attempting to create a historically informed performance, it is important to be faithful to the characteristics of the original venue, the constraints of the chosen instruments and the size of the performing forces.

Finally, the construction and the material of the bow have changed dramatically. Previous to the seventeenth century, the bow contained only about 80 to 100 hairs as compared to 150 to 200 hairs in today’s standard bow.⁴⁹ Also, the tension and the shape of the bow has changed and evolved over the years. The bow-stick is now longer and the convex curvature of the bow is less. The introduction of the modern screw nut, which is used to tighten the horsehair, was a major innovation that was not widely in use by the beginning of the seventeenth century. It resulted in providing much greater tension on the hairs than had previously been possible. The greater tension produced a stronger sound and brighter tone, which also gave the string instrument greater variety in tone production. Further, it helped the player to make longer and more subtle bow strokes, and resulted in greater possibilities for the violinist to play a wider range of dynamics and an increased range of expression.

Although the construction of the bow had much to do with the sound, so too, did the way the bow was held. According to David D. Boyden, there were two basic types of grips, the French grip and Italian grip. In the French grip the bow was held with the “thumb-under-the-hair.” This seems to have given the necessary firmness to the bow stroke because of the direct contact of the hand with the bow hair, but afforded very little

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52 Ibid.
control and subtlety in the bow stroke. The French grip was much better suited to the articulation of dance music.

The Italian grip, as it was later referred to, enabled the musician to play with much more subtlety and more control in the stroke. In this technique the bow was held so that the thumb was placed between the hair and the bow stick. In both grips the wrist, elbow and arm were supposed to be held free and loose, which would result in a light and articulated touch. Depending on the length of the bow and where it was balanced, the hand held the bow at either the frog (for the shorter bow) or several inches above the frog (for the longer bows). The balancing of the bow, as well as the violinist’s personal preference, were major deciding factors in the hand position.

OBOE

The oboe, or *hautbois*, of the baroque period is substantially different from the twenty-first century oboe. The oboe is a descendant of the renaissance shawm, which was mostly suited to playing at outdoor venues due to its shrill tone quality. By the reign of Louis XIV, r. 1643-1715, the instrument was a two-keyed, double-reed woodwind instrument developed to replace the shawm for indoor performances.53

Figure 9 and Figure 10 illustrate the early baroque oboes. The baroque oboe had a limited number of fingering combinations, whereas the modern oboe utilizes the Boehm system of keys.54 The early oboe was more dependent on the embouchure of the player

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to achieve a particular note than on the use of the keys. The modern oboist can produce a
particular note with several key combinations and with the embouchure. Ultimately, this
allows the player greater control and increased tuning accuracy. The baroque performer
was solely dependent on his/her embouchure control and a well-trained ear.
Figure 9. Parts of a baroque oboe

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BASSOON

Like the oboe, the bassoon was a relatively new instrument in the baroque period. It was originally called the double base or base curtal. Over the ensuing quarter century it was modified to become a three-jointed woodwind. The baroque bassoon was outfitted with two keys operated by the thumbs and one by the little finger in addition to the holes which were directly covered by the fingers, and which increased the range of pitches that could be produced by the instrument. The bassoon measured eight feet in length, with a bore which expanded in width continuously from the butt to the bell. In order to make the instrument manageable to hold it was restructured to double back on itself. As the bassoon evolved over the centuries more keys were added and the range was extended to include almost four octaves. The baroque bassoon was made of maple or pear wood.

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while the modern bassoon is made of rosewood. Figure 11 illustrates the evolution of the early bassoon to its modern form.

Figure 11: Early bassoons

From left to right: (a) three-key by Johann Christoph Denner, Nuremberg, c1700 (Musikinstrumenten-Museum, Berlin); (b) four-key by Thomas Stanesby (ii), London, 1747; (c) seven-key by Friedrich Kirst, Potsdam, late 18th century; (d) Boehm system, with 30 keys, by Triébert-Marzoli-Boehm, Paris, c1855 [(b)–(d) private collection]

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TRUMPET

The baroque trumpet’s body and construction had been standardized since the sixteenth century. Made from a sheet of brass or silver and measuring about 0.35 millimeter in thickness, it was rolled in the shape of a tube “creating a bore of about 9.5 - 11.2 mm.”58 The tubing was in two separate sections: the main body and the bell section. These were joined by telescoping one section into the other and then sealing them with beeswax. There were a few other modifications to the trumpet that were specific to the country of origin, including encircling the mouthpipe yard with a type of hollowed-out ball to create a seal.

Figure 12. Baroque trumpet59
(1741 Trumpet Kunsthistorisches Museum, Vienna)

Sarkissian and Tarr state that “extant baroque trumpet mouthpieces differ from modern ones in several ways. The rims were flatter and wider, and there was a sharp edge between cup and throat.” The trumpet’s brilliant tone was produced by the sharp edge between the cup and the throat of the mouthpiece. The depths of the mouthpieces varied, depending on whether the player needed to play in the high clarion register (using a shallow cup design), or whether he played the lower principal part (using a deeper, wider cup). The form of the trumpet did not change during the seventeenth and early eighteenth centuries. The flare of the bell design, however, varied in width from four to six inches. The larger bell width caused the trumpet’s tone quality to be less penetrating and more rounded.

The English trumpet craftsmen constructed their instruments to the standard pitch of “D” or “Eb” and as mentioned previously, extra crooks were inserted between the mouthpiece and the body to lengthen the tube, thus effectively lowering the pitch of the instrument.

TIMPANI

The timpani or baroque kettle drums were “large bowl-shaped resonating” copper shells which were open at the top. These shells were then covered with tightly stretched calf-skin which could be adjusted to a tension which would resonate at a particular pitch.

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The inherent characteristics of the calf-skin and the design of the shell limited the extent to which the tuning of the drum could be modified. The design of the shell is principally hemispherical, but may be either deeper or shallower depending on its country of origin. Deeper shells were used in England and it is the contention of many percussionists that deeper shells produce a more resonant tone.

The kettle drum had a hoop of wood just slightly larger than the diameter of the resonating chamber which held the skin head to the shell. The tension was adjusted by a series of handles which passed through rings on the hoop and were attached by threaded screws to brackets affixed equidistantly around the perimeter of the drum body. The tension had to be evenly distributed around the circumference of the drum and the degree of tension applied established the pitch of the drum.

The timpani provided pitch and rhythm for the baroque festival orchestra. The timpani part almost always closely followed the third trumpet part, reinforcing the root and the fifth of the tonic harmony. Two or three kettle drums were used to play the tonic, dominant, and sub-dominant notes as necessary. Baroque mallets were constructed of hard wood that produced a crisper, more articulated sound on the calf-skin heads.
CHAPTER 5: PITCH AND TERMINOLOGY

The scale and the stave on which to notate the intervals of music were developed to describe compositions beyond the oral tradition.\textsuperscript{62} Pitch and its notation is a convention that has developed as a means of communicating the distance from one sound or pitch to another. By standardizing pitch and notation it became possible for players in different locations and at different dates to perform a particular composition in the manner intended by the original composer.

Standardized pitch is relatively recent, having occurred in May 1939 in London at a meeting of the International Standardizing Organization. Before 1939, pitch varied according to both time and geography. In order to authentically create a historic performance and fulfill the composer’s intent, it is important to acknowledge the environment in which the original performance occurred and the characteristics of the instruments which were available to the performers at that time.

Discussing pitch is easier today than it was 300 years ago because we can quantify pitch in terms of vibrations per second, or Hertz value, and many people have a basic understanding of this concept. A Hertz value describes the number of complete repetitions of a wave during a second and this corresponds to the sensation of a particular pitch to the listener. Throughout this study each pitch that is noted has been converted to its corresponding Hertz value in order to maintain consistency and provide a universal standard for reference.

Pitch has been referred to in a variety of ways, depending on the country or region of the world in which musical compositions were developed. Over the centuries names for performance pitch have included: cammerton, chorton, cornet-ton, consort-pitch, quireton, quire-pitch and ton de la chambre, to name a few.63 Further complicating matters, the same name did not necessarily mean the same pitch in different regions.

As seen in the section on Germany in Table 2 cammerthon in the early seventeenth century was determined to be A+1 or a1 = 464 Hertz. However, by the late seventeenth century and into the eighteenth century, cammerthon changed to A-1 or a1 = 413. This change in pitch occurred to accommodate the introduction of French instruments which were pitched lower than the locally made instruments.64 Table 2 also illustrates that France’s chamber pitch and opera pitch were as much as a minor third lower than similar standards in Germany and England.65 The exception was the Ton de l’Ecurie, which was for the French military band to use in ceremonial and outdoor applications and was necessarily pitched higher in order to excite the listener and carry to greater distances.66

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64 Ibid., 125.
65 Ibid., liii.
66 Ibid., 99.
Table 2. Terms of Pitch Used from 1670 to 1730

