The Myth of A+3

Andrew Johnstone accounts for a long-standing misconception about the performing pitch of English pre-Restoration vocal music, and explains the historical basis of the pitch adopted for Fretwork's *Chains of Gold* project.

> The following observations were first published by the author in 2003,[1] and are here restated in what he hopes is a more readily intelligible narrative. (In response to the late Prof. David Wulstan's objection that the argument was complicated by the question of pipe scales,[2] the relevant remarks—which are in fact merely corroborative—are here made in parenthesis.)

It has been one of the most cherished notions of the early music revival that the works of Gibbons and his contemporaries could and should be restored to their intended sounding pitch by transposing them a minor third above modern pitch. In the nomenclature devised by the pitch historian Bruce Haynes,[3] that transposition may be expressed as 'A+3', 'A' signifying concert pitch of $a' = 440$ Hz and '+3' an upward shift of three semitones.

The basis of the A+3 rule, however, was an isolated scrap of late seventeenth-century evidence which, as we shall see, was seriously misinterpreted by almost every scholar who cited it. In a printed addendum to one copy (still held at the Bodleian Library, Oxford) of the organ part of Thomas Tomkins's *Musica Deo Sacra* (a collection of church music posthumously published in 1668 under the editorship of his son Nathaniel), there appears a semibreve *f* on the fourth line of a bass staff with the caption 'Sit tonus fistulae apertae longitudine duorum pedum & semissis: sive 30 digitorum Geomet'. The wording seems perfectly unambiguous: 'Let this be the note of an open pipe two and a half feet or thirty inches long' (an open pipe being one whose pitch is not artificially lowered an octave by the insertion of a stopper).

Expressed doubly in feet and inches, the Tomkins pipe-length certainly has the appearance of the exact measurement it has all too often been mistaken for. Frederick Ouseley, the nineteenth-century Oxford music professor who first drew attention to the addendum, declared that the pipe referred to would produce not the stated *f* but a 'somewhat sharp' *g*, and that 'transposing the church music of [Gibbons's] period upwards by a whole tone' was 'restoring it to that which was intended by the composer'.[4]

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1 Andrew Johnstone, '"As it was in the beginning": Organ and Choir Pitch in Early Anglican Church Music', *Early Music*, vol. 31, 506–25

2 Letter, 'Pitch in Early Anglican Church Music', *Early Music*, 32 (2004), 348.

3 *A History of Performing Pitch: The Story of 'A'* (Lanham, MD: Scarecrow Press, 2002). In the present article, note names are specified in their particular octaves according to the Helmholz system, whereby the lowest octave of the organ keyboard and the cello is shown as *C*–*B*, the octave below as *C*′–*B*′, and the octaves above as *c*–*b*, *c*′–*b*′, *c*″–*b*″ and so on, middle 'C' thus being shown as *c*′.

4 *A Collection of the Sacred Compositions of O. Gibbons* (London: printed for the editor, 1873), p. [iii].

For what it is worth, the unstated reference pitch for Ouseley's dictum was very likely old philharmonic pitch (*a′* = *c.*450 Hz), which itself being rather sharp of concert pitch would have yielded an outcome close to A+3. But this point is merely academic: what matters is that Ouseley remained tacit as to his method, and can have done nothing more than reach for the nearest organ pipe that apparently matched the Tomkins description. To do so, however, was to overlook two crucial variables in the dimensions—and hence also in the pitch—of organ pipes generally.

The first variable concerns a given pipe's stated or nominal length, which seldom if ever corresponds to its actual length. To judge by the nominal lengths given on organ stop knobs, an eight-foot open pipe sounds *C*, a four-foot pipe *c*, a two-foot pipe *c′*, a one-foot pipe *c″*, and so on. Yet the relevant pipes are in fact shorter than this: the only English organ ever known to have had a one-foot *c″* pipe (that of Trinity College Cambridge in the mid eighteenth century) consequently sounded at the exceptionally low pitch