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>NAME</th>
<th>QUIRE PITCH</th>
<th>HERTZ VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td>New Consort Pitch in 1730</td>
<td>Q-2</td>
<td>a¹ = 423</td>
</tr>
<tr>
<td>England</td>
<td>Consort Pitch, Previous to 1730</td>
<td>Q-3</td>
<td>a¹ = 403</td>
</tr>
<tr>
<td>England</td>
<td>Quire-Pitch</td>
<td>Q-1</td>
<td>a¹ = 448</td>
</tr>
<tr>
<td>England</td>
<td>Chappell-Pitch</td>
<td>Q-2</td>
<td>a¹ = 423</td>
</tr>
<tr>
<td>England (London)</td>
<td>Queen’s Theatre Opera Pitch</td>
<td>Q-3</td>
<td>a¹ = 403</td>
</tr>
<tr>
<td>France</td>
<td><em>Ton de la Chambre du Roy</em></td>
<td>A-1½</td>
<td>a¹ = 404 to 409</td>
</tr>
<tr>
<td>France</td>
<td><em>Ton d’Ecurie</em> (Military Band)</td>
<td>A+1</td>
<td>a¹ = 464</td>
</tr>
<tr>
<td>France</td>
<td><em>Ton d’Opéra</em></td>
<td>A-2</td>
<td>a¹ = 394</td>
</tr>
<tr>
<td>Germany, early 17th Century</td>
<td><em>Cammer Thon</em> (Chamber Tone)</td>
<td>A+1</td>
<td>a¹ = 464</td>
</tr>
<tr>
<td></td>
<td><em>Cornetenthon</em> (Coronet Tone)</td>
<td>A+1</td>
<td>a¹ = 464</td>
</tr>
<tr>
<td></td>
<td><em>Chorthon</em> (Choir Tone)</td>
<td>A-1</td>
<td>a¹ = 464</td>
</tr>
<tr>
<td>Germany, late 17th &amp; early 18th centuries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Chorton, Cornet–ton</em></td>
<td>A+1</td>
<td>a¹ = 464</td>
</tr>
<tr>
<td></td>
<td><em>Cammerton</em></td>
<td>A-1</td>
<td>a¹ = 413</td>
</tr>
</tbody>
</table>

The French influence was felt most strongly at the end of the seventeenth century as French instrumentalists travelled outside of France to perform, and French instruments were exported to other countries. Since instruments with different pitches were found throughout Europe, the practice of transposing by sight a half or whole step up or down to accommodate the indigenous instruments was a standard skill of musicians in Europe and has been well documented. In his book *A History of Performing Pitch*, Bruce Haynes states, “It is known that the pitch of the opera orchestra at the Queen’s Theatre...”

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(in England) where Handel produced his first operas was a quarter tone higher than *Ton d’Opéra* in France.\(^{68}\) Therefore pitch at the Queen’s Theatre would have been A-1 ½ or \(a^1 = 403\) Hz. “[I]n fact we know that Handel’s opera pitch was about \(A = 403\), about \(\frac{3}{4}\) of a whole step below 440.”\(^{69}\) “By the early 1720s Handel was probably using A-1 or \(a^1 = 413\), which was the standard opera pitch on the continent. His later oratorios were probably performed at the New Consort Pitch or Q-2 (\(a^1 = 423\) Hz.).”\(^{70}\)

Pitch was not internationally standardized at \(a^1 = 440\) Hz. until 1939. Previously, the initial standardization of pitch “was made in France by 1859, when A-1 at 435 Hz. (vibrations per second) was adopted by ministerial decree.”\(^{71}\) Standardization of pitch facilitates the training and performance of musicians within different schools and their ability to travel and perform together regardless of the region in which they received their training. It also facilitates communication between composers and performers.

Bruce Haynes has developed a reference table of pitch levels to provide a common standard for comparing modern and historical pitch.\(^{72}\) The relationships are shown in Table 3, reproduced from his text. Quire-pitch, as a system of pitch reference, was developed in England to describe the performing range of the choir voices. A transposition grid of the quire-pitch designations and their corresponding frequencies in Hertz is shown in Table 4.

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\(^{69}\) Ibid., xxxiv.


Table 3. Pitch Terminology\textsuperscript{73}

<table>
<thead>
<tr>
<th>PITCH NAME</th>
<th>HZ. VALUE FOR A</th>
<th>FREQUENCY RANGE FOR A</th>
<th>COMMAS FROM 440</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+3</td>
<td>521</td>
<td>509-531</td>
<td>13</td>
</tr>
<tr>
<td>A+2</td>
<td>495</td>
<td>480-508</td>
<td>9</td>
</tr>
<tr>
<td>A+1</td>
<td>464</td>
<td>453-479</td>
<td>4</td>
</tr>
<tr>
<td>A+0</td>
<td>440</td>
<td>428-452</td>
<td>0</td>
</tr>
<tr>
<td>A-1</td>
<td>413</td>
<td>409-427</td>
<td>5</td>
</tr>
<tr>
<td>A-1½</td>
<td>403</td>
<td>398-408</td>
<td>7</td>
</tr>
<tr>
<td>A-2</td>
<td>392</td>
<td>384-397</td>
<td>9</td>
</tr>
<tr>
<td>A-3</td>
<td>373</td>
<td>361-383</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 4. A History of Performing Pitch\textsuperscript{74}

<table>
<thead>
<tr>
<th>PITCH SYMBOL</th>
<th>APPROXIMATE VALUE</th>
<th>INTERVAL FROM QUIRE-PITCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-0</td>
<td>473</td>
<td>(quire-pitch)</td>
</tr>
<tr>
<td>Q-1</td>
<td>448</td>
<td>m2 below</td>
</tr>
<tr>
<td>Q-2</td>
<td>423</td>
<td>M2 below</td>
</tr>
<tr>
<td>Q-3</td>
<td>400</td>
<td>m3 below (= A-1½)</td>
</tr>
</tbody>
</table>

Organ pitch through the seventeenth century in England was founded on a bottom pipe length of 5 or 10 feet which was assigned the designation C. This bottom pipe has been calculated to produce a note of approximately 35.16 Hz. which corresponds to a\textsuperscript{1} = 473.\textsuperscript{75} This is almost a half-step higher than the modern day standard of a\textsuperscript{1} = 440 Hz. The bottom note of the organ was referred to as C when the organ was played alone.

\textsuperscript{74} Ibid., 90.
\textsuperscript{75} Ibid., 89.
However, when the organist accompanied a choir it was necessary to devise a transposing scheme that shifted the keys of the organ so that the bottom note became F in order to be consistent with the accepted ranges of the choirs. This accepted range for the vocal performance of the choir was known as quire-pitch, whereas the un-transposed key of the organ is now referred to as Organ-pitch. The approximate relationships of quire-pitch to Organ-pitch and the matching Hertz values are shown in Table 5.

<table>
<thead>
<tr>
<th>QUIRE-PITCH</th>
<th>HERTZ</th>
<th>ORGAN-PITCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>473</td>
<td>D</td>
</tr>
<tr>
<td>G♯</td>
<td>448</td>
<td>C♯</td>
</tr>
<tr>
<td>G</td>
<td>423</td>
<td>C</td>
</tr>
<tr>
<td>F♯</td>
<td>400</td>
<td>B</td>
</tr>
<tr>
<td>F</td>
<td>377</td>
<td>A♯</td>
</tr>
</tbody>
</table>

In the sixteenth and seventeenth centuries, English organs became commonly known as transposing organs because the same key on the organ was known by two different names, which explains the origin of the term quire-pitch. Bruce Haynes explains it this way:

To match [a particular] pitch to the ranges of choirs, organists evidently found it necessary to use a transposing scheme that involved shifting the names of the keys on the keyboard. The note that was normally C was transformed into an F. Thus when playing alone, an organist considered his bottom note a C, but when he accompanied a choir, he customarily changed it to an F, thereby effectively performing a transposition. The untransposed system (where the key C was called C) is now sometimes called "organ-pitch". The other system, where the key C became F was called "quire-pitch". Because the keys were nominally a 4th lower than quire-pitch, organ pitch sounded a 4th higher than Quire - pitch [or a 5th lower].

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77 Ibid., 88.
Prior to the development of the theory and equipment necessary for describing pitch in terms of Hertz values, musicians used terminology such as commas, semi-tones, thirds and fifths to describe differences in pitch. Although commas are more important in the discussion of just intonation and mean-tone temperament than in equal temperament applications, a definition and discussion is provided in order to provide greater context for the historical understanding of pitch.

In just intonation, the comma, sometimes called the comma of Didymus, has a frequency ratio of 81:80 and is the amount by which four perfect fifths exceeds two octaves and a true major third. It is also the difference between a major tone which has a ratio of 9:8 and a minor tone which has a ratio of 10:9. The comma of Pythagoras is the amount by which twelve fifths exceeds 7 octaves in frequency. Other definitions of the comma exist but are less frequently used. In mean-tone temperaments the major second and minor second are averaged and the whole tone is substituted for the pitches which differ by a comma. Temperament describes the methods by which commas are addressed on a keyboard with fixed notes. In mean-tone tuning, each of the fifths is flattened in order to eliminate the commas. In Pythagorean tuning the fifths are tuned in an exact

78 “A comma is a musical interval by which four fifths exceeds a seventeenth (i.e., two octaves and a major third. It can also be found through the circle of fifths by starting on C. The sequence eventually circles back to C, but this the final C, which is obtained by adding 12 fifths, is 24 cents higher than the C obtained by adding 7 octaves. The difference between those two pitches is called the Pythagorean comma.” http://www.theviolinsite.com/music_dictionary/index.html.
ratio of 3:2 and the ratio of 81:64 is used for the major thirds. Other temperaments or systems use alternative compromises to eliminate the commas.

The concept of the comma is much less relevant in modern music because equal temperament has been developed in order to avoid commas. In equal temperament enharmonic notes are tuned identically. The Pythagorean comma has approximately twelve-elevenths of the syntonic comma. In equal temperament each fifth is flattened by one-eleventh of a comma and consequently the octave is divided into twelve equal intervals. The tempered semi-tone becomes half of the tempered whole tone.

The cent is the smallest denomination used to measure a musical interval. As defined in *The New Grove Dictionary of Music and Musicians*,

The cent is a very small (theoretical) interval which is used by some modern writers to measure the intervals produced on ancient instruments or the errors which occur in tuning a keyboard instrument as nearly as possible in equal temperament. Of these uses the second accounts for the definition of the cent, which is one hundredth part of a (theoretical) semitone of equal temperament or one twelve-hundredth part of an octave. It is essentially a unit of physical measurement – that of intervals determined by the frequency ratio of two vibrations, *i.e.* the ratio between their rates. It is therefore a convenient unit to use in the physics laboratory. It is important not to think of it as a *musical* interval.  

---


Table 6. Table of frequencies for notes in the range C0 to B8 in the equal temperament scale based on A4 = 440 Hz.\textsuperscript{82}

<table>
<thead>
<tr>
<th>Octave</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>30.87</td>
<td>61.74</td>
<td>123.5</td>
<td>246.9</td>
<td>493.9</td>
<td>987.8</td>
<td>1976</td>
<td>3951</td>
<td>7902</td>
</tr>
<tr>
<td>A#</td>
<td>29.14</td>
<td>58.27</td>
<td>116.5</td>
<td>233.1</td>
<td>466.2</td>
<td>932.3</td>
<td>1865</td>
<td>3729</td>
<td>7459</td>
</tr>
<tr>
<td>A</td>
<td>27.50</td>
<td>55.00</td>
<td>110.0</td>
<td>220.0</td>
<td>440.0</td>
<td>880.0</td>
<td>1760</td>
<td>3520</td>
<td>7040</td>
</tr>
<tr>
<td>G#</td>
<td>25.96</td>
<td>51.91</td>
<td>103.8</td>
<td>207.7</td>
<td>415.3</td>
<td>830.6</td>
<td>1661</td>
<td>3322</td>
<td>6645</td>
</tr>
<tr>
<td>G</td>
<td>24.50</td>
<td>49.00</td>
<td>98.00</td>
<td>196.0</td>
<td>392.0</td>
<td>784.0</td>
<td>1568</td>
<td>3136</td>
<td>6272</td>
</tr>
<tr>
<td>F#</td>
<td>23.12</td>
<td>46.25</td>
<td>92.50</td>
<td>185.0</td>
<td>370.0</td>
<td>740.0</td>
<td>1480</td>
<td>2960</td>
<td>5920</td>
</tr>
<tr>
<td>F</td>
<td>21.83</td>
<td>43.65</td>
<td>87.31</td>
<td>174.6</td>
<td>349.2</td>
<td>698.5</td>
<td>1397</td>
<td>2794</td>
<td>5588</td>
</tr>
<tr>
<td>E</td>
<td>20.60</td>
<td>41.50</td>
<td>82.41</td>
<td>164.8</td>
<td>329.6</td>
<td>659.3</td>
<td>1319</td>
<td>2637</td>
<td>5274</td>
</tr>
<tr>
<td>D#</td>
<td>19.45</td>
<td>38.89</td>
<td>77.78</td>
<td>155.6</td>
<td>311.1</td>
<td>622.3</td>
<td>1245</td>
<td>2489</td>
<td>4978</td>
</tr>
<tr>
<td>D</td>
<td>18.35</td>
<td>36.71</td>
<td>73.42</td>
<td>146.8</td>
<td>293.7</td>
<td>587.3</td>
<td>1175</td>
<td>2349</td>
<td>4699</td>
</tr>
<tr>
<td>C#</td>
<td>17.32</td>
<td>34.65</td>
<td>69.30</td>
<td>138.6</td>
<td>277.2</td>
<td>554.4</td>
<td>1109</td>
<td>2217</td>
<td>4435</td>
</tr>
<tr>
<td>C</td>
<td>16.35</td>
<td>32.70</td>
<td>65.41</td>
<td>130.8</td>
<td>261.6</td>
<td>523.3</td>
<td>1047</td>
<td>2093</td>
<td>4186</td>
</tr>
</tbody>
</table>

To better understand how Hertz values, commas and cents relate to each other refer to Table 7, Pitch Equation in Equal Temperament. The equation at the top of the table compares Hertz values with the number of commas and with cents values. Any measurement can be used to tune an instrument; these are simply three different ways to arrive at the same pitch. The difference between a major second and a minor second is 21.51 cents or one comma.

Table 7. Pitch Equation in Equal Temperment

<table>
<thead>
<tr>
<th>CENTS</th>
<th>COMMAS</th>
<th>HERTZ</th>
<th>STEPS/TONES</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>4 ½</td>
<td>23 to 25 Hz.</td>
<td>One half step or</td>
</tr>
<tr>
<td></td>
<td>commas</td>
<td></td>
<td>semitone</td>
</tr>
<tr>
<td>200</td>
<td>9</td>
<td>46 to 50 Hz.</td>
<td>One whole step or</td>
</tr>
<tr>
<td></td>
<td>commas</td>
<td></td>
<td>whole tone</td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Table 8, provides the translation of pitch names with the corresponding country of origin, Hertz value, frequency range, and number of commas from $a^1 = 440$. For example, A-1 would be equal to $a^1 = 413$ and is five commas away from A+0 or $a^1 = 440$. This table also puts into perspective the names of the pitches as they were known in their own country or region. Evidence has been drawn from existing organs or surviving instruments in order to establish what pitches were in use in particular places and eras. Modern tests were then done in order to determine the Hertz value of each instrument. For further investigation into and a detailed listing of existing instruments and their pitches, refer to Bruce Haynes’ book.\(^{83}\)

Table 8. Translations of Pitch Names\(^{84}\)

<table>
<thead>
<tr>
<th>PITCH NAME</th>
<th>COUNTRY</th>
<th>HERTZ VALUE</th>
<th>FREQUENCY RANGE FOR “A”</th>
<th>COMMAS FROM “A”</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+2</td>
<td>Various Regions</td>
<td>495</td>
<td>480-508</td>
<td>9</td>
</tr>
<tr>
<td>A+1</td>
<td>France, Germany</td>
<td>464</td>
<td>453-479</td>
<td>4</td>
</tr>
<tr>
<td>A+0</td>
<td>England, Italy</td>
<td>440</td>
<td>428-452</td>
<td>0</td>
</tr>
<tr>
<td>A-1</td>
<td>England, Italy, Germ.</td>
<td>413</td>
<td>409-427</td>
<td>5</td>
</tr>
<tr>
<td>A-1 ½</td>
<td>England, Holland, Bel.</td>
<td>403</td>
<td>398-408</td>
<td>7</td>
</tr>
<tr>
<td>A-2</td>
<td>France, Germany</td>
<td>392</td>
<td>384-397</td>
<td>9</td>
</tr>
</tbody>
</table>


\(^{84}\) Ibid., lii.
Pitch classification is a useful convention that enables composers, conductors and performers to communicate their expectations for the sound of a performance of a particular composition. Mary Cyr discusses some considerations in “choosing a pitch for modern performance.”\textsuperscript{85} She states that “[r]eturning a piece to its original pitch level may also ease the vocal register and thus change the sonority significantly.”\textsuperscript{86} Therefore, I submit that, in order to authentically replicate a historic performance and fulfill the composer’s intent, it is important to consider the initial performing pitch as well as to identify and simulate the concert space and the complement of performing instruments and chorus.

A GUIDE TO HISTORIC ENGLISH PITCH

Previous to the seventeenth century, the prevailing church pitch in England was $a_{1} = 473$, which was known by three names: A+1, A+2 and quire-pitch. Instruments constructed in England, like cornetts and shawms, were pitched even lower than other European instruments such as recorders, cornetts, and sackbuts. These instruments were generally pitched one semitone or half step lower than Praetorius’s quire-pitch, which was Q-1, or $a_{1} = 448$. Thus, English pitch, as shown by surviving instruments, was lower than Praetorius’ cammerton of $a_{1} = 464$. Table 9 shows the development and range of some of the English organs and their pitches from 1670 to 1770.

\textsuperscript{85} Mary Cyr, \textit{Performing Baroque Music} (Portland, OR: Amadeus Press, 1992), 64.
\textsuperscript{86} Ibid.
The Civil War in England from 1644-1660 brought with it the major destruction of many of England’s church organs. During the Restoration, however, many new organs were built, but at a lower pitch so they could play with the newer French woodwind instruments pitched at Consort-Pitch: Q-3, or \( a_3 = 400 \). By 1730, \( a_3 = 423 \), or Q-2, was generally adopted as the standard pitch for most orchestral instruments and the newly built organs in England. This pitch was known as the New Consort Pitch.\(^87\) Further evidence of the prevailing pitch in England, the pitch at which Handel was accustomed to performing, came after a discovery of his tuning fork that had been left at the Foundling Hospital in London after a performance of the *Messiah*. The tuning fork was identified to sound at \( a_3 = 422 \frac{1}{2} \).\(^88\)

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\(^{88}\) Ibid.
Table 9. English organ pitches^89^  

<table>
<thead>
<tr>
<th>Hertz Value</th>
<th>Location</th>
<th>Organ Builder</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>406</td>
<td>Adlington Hall near Macclesfield</td>
<td>B. Smith</td>
<td>1692ca</td>
</tr>
<tr>
<td>425 +/-</td>
<td>Oxford, Magdelen College</td>
<td>R. Harris</td>
<td>1690</td>
</tr>
<tr>
<td>423</td>
<td>London, Temple Church</td>
<td>Unknown</td>
<td>1687</td>
</tr>
<tr>
<td>427</td>
<td>Norwich Cathedral</td>
<td>R. Harris</td>
<td>1689</td>
</tr>
<tr>
<td>428</td>
<td>London, St. Andrew Undershaft</td>
<td>R. Harris</td>
<td>1696</td>
</tr>
<tr>
<td>429</td>
<td>Newcastle-on-the-Tyne, Cathedral</td>
<td>R. Harris</td>
<td>1670</td>
</tr>
<tr>
<td>439</td>
<td>Boston, Lincs</td>
<td>C. Smith</td>
<td>1696</td>
</tr>
<tr>
<td>442</td>
<td>London, Hampton Court Palace</td>
<td>B. Smith</td>
<td>1690</td>
</tr>
<tr>
<td>445</td>
<td>Cambridge, University Church</td>
<td>B. Smith</td>
<td>1698</td>
</tr>
<tr>
<td>449 +/-</td>
<td>London, St. Paul’s Cathedral</td>
<td>B. Smith</td>
<td>1696</td>
</tr>
<tr>
<td>450 +/-</td>
<td>Canterbury, Cathedral Chamber Organ</td>
<td>unknown</td>
<td>1680ca</td>
</tr>
<tr>
<td>452 +/-</td>
<td>Cannons Ashby, chamber organ</td>
<td>unknown</td>
<td>Late 17th century</td>
</tr>
<tr>
<td>474 +/-</td>
<td>London, Whitehall (Chapel Royal)</td>
<td>B. Smith</td>
<td>1676</td>
</tr>
</tbody>
</table>

**From: 1700-1730**

<table>
<thead>
<tr>
<th>Hertz Value</th>
<th>Location</th>
<th>Organ Builder</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>419</td>
<td>London, St. Johns Clerkenwell</td>
<td>R. Harris</td>
<td>1700</td>
</tr>
<tr>
<td>424</td>
<td>Gosport, Trinity Church (originally at Cannons)</td>
<td>Jordans</td>
<td>1715ca</td>
</tr>
<tr>
<td>427</td>
<td>Edinburgh, Russell Collection</td>
<td>unknown</td>
<td>1700ca</td>
</tr>
<tr>
<td>443</td>
<td>Cambridge, Trinity College</td>
<td>B. Smith</td>
<td>1708</td>
</tr>
<tr>
<td>474</td>
<td>London, Mercer’s Hall</td>
<td>B. Smith</td>
<td>1708</td>
</tr>
<tr>
<td>495</td>
<td>London, Royal College of Music</td>
<td>unknown</td>
<td>1702</td>
</tr>
</tbody>
</table>

**From: 1730-1770**

<table>
<thead>
<tr>
<th>Hertz Value</th>
<th>Location</th>
<th>Organ Builder</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>420 +/-</td>
<td>London, Chamber Organ</td>
<td>J. Snetzler</td>
<td>1761</td>
</tr>
<tr>
<td>424</td>
<td>London, All Hallows the Great &amp; Less</td>
<td>Glyn &amp; Parken</td>
<td>1749</td>
</tr>
<tr>
<td>426</td>
<td>London, (Westminster), St. John, Smith Sq.</td>
<td>Byfield Jordan, Bridge</td>
<td>1740</td>
</tr>
<tr>
<td>426</td>
<td>London, St. James Palace Chapel Royal</td>
<td>J. Snetzler</td>
<td>1740</td>
</tr>
<tr>
<td>448</td>
<td>London, Westminster Abbey</td>
<td>Schreider &amp; Jordan</td>
<td>1730</td>
</tr>
</tbody>
</table>

**There is no extant record of the organ pitch at Westminster Abbey previous to 1730**

---

By 1770, the New Consort Pitch at Q-2 and A+0 was being employed in the newly constructed French and English woodwind instruments. Although the lower pitch of \( a^1 = 423 \) was still retained in many organs of the day, most woodwinds were pitched at A+0. Since the prevailing pitch in England during the 1700s was between \( a^1 = 420 \) and \( a^1 = 426 \), I chose \( a^1 = 423 \) as the pitch for this study.

**PREVIOUS PITCH RESEARCH**

Research into baroque performance practice is vast. Leading writers in this field of research include Mary Cyr, Donald Burrows, Robert Donington, Bruce Haynes and Alfred Mann, who have written about the different pitches in use in Europe during the baroque period. The works of Bruce Haynes and Mary Cyr were the most valuable sources I found for identifying the prevailing pitches used in baroque England for organs, woodwinds, and cornets. As a matter of interest, organ pitch in England during the early 1700s ranged anywhere from \( a^1 = 408 \) to \( a^1 = 505 \), with most of the organs generally pitched below \( a^1 = 440 \).

As mentioned previously, baroque pitch was more often referred to in a broader sense with such terms: *shorton, cammerton*, quiere-pitch and chamber pitch. Bruce Haynes’s book, *A History of Performing Pitch: The Story of A*, gives us a comprehensive guide to the pitches in use throughout Europe. I have included a condensed version of Haynes’ data in Table 10. This table shows differences of pitch that prevailed in Europe and even within individual countries, such as in Germany and France. Although some authors have discussed pitch performance suggestions, the decision of what and how to
handle pitch and performance issues when trying to replicate a historic performance of a specific composition is ultimately left to the conductor’s knowledge and discretion.

Table 10. Centers of historical pitch standards for woodwinds

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>PITCH NAME</th>
<th>HERTZ VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>France, Germany</td>
<td>A-2</td>
<td>a¹ = 392</td>
</tr>
<tr>
<td>France, England, Holland, Belgium</td>
<td>A-1½</td>
<td>a¹ = 403</td>
</tr>
<tr>
<td>Italy, Germany</td>
<td>A-1</td>
<td>a¹ = 413</td>
</tr>
<tr>
<td>Italy</td>
<td>A+0</td>
<td>a¹ = 440</td>
</tr>
<tr>
<td>France, Germany</td>
<td>A+1</td>
<td>a¹ = 464</td>
</tr>
</tbody>
</table>

Although several articles have been written about the *Four Coronation Anthems* that discuss Handel’s compositional techniques regarding melody, harmony and ornamentation, I found no prior information to specify what modifications would be necessary to replicate a performance of Handel’s *Four Coronation Anthems* at historical pitch without the benefit of baroque instruments, and how the performing forces could be adapted when performing with modern instruments.
CHAPTER 6: THE PROCESS OF PITCH MODIFICATION

STRINGS

For my study, modification of the stringed instruments was accomplished in two different ways. Each violinist played two separate violins with different tunings: one at $a^1 = 423 \text{ Hz.}$ and the other at $a^1 = 440 \text{ Hz.}$ For the violin tuned to $a^1 = 423$ the D, A and E strings were replaced with gut strings, which allowed the violinist to produce a softer, mellower tone. All of the strings were tuned at least one week prior to the performance and that tuning was maintained in order to allow the instrument to settle into the lower pitch of $a^1 = 423 \text{ Hz.}$

The baroque bow had eighty to one hundred horse hairs, which is only half the number of horsehairs used in the modern bow. In order to approximate the baroque bow the screw nut was loosened slightly to soften the sound of the attack and soften the tone. The other stringed instruments, the viola, cello and bass, were simply tuned down almost a half step to $a^1 = 423 \text{ Hz.}$ Most string players are generally reluctant to tune their instruments to any standard other than $a^1 = 440 \text{ Hz.}$ because this will create a slightly modified scordatura and mutate the fine tuning of the instrument. However, the students involved in this project were amenable to participating in this study and therefore retuned their instruments accordingly.

Mr. Mark Rush, associate professor of violin at the University of Arizona, was consulted for his opinion about how the change of pitch from $a^1 = 440$ to $a^1 = 423$ would affect the playing and the sound of the violin. He said, “the sound of the violin will change to become less cutting. Because the strings have less tension the sound will be
somewhat softer with less attack. The violin will have less sonority as well. Intonation should not be a problem other than driving people with perfect pitch crazy. I am not a fan of the low A.”

WIND INSTRUMENTS

Changing the pitch on the wind instruments presented a different challenge. In order to adjust pitch in the seventeenth and eighteenth centuries, musicians added extra crooks or extensions to the instrument, lengthening the tube to achieve the necessary pitch. For my study, if the addition of crooks or extensions did not affect enough of a change, the musicians transposed their individual parts by sight either up or down to whatever pitch was necessary.

In order to address the issues that might arise by manipulating the pitch and lengthening the reed, and or the bocal, four questions regarding the impact of lowering the pitch of a modern-day instrument were prepared for professors who specialized in the oboe and bassoon. Since tuning and intonation were the most critical factors, the questions focused on those issues. One question addressed the possibility of transposing the pieces down one half step because this option was being explored for its feasibility in the initial planning stages of this research.

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OBOE

For this study, to lower the pitch on the oboes, a longer reed of 49 millimeters was used as opposed to the usual 47 millimeters length. This gave enough extra length to the tube to lower the pitch to $a^1 = 423$. If a lower pitch than $a^1 = 423$ had been required, a further lengthening of the tube would have been necessary.

BASSOON

The bassoon presented the same basic problem of how to lower the pitch, but needed a different solution. Because the bocal, or mouthpiece, cannot be extended far enough to lower the pitch a half step (due to the whisper valve that must be covered by a keypad located at the bottom where the end of the bocal inserts into the bassoon), an extension was fashioned from a length of copper tube and plastic pipe.
The copper tubing used was the same diameter as the mouthpiece end of the bocal, which was \(3/16\text{th}\) of an inch. Plastic tubing was then used as a sheath to create an airtight joining of the copper tubing to the end of the bocal. The additional length required to lower the pitch a half step was 3 centimeters. A further lengthening of the bassoon body was affected by inserting a paper towel tube into the top end of the bassoon. This extension helped to make the scale more accurate within itself. When the extensions were tested for accuracy, the pitch had successfully been lowered to \(a^1 = 423\) and the scale was more accurate, but embouchure adjustments were still necessary.
TRUMPET

With respect to the brass, the second and third trumpet players played on ‘C’ trumpets and the musicians were able to pull the slide out far enough to lower the pitch a half step. After looking at the range of the first trumpet part, I decided to use a B♭ piccolo trumpet in order to closely resemble the clarino trumpet of the baroque period. In this instance, the musician transposed his part up a whole step since this performance edition was written for “C” trumpet. When it was necessary to play at the lower pitch, the leadpipe was pulled out enough to lower the pitch to $a^1 = 423$, but the musician still transposed up a whole step.

HARPSICHORD

The harpsichord at the University of Arizona is a transposing keyboard, so one set of strings was tuned to each pitch standard. A professional piano tuner was contracted to tune the harpsichord to the exact specifications required for this study. A digital tuner was used to tune the upper keyboard to $a^1 = 423$ and the lower keyboard was tuned to $a^1 = 440$.

ORGAN

When planning a historically informed performance that involves an organ the conductor must decide how to address the issue of pitch. A pipe organ is manufactured and tuned to produce notes related to a reference pitch such as $a^1 = 440$. The exponential relationships of the notes prohibit a simple modification of the organ tuning. Table 9 in
the previous chapter illustrates some of the reference pitch-ranges of organs throughout England.

Two strategies could be applied in order to modify the organ performance. First, a partial step adjustment to the tuning of the organ would require modifications to the construction of each of the individual pipes. The diameter or length of the pipe, or some combination of these characteristics, must be altered in order to produce a pitch which is shifted by the required amount. Alternatively, the organ could be played by transposing a full half-step down to approximate the historic pitch. The tonal relationships of the organ cannot easily be adjusted either higher or lower.

The pipe organ at the University of Arizona’s Holsclaw Hall is tuned to $a^1 = 440$ and modifications to the existing pipes are not practical. Since the performance pitch was $a^1 = 423$ the only way to reproduce the required pitch was to use a synthesized pipe organ with a pitch adjuster. Using a digital tuner it was possible to lower the pitch to precisely $a^1 = 423$. Originally I had intended to transpose the organ part down a half step, however, since $a^1 = 423$ is less than a full half step, I decided to use a synthesized organ which could transpose to whatever Hertz value was necessary. A Roland E3 was used for this study and the pitch bender effectively lowered the pitch to precisely $a^1 = 423$. The pitch bender was taped so that it would remain in a fixed position. This method worked to faithfully perform the composition at the intended pitch.
TIMPANI

Modifications to the timpani were minimal. The player used the pedal to tune to the appropriate pitches. The tuning pitch was set with a digital tuner. It should be noted that on the modern timpani, the preset notes that are indicated on the timpani itself are not useful to the timpanist when changing the pitch of the instrument.

In the absence of baroque, hand-tuned, copper kettle drums with calf-skin heads, it was necessary to evaluate the changes in the design of the modern drum and the impact on the ability to perform a baroque composition. The timpani at the University of Arizona are machine-tuned drums with synthetic heads. The synthetic heads were developed to replicate the sound of calf-skin heads but also to provide greater durability and consistency in tone and tuning. They are made of a more uniform material and are more resistant to temperature and humidity changes. It was determined that there would be no significant advantage to substituting authentic calf-skin heads on the drums.

Hand-tuned drums have a smaller tuning range than mechanically tuned drums. The mechanically tuned drum has a metal hoop which is somewhat larger than the drum body. This is placed over the opening of the resonating chamber, creating a floating head. A second hoop, the counter-hoop, is then placed atop the flesh hoop and tension is applied to the whole assembly in order to set the pitch of the drum. Mechanically tuned drums most frequently use a pedal or a handle to adjust the tension, and it may be preset for a particular composition or performance or may be altered within an individual performance. The timpanist in my study relied on a digital tuner and his ear to tune the individual drums to the required pitch.
For the purposes of the performance of April 2004, once the pitch was fixed it remained constant for all four anthems, so no adjustments were necessary. A further modification made for this performance was the use by the percussionist of contemporary, hard mallets which are representative of mallets used in the baroque period.

SINGERS

The reference pitch for the singers in the 2004 performance was set by the harpsichord and organ. The singers then used their ear to tune throughout the piece to maintain pitch integrity. Performing at an altered pitch was not problematic for the singers because the human voice can adjust quite quickly to reasonable pitch changes. Singers are skilled at adapting their voices to match the tuning of any given composition. They produce the complementary tones that create the appropriate relationships to the reference pitches.

As stated previously, the singers were all students from the University of Arizona Collegium Musicum. From the forty-one singers, only one person had absolute pitch and six students plus the conductor had relative pitch. The student with absolute pitch reported that he mentally compensated his inner ear pitch by calculating a “slightly sharp” semitone down from a\(^1\) = 440. He stated, “It is much like singing with a choir that has “gone flat” while performing an unaccompanied piece, except that we started out flat and ended up flat. Other than that I experienced no difficulties.”\(^91\)

\(^{91}\) Chris Jackson, personal communication, February 20, 2004.
Those with relative pitch could tell that the piece was pitched slightly lower than $a^1 = 440$. However, over a period of time, most singers tend to develop a kind of “muscle memory” with respect to where the note was placed within their individual vocal mechanism.

The singers rehearsed with a piano tuned to $a^1 = 440$ up until the day before the performance. The modifications required for retuning the voices for the performance at $a^1 = 423$ simply involved informing the singers at which pitch we were performing by providing an instrumental reference note. The singers tuned as they normally would by producing the corresponding pitches to the reference pitch. The singers had little or no difficulty in performing at the modified pitch.

**ASSESSMENT TOOLS**

All musicians in the study were presented with a questionnaire. In consultation with my committee, I tailored the musicians’ questionnaires to allow the instrumentalists and vocalists to address the issue of performing at both $a^1 = 423$ and $a^1 = 440$. I also employed a scale of 1 to 5, (1, indicating no difficulties and 5, indicating extreme difficulty) on tuning, intonation, articulation, technical facility and tessitura to allow for summarization and interpretation of the data.

The experts interviewed and consulted for this study were associate professor Neil Tatman (Oboe), associate professor William Dietz (Bassoon) and associate professor Mark Rush (Violin) at the University of Arizona. The oboes and bassoons were the instruments that required the most extreme modifications and adjustments.
During the dress rehearsal, the day before the lecture-recital, all four anthems were performed at both $a^1 = 423$ and $a^1 = 440$. For the following day’s recital only *Zadok the Priest* was performed at both $a^1 = 423$ and $a^1 = 440$ while the other three anthems were performed at only $a^1 = 423$ due to time constraints. This gave the performers and evaluators the complete performance of the *Four Coronation Anthems* at $a^1 = 423$ and also at $a^1 = 440$ on which to base their judgment of the success of the modifications. At the end of the dress rehearsal, the questionnaires were distributed to the musicians and a group of five evaluators.
CHAPTER 7: RESULTS

The overall effect of the modifications to the instruments on the performance of the selected compositions was generally positive. There were some issues that could not be resolved, but the overall performance was successful. For the most part, the vocalists experienced little to no difficulty with the change in pitch; however, I believe that several of the singers, instrumentalists, and evaluators’ judgments were influenced by their biases regarding lowering the pitch to something less than $a^1 = 440$. The strings, reeds and brass had varying degrees of success during the performance. The trumpets and timpani had the least amount of difficulty; the strings experienced some initial problems which became less troublesome as the instrumentalists became more familiar with the differently tuned instruments. The double reed instruments experienced the greatest number of problems with the internal tuning of their instruments. This is discussed in further detail under the headings for each of the specific instruments.

VIOLIN

The modified violin with the gut strings was capable of being tuned to the appropriate baroque pitch. The gut strings produced the desired softer, mellower tone. The slackened bow reduced the severity of attack and softened the tone to contribute to a more authentic baroque sound. The sound produced by the modified modern violin had slightly more volume and resonance than a true baroque instrument.

This stronger sound seemed to balance the sound produced by the cello and double bass, whose strings had not been changed or modified in any way, due to limited
resources and lack of availability at the time of the performance. These instrumentalists were amenable to simply retuning their instruments down to the appropriate pitch and they experienced less difficulty in intonation than the violins experienced with their modified instruments. These results might suggest that just retuning the instruments down to $a^1 = 423$ could be less problematic; however, this suggestion does not take into consideration the talent level of the player involved.

The inner sense of tuning of the violinists made it difficult for them to adapt to the pitch that was not $a^1 = 440$. Many of the instrumentalists were undergraduates, thus, their experience was limited to some degree. Contemporary players are trained to tune to $a^1 = 440$. Since most players were unfamiliar with pitch other than $a^1 = 440$, the performers may have unconsciously tried to correct due to their discomfort with this pitch level.

The following excerpt of Zadok the Priest, in Figure 14, was one of the most problematic for the violins because their part outlines the harmony of the piece and inaccurate tuning negatively affected the arpeggiated passage. This passage was a difficult portion of the concert because the violins were rather exposed and thus the challenge of maintaining the altered tuning was more apparent.
Figure 14. Zadok the Priest mm. 1-25

Zadok the Priest

Violin I

Andante maestoso

HWV 258

George Frideric Handel
OBOE

Lengthening the reed on the modern oboe produced a scale that was not always true. The F-sharp and C-sharp were noticeably flat, requiring the oboists to use alternative fingering or to “lip up”\(^92\) the tone. This would present less of a problem with more experienced players, who are able to make embouchure adjustments quickly and easily. Since the baroque oboe only had 2 keys, the performer had to rely on the embouchure to accurately produce a particular note. By contrast, the modern oboe has benefited from the invention of the Boehm System of keys which permits a broader range of fingering combinations, provides greater flexibility and variation in producing specific notes, and has decreased the reliance on embouchure to match the desired pitch.

In order to create a historically informed performance on modified instruments, the instrumentalists were required to use alternate fingerings, their embouchures, and their ears to accurately reproduce the desired tone. Many performers have mastered their instrument’s capabilities to perform at \(a^1 = 440\). When the structure and pitch of the instrument has been modified, musicians often retain their expectation, based on experience, of a particular pitch being produced by a practiced technique. Retuning the instrument produced a different pitch and the performers often tried to manipulate the embouchure in order to bring the pitch of the instrument closer to their expectation of \(a^1 = 440\), when in fact it should have been maintained at \(a^1 = 423\).

In addition to the performers and conductors regarding the implications of the instrument modifications on the performance, Dr. Neil Tatman was consulted for his

\(^92\) “Lip-up” is a slang term that refers to the technique of using the embouchure to affect the tuning of the instrument to adjust the pitch sharper or flatter, depending on what is required.
opinion on the issues pertaining to the oboe mechanics and for his suggestions on possible modifications. Dr. Tatman recommended the use of the longer 49 to 51 millimeter reed, sometimes referred to as the baroque reed.

Dr. Tatman also responded to the following questions regarding the performance:

1. How do you think the change of pitch from $a^1 = 440$ to $a^1 = 423$ will affect the tuning of the oboe?

   The procedure will work, but there will probably be some minor differences in the individual player's tuning and response expectations. In other words, the oboist will most likely experience a different scale than the usual one (which is not always completely reliable anyway!).

2. How do you think the change of pitch will affect the intonation?

   Speaking from my own limited experience in doing so, the change of pitch may affect the intonation somewhat adversely.

3. What other problems do you foresee occurring when changing the pitch?

   Possible response (note "speaking") delays. Much depends on the quality of the reed and the preparedness of the oboist.

4. Why not just transpose the pieces down a half step and play them in the keys of $D^b$ or $C^#$ and $F^g$ or $G^b$, depending on the anthem?

   Why not? For the simple reason that the tone colors of the originally intended notes need to be respected and maintained. The use of the remote keys mentioned above would produce foreign tone colors that would be quite remote from those achieved by attempting to imitate the tone colors of the baroque oboe (through the modifications you wish to experiment with). There are two good reasons why one does not encounter the keys of $d^b$ ($c^g$) and $f^g$ ($g^b$) in baroque oboe playing: tuning problems and challenges to technical facility. Although the modern oboe has improved these aspects considerably, the tonalities mentioned above are still quite troublesome for oboists, and I suspect that baroque string

instrument performers may agree with this. Finally, there are, in my opinion, many similarities between the tone of the baroque oboe in comparison to the baroque violin (when performing in relatively low positions). A similar comparison exists between the modern oboe and the modern violin. In my opinion, this relationship should not be tampered with.

With these suggestions in mind, I felt that the project had the potential to become a worthy study of pitch modification and I went forward with the proposed study, taking into consideration Dr. Tatman’s suggestions.

**BASSOON**

The bassoon also was structurally modified in order to perform at the appropriate pitch. The lengthening of the bocal in combination with the lengthened tube effectively produced the $a^1 = 423$ pitch. Similarly to the oboist, the bassoonists were required to modify their technique in order to accurately produce the necessary pitch. Because the bassoon is a larger instrument, the tuning issues were greater than those encountered with the oboe. The alteration of the tone column was insufficient to transpose the pitch of the instrument. The performers required substantially more practice and experience in order to adapt to the variations in the tuning of the instrument. The $F^9$ was particularly problematic; it was often flat despite the efforts of the musicians. It is my belief that if the bassoonists had been able to spend more time with their instruments at the altered pitch, they would have been able to overcome the tuning problems by exploring alternate fingering combinations in conjunction with manipulation of the embouchure.

In passages where the bassoon part was relatively high in its range, I decided to have the bassoonists omit certain notes that would have been exposed and out of tune.
This effectively solved the tuning issues in the bassoon part. These parts were also covered by the sustaining instruments (organ, harpsicord, cello and double bass) of the basso continuo, so that removing the bassoons had no detrimental effect on the performance.

TRUMPETS

The trumpets experienced no difficulties in tuning. The integrity of the trumpet was maintained throughout the performance, proving that pulling out the lead pipe effectively reproduced $a^1 = 423$. The use of the $B$\textsuperscript{b} piccolo trumpet in the first trumpet part worked well. The instrumentalist transposed his part up one whole step by sight. In future performances it would be helpful to provide the trumpet player with a manuscript of the transposed notation. The piccolo trumpet was a good choice in that it admirably approximated the clarion trumpet of the baroque period.

HARPSICHORD

The harpsichord presented no problems for a performance at $a^1 = 423$. Because of the mechanical nature of the instrument it is much less affected by the technique of the musician. Once the keyboard was tuned to the appropriate pitches it provided a consistent reproduction of the pitch.
ORGAN/SYNTHESIZER

To modify a pipe organ to the lowered pitch of $a^1 = 423$ would have required a prohibitive amount of reconstruction on the individual pipes. Alternatively, a shift of a half-step would merely approximate and not accurately reproduce the required pitch change. The synthesized organ was able to effectively perform the concert at $a^1 = 423$ and easily shift between the altered and standard pitches while maintaining all of the appropriate pitch relationships on the keyboard. The synthesizer and the harpsichord were the two instruments that were able to provide fixed tuning in equal temperament. There was no variation within the scale and they provided the standard to which all other performers tuned during the performance.

TIMPANI

The timpani, although of modern construction, were tuned and set with a digital tuner to the modified pitch. Hard mallets typical of baroque specifications were used to provide a more authentic sound. This method complemented the sound of the orchestra. I decided not to employ calf-skin heads which would soften the volume of the timpani, because of the greater power of the modern instruments.

SINGERS

The singers (and the keyboard players) were best able to adapt, and experienced the least difficulties of any of the performers. As stated previously, singers have the ability to adjust their pitch in order to match the instrumental accompaniment. The
singers found less difficulty than the other musicians in adapting to the modified pitch standard. The singers most affected were the sopranos and basses. Since the *Four Coronation Anthems* are in the key of D, the sopranos were required to sing frequent and sustained high F#s and Gs. The lowering of a1 produces a corresponding lowering of G5 (see Table 6) and the reduced frequency of the vibration placed less stress on the vocal cords of the singer. In addition, the basses were required to sing D5’s which are at the top end of their range. This produced a similar strain on their voices as well as fatigue from sustaining high frequency pitches. Conversely, the basses needed to approximate a low F# in order to sing the required G2’s at the bottom of the range. This can be out of the range of some singers.

**SUMMARY OF RESULTS**

As shown in Figure 15, the arpeggiated passages outline the dominant chord of *Zadok the Priest*. As the violinists were playing the triadic patterns, it became evident that their pitch perception made it difficult to maintain consistency at the new pitch level. Since the instrumentalists had a pre-conceived expectation of pitch due to their years of training, they consciously, or perhaps unconsciously, tried to compensate for the lowered pitch by fingering the notes slightly higher as their inner era dictated. Consistently, the pitch fluctuated while the musicians tried to manipulate the pitch to their own personal pitch perception. As the performance progressed through the *Four Coronation Anthems*, the pitch gradually settled into a1 = 423 as the musicians became accustomed to the
lowered pitch. This supports the theory that the longer the musicians played and sang at
the lowered pitch, the more comfortable they became with $a^1 = 423$.

Although the trumpet pitch was lowered by pulling the lead pipe out, the
trumpeters experienced no difficulty with the lowered pitch. Basically, the pitch was
“fixed” for them by the instrument and it remained in tune. Thus, the musicians were less
likely to try to manipulate their pitch with their embouchure. Typically, the trumpet and
the timpani are harmonically linked in a baroque festival orchestra, so in this instance the
trumpets and the timpani stayed in tune with each other during the performance. This
helped anchor the tuning of the orchestra to $a^1 = 423$. Further, the synthesizer and
harpsichord were also fixed in pitch, thus they consistently maintained pitch at $a^1 = 423$.
Between the trumpets, timpani, synthesizer, and harpsichord the pitch was firmly
established; however, it also illuminated the inconsistent tuning in the woodwinds and
upper strings.

Throughout the performance, articulation was only mildly affected in the strings
because of the slightly slackened bow tension. While the onset of sound in a string
instrument often can be somewhat delayed, I found that the delay of sound was nearly
twice as long as the delay of sound in modern stringed instruments. It should be noted
that not all string instrumentalists play behind the beat because of the string-speaking
delay; however, this may occur with some less experienced musicians. Further, it was
only during the rapid passages that the players found the slackened-bow to cause
sluggishness. After the instrumentalists became more familiar with the modified,
slackened bow they were able to adapt their technique to make the string speak on time.
The effects of using English baroque pitch of \( a^1 = 423 \) with a modern collegiate ensemble, rather than playing at today’s standard pitch of \( a^1 = 440 \) can be created, and was successfully executed in this study. No matter what modifications to the instruments one does or does not make, however, I repeat my earlier assertion that the western ear adapts more readily to a full semitone pitch difference rather than a quarter tone pitch difference, i.e. \( a^1 = 415 \) rather than \( a^1 = 423 \). I would endorse performing a baroque piece at the pitch in which it was originally conceived as this is more historically accurate compared to performing the same piece at the modern-day pitch of \( a^1 = 440 \).

In this study I attempted to demonstrate that performing a baroque piece in its original key was viable and I suggested that the difference in the performance outcome was sufficient to justify the time and efforts it took to make the necessary modifications and adjustments. In order for the instrumentalists and the singers to maintain consistency within the modified pitch scale and acquire a moderate amount of comfort with the adjusted pitch, they must have enough time to practice with the modified pitch. This suggestion would also alleviate some of the frustration on the part of every musician participating when performing at any pitch other than \( a^1 = 440 \).

**RESPONSES TO QUESTIONNAIRES**

The responses to question one (refer to Appendix C for Questionnaire and Appendix D for Responses to Questionnaire) revealed that 64% and 68% of the musicians experienced little to no difficulty with tuning and intonation, respectively. It also indicated that 34% and 28% experienced significant difficulties in tuning and
intonation. The differential between the two performances is approximately 30%.

Regarding question three, the responses indicate that 58% had little or no difficulties performing the *Four Coronation Anthems* at $a^1 = 423$, while only 26% experienced difficulty. Again, the differential between the two extremes is approximately 30%. With regard to question three, please note that 16% of the participants were unsure or the question was deemed not applicable.

As the reader reviews the questionnaire responses, he or she can interpret the data to be in support of pitch modification or against it. Certainly, preconceived concepts play a large role in a study like this. Although I hoped that the experiment of pitch modification would be successful, I was surprised to find that only 58% did not experience insurmountable difficulties when changing the pitch to $a^1 = 423$ and that 6% were unsure of the difficulties. When undertaking any experiment, one must be prepared to accept that not every participant will be in support of the idea being presented.

Regarding question four, I found it surprising that 33% of the musicians were unsure of how “joyful” or “celebratory” $a^1 = 423$ sounded and 35% felt as though it was “joyful” whereas 32% believed that it was not a celebratory pitch at all. It is unfortunate that I did not initially measure the individual musicians’ preconceived perceptions about pitch modification, as this may have revealed opinions relevant to the outcomes of the study. Question five may indicate an answer to the issue of preconceived pitch perception, since 66% of the participants answered that they felt that $a^1 = 440$ was a more celebratory or joyful pitch.
It is my opinion that the results indicate that a performance at $a^1 = 423$ is possible with the modifications mentioned in this study. Although some of the participants revealed through their responses that they were not in support of changing the modern pitch, their answers confirm that these methods of pitch modification can be utilized with some degree of success. Regardless, the performance of Handel’s *Four Coronation Anthems* was completed and I would encourage anyone who wishes to create a historically informed performance of any period piece to further investigate and pursue the methods outlined in this study.
CHAPTER 8: CONCLUSIONS

The two purposes of this study were to attempt to create a historically informed performance without the benefit of baroque instruments; and to successfully modify the instruments available at a typical American university. Although there are still many baroque instruments available today, they are very costly to obtain and not all institutions have the financial resources to procure an entire orchestral complement. Therefore, in order to replicate a baroque sound, modification to the existing modern instruments was employed and Handel’s *Four Coronation Anthems* were selected as test pieces. The following are my observations of the experiment.

There are a multitude of great performance halls in the United States; however grand cathedrals on the scale of Westminster Abbey are far fewer. In the performance of the *Four Coronation Anthems* in April 2004, I did not try to replicate the venue but instead performed in Holsclaw Hall at the University of Arizona. This venue has excellent, resonant acoustical properties that allow the sound to resonate, thereby producing a close approximation of a typical baroque performance hall. I contracted an ensemble consisting of 22 instrumentalists and a choir of 42 singers, typical of a baroque ensemble. This maintained the proportional ratios of performers vis-à-vis the size of the hall. I would recommend to any conductor wishing to pursue this kind of performance to keep the ratios of musicians matched to the size of the performance venue. Generally, most conductors, performers, and listeners would agree that an ensemble under-playing and/or under-singing to accommodate the venue is not desirable.
Due to the performing schedule of Collegium Musicum I had twelve hours of rehearsal time to prepare for the performance. Six hours were spent rehearsing the singers, two hours were spent exclusively with the orchestra, and two hours were devoted to the full ensemble, with the final two hours used for a dress rehearsal. I would recommend that the instrumentalists spend more rehearsal time becoming accustomed to the changes or modifications made to their instruments in order to produce a better performance.

Under normal circumstances, nine and one-half hours of rehearsal for a concert of this nature would be more than enough time for students to learn the material and present it successfully. However, the instruments had been modified to such a degree that the instrumentalists had to concentrate on re-adjusting their technique in order to produce the desired results. I believe that had both groups, instrumentalists and singers, spent an equal amount of time rehearsing, i.e., six hours, then the tuning issues encountered in the final performance might have been avoided. Although more rehearsal time with the instrumentalists would have been ideal, financial limitations were a major issue. Also, if the performance situation had not involved a dissertation study with limited time allowed with the ensembles, then I believe the final performance would have been more in tune.

If we examine the question of how modern performers most effectively present a historically informed performance of Handel’s *Four Coronation Anthems* and similar works, we are presented with five possibilities: First, present the piece as it is, with no instrumental modifications or changes in pitch. Use modern instruments tuned to $a^1 = 440$ while maintaining the proportional ratios of the number of performers to the size
of the hall. This option is generally what most conductors choose as it presents the fewest problems, allowing the piece to be executed easily and effectively, although inaccurately with respect to historic pitch. Can it then be called a historically informed performance? Yes, as long as the baroque standards of instrumentation, ornamentation, and performance are maintained; however, the piece was not conceived by the composer at the pitch of $a^1 = 440$. Therefore, the notes written would have been conceived at a different pitch. A conductor wishing to present a truly historically informed performance of any period piece should present it at the pitch in which it was originally conceived and written.

Second, with the availability of authentic instruments and with unlimited financial resources, a university could import or buy the appropriate instruments. If the instruments were rented, this choice would prove extremely costly. Additionally, enough time would need to be allotted for the instrumentalists to become accustomed to the characteristics of the baroque instruments. Employing authentic instruments would ensure that the performance pitch was consistent with the historical pitch, in this case, between $a^1 = 415$ and $a^1 = 423$.

The third alternative is closely related to the second and requires significant financial resources. An institution could bring in a baroque specialist for each instrument, to perform with and train each of the musicians on baroque instruments. This option would be similar to hiring several artists in residence. For a post-secondary institution this could be a valuable undertaking, benefiting most any school of music. The performance could then be performed at historically accurate pitch.
The fourth possibility would be to transpose the entire work down one semitone, in this case, performing the piece in the key of D\textsuperscript{b} major. This option has several inherent difficulties and complications. First and foremost, the key impacts the baroque theory of the Doctrine of Affections (for further clarification of the major and minor keys and their attributes, refer to Appendix E). Instead of having a celebratory piece written in the celebratory key of D major, changing the key would create a piece that would not sound as bright, due to the fact that the piece would lose the ability to utilize the natural resonating qualities of the open strings on all of the string instruments. Further complications stem from the different fingering combinations on the oboes, bassoons, trumpets, harpsichord, and organ. Although I was initially prepared to lower the key by one half-step for the benefit of the organist, the substitution of a synthesizer equipped with a pitch adjustment lever alleviated the need for this course of action.

The fifth and final possibility is to follow the suggestions described in this document and implement modifications to the instruments required to perform the piece at the pitch in which it was originally conceived. I would recommend that the reader consult Bruce Haynes’ book, *A History of Performing Pitch: The Story of “A”* to discover what the prevalent pitch was in specific locales during certain years. Dr. Haynes has listed many pipe organ pitches of cathedrals throughout Europe. Although one may not be able to locate the pitch of the organ on which the piece was originally performed, the survey of information can give a conductor and/or performer a general idea of the prevailing pitch of the place and time.
After reviewing the audio and video recordings of the final performance, the following effects were noted and identified in the areas of intonation, tuning, vocal uniformity, and articulation. Intonation is always a factor when several instrumentalists are playing in an ensemble. However, with the added complications of changing the pitch from $a^1 = 440$ to $a^1 = 423$ and working with a quartetone increment rather than a semitone, physically modifying the instruments, and working with some inexperienced musicians, intonation was more pronounced and variable. In my opinion, these factors contributed to a situation where the pitch perceptions of the musicians had a significant effect on the final performance.

With respect to the singers, their pitch perception was closely related to vocal muscle memory (pitch perception means that the performers connected certain physical sensations felt within their vocal mechanism to produce a tone that corresponded with a particular note written on the staff). Although this only affected a few singers, it was expressed by those same singers that the change in pitch was noticeable. Here, it is difficult to determine if these individuals had some pre-conceived prejudices for singing at any pitch other than $a^1 = 440$ or whether the trained “western” ear would or could not allow them to reproduce the required accurate pitch. Some difficulties that were encountered could be attributed to the possibility that the pitch change created an uncomfortable feeling in the singer’s voice. Also, lack of rehearsal time at $a^1 = 423$ may have augmented some of the difficulties encountered. Conversely, there were no difficulties in the change of tuning experienced in the harpsichord, synthesized organ, trumpets, and timpani.
Both the oboes and bassoons had difficulties with the internal tuning of the instruments after the modifications had been employed because the notes within the scale of the instruments were variable. In addition, because the pitch was lowered, from $a_1 = 440$ to $a_1 = 423$, the natural tendency for musicians in the orchestra was to try to pull the pitch up to where their individual perception felt it should be. Please refer to the Results section of this document for further explanation of the individual issues that the oboes and bassoons encountered.

The string players’ issues with tuning were directly related to their pitch perception rather than any physical modifications to the instrument. Although the strings were changed from steel to gut, this was not the only factor that impacted the tuning issues. The aspect of pitch perception was the prime area where the musician’s individual pitch preference had the most impact on performance. Generally, throughout the performance, the strings were in tune most of the time; however, it was during the arpeggiated passages that the players encountered the most difficulties with consistent tuning.

I investigated the question of whether a historically informed performance could be created without the use of period instruments while maintaining the musical integrity of the composition. I believe that it is a successful and worthy endeavour for a conductor to consider when performing a period piece, and I offer this study as positive proof that an undertaking is well worth the effort.
APPENDIX B

Documentary Evidence for the Music of the 1727 Coronation

<table>
<thead>
<tr>
<th>Published Order of Service</th>
<th>New Chorale Book</th>
<th>O Lord, Grant the King a long Life  [text as set by William Child]</th>
<th>Full Anthem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procession</td>
<td></td>
<td><strong>The Entrance into the Church</strong></td>
<td></td>
</tr>
<tr>
<td>Anthem I. I was glad</td>
<td></td>
<td><em>This was omitted and no Anthem at all Sung; in the Coronation of King George II by the Negligence of the Choir of Westmin.</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>I was glad</strong></td>
<td>Full Anthem</td>
</tr>
<tr>
<td>The Recognition</td>
<td></td>
<td><strong>The King shall rejoice</strong></td>
<td></td>
</tr>
<tr>
<td>Anthem II. The King shall rejoice</td>
<td></td>
<td><em>The Anthem is Confusion: All irregular in the Music (Canon G 2)</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Let thy hand be strengthened [sic]</strong></td>
<td>Verse Anthem</td>
</tr>
<tr>
<td>The Litany</td>
<td></td>
<td><strong>The Litany to be read</strong></td>
<td></td>
</tr>
<tr>
<td>The Choir singing the Responses to the Organ</td>
<td></td>
<td><strong>To shew the Service let this be Read, so it was G 2</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>The Anointing</strong></td>
<td></td>
</tr>
<tr>
<td>Anthem III. Come Holy Ghost</td>
<td></td>
<td><strong>This Hymn by mistake of the Music not sung; but the next Anthem instead of it</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Comes Holy Ghost</strong></td>
<td>This Chanted for shortness sake</td>
</tr>
<tr>
<td>Anthem IV. Zadok the Priest</td>
<td></td>
<td><strong>Zadok the Priest</strong></td>
<td>Verse Anthem</td>
</tr>
<tr>
<td>Anthem V. Behold, O God our defender</td>
<td></td>
<td><strong>Behold, O Lord, our defender</strong></td>
<td>This Chanted</td>
</tr>
<tr>
<td>The putting on of the Crown</td>
<td></td>
<td><strong>The King shall rejoice</strong></td>
<td>Verse Anthem</td>
</tr>
<tr>
<td>Anthem VI. Praise the Lord, O Jerusalem</td>
<td></td>
<td><strong>Verse of Gibbons's was Sung</strong></td>
<td></td>
</tr>
<tr>
<td>The Benediction, and Te Deum</td>
<td></td>
<td><strong>Anthem VII. Let Thy hand be strengthened</strong></td>
<td></td>
</tr>
<tr>
<td>Anthem VII. We praise thee, O God ['Anthem VII. deleted']</td>
<td></td>
<td><strong>Te Deum of Gibbons's was Sung</strong></td>
<td></td>
</tr>
<tr>
<td>The Infiltration</td>
<td></td>
<td><strong>During the Homage</strong></td>
<td></td>
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<tr>
<td>Anthem VIII. The Lord is a Sun and a Shield</td>
<td></td>
<td><strong>God spake sometimes in visions</strong></td>
<td>This Chanted</td>
</tr>
<tr>
<td>The Queen's Coronation</td>
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<td><strong>My heart is enditing</strong></td>
<td>Verse Anthem</td>
</tr>
<tr>
<td>Anthem IX. My heart is enditing</td>
<td></td>
<td><strong>During ye Offertory the Organ plays, till the Altar are done</strong> Collecting</td>
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<tr>
<td>The Communion</td>
<td></td>
<td><strong>Sanctus &amp;c. sung in Munick</strong></td>
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<tr>
<td>The Organ plays, and the Choir sings:</td>
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<td><strong>The Choir sings. Therefore with Angels</strong></td>
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</tr>
<tr>
<td>Anthem X. Let my prayer come up into thy presence</td>
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<td><strong>The Gloria in Excelsis [st], sung in Munick</strong></td>
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</tbody>
</table>

Italic indicates comments or amendments by William Wake in GB-Liv Cod. Misc. 107970.

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APPENDIX C

Questionnaire

Please circle the following as it applies to you:

Vocalist  Instrumentalist  Conductor

Please rate the following questions on a scale of 1 to 5.

1 = NOT DIFFICULT
2 = MINOR DIFFICULTIES
3 = UNSURE
4 = DIFFICULT
5 = EXTREMELY DIFFICULT

1. Did you experience any of the following issues in singing or playing at the performance pitch of \( a^1 = 423 \)?

- Tuning  1 2 3 4 5
- Intonation  1 2 3 4 5
- Articulation  1 2 3 4 5
- Technical Facility  1 2 3 4 5
- Tessitura  1 2 3 4 5

2. Did the performance at \( a^1 = 440 \) present any difficulty with tuning, intonation, articulation, or technical facility? Please rate each area on a scale of one to five, five being the most difficult.

- Tuning  1 2 3 4 5
- Intonation  1 2 3 4 5
- Articulation  1 2 3 4 5
- Technical Facility  1 2 3 4 5
- Tessitura  1 2 3 4 5
APPENDIX C (continued)

3. On a scale of 1 to 5, how difficult was $a^1 = 423$ for you to play/sing? (One being least difficult and five being the most)

   1  2  3  4  5

4. On a scale of 1 to 5, how joyful or celebratory did $a^1 = 423$ sound? (One being the least and five the most)

   1  2  3  4  5

5. On a scale of 1 to 5, how joyful or celebratory did $a^1 = 440$ sound? (One being the least and five the most)

   1  2  3  4  5

6. Did you have any difficulty in any other area not specified in question 1 or 2? If so, please define.
## APPENDIX D

### Responses to Questionnaire

<table>
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<tr>
<th>Scale</th>
<th>1</th>
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<th>3</th>
<th>4</th>
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<td>Tuning</td>
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<tr>
<td>Intonation</td>
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<tr>
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<tr>
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<td><strong>Question 2</strong></td>
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<td>0%</td>
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<tr>
<td>Intonation</td>
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<td>35%</td>
<td>4%</td>
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<td>0%</td>
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<td>Articulation</td>
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<td>Technical Facility</td>
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<td>18%</td>
<td>8%</td>
<td>6%</td>
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<td>4%</td>
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<tr>
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<td>0%</td>
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<tr>
<td><strong>Question 3</strong></td>
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<td><strong>Question 4</strong></td>
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<td><strong>Question 5</strong></td>
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## APPENDIX E

### Doctrine of Affections Keys and Modes

Table 2.1: Major and minor keys and their affections, according to Charpentier, Mattheson, Rameau, Quantz, and Labrode.

<table>
<thead>
<tr>
<th>Key and Mode</th>
<th>Mary Cyr, Performing Baroque Music (Portland, OR: Amadeus Press, 1992), 32-34.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C major</td>
<td>&quot;gay and warlike&quot;</td>
</tr>
<tr>
<td>C minor</td>
<td>&quot;obscure and sad&quot;</td>
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<tr>
<td>D major</td>
<td>&quot;joyous and very warlike&quot;</td>
</tr>
<tr>
<td>D minor</td>
<td>&quot;serious and pious&quot;</td>
</tr>
<tr>
<td>E flat major</td>
<td>&quot;truel and hard&quot;</td>
</tr>
<tr>
<td>E major</td>
<td>&quot;quarrelsome and boisterous&quot;</td>
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<tr>
<td>E minor</td>
<td>&quot;offensive, stern, plaintive&quot;</td>
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<tr>
<td>F major</td>
<td>&quot;イヤ and quick-tempered subjects&quot;</td>
</tr>
<tr>
<td>F minor</td>
<td>&quot;obscure and plaintive&quot;</td>
</tr>
<tr>
<td>G major</td>
<td>&quot;quietly joyful&quot;</td>
</tr>
<tr>
<td>G minor</td>
<td>&quot;serious and magnificent&quot;</td>
</tr>
<tr>
<td>A major</td>
<td>&quot;joyful and pastoral&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>A minor</td>
<td>&quot;tender and plaintive&quot;</td>
<td>&quot;somewhat plaintive, melancholy, honorable, and calm&quot;</td>
<td>&quot;melancholy . . . mournful&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B major</td>
<td>&quot;harsh and plaintive&quot;</td>
<td>&quot;occurs only sometimes, seems to have an offensive, hard, unpleasant, and also somewhat desperate character&quot;</td>
<td></td>
<td>&quot;animated and brilliant; sometimes agreeable and soft, other times given to funereal airs and sublime meditations&quot; [both modes]</td>
<td></td>
</tr>
<tr>
<td>B minor</td>
<td>&quot;solitary, melancholic&quot;</td>
<td>&quot;it can touch the heart&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B flat major</td>
<td>&quot;magnificent and joyfull&quot;</td>
<td>&quot;very diverting and sumptuous, also somewhat modest, can pass as both magnificent and dainty&quot;</td>
<td></td>
<td>&quot;imposing, although sad&quot; [both modes]</td>
<td></td>
</tr>
<tr>
<td>B flat minor</td>
<td>&quot;obscure and terrible&quot;</td>
<td>&quot;mournful songs&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
REFERENCES


Macy, Laura ed. “Grove Music Online.”  
<http://www.grovemusic.com.ezproxy1.library.arizona.edu/index.html>


Sandford, Francis. *The History of the Coronation of the Most High, Most Mighty and Most Excellent Monarch, James II... and of His Royal Consort Queen Mary: Solemnized in the Collegiate Church of St. Peter in the City of Westminster on Thursday the 23rd of April, ...in the Year of Our Lord 1685*. London, 1687.  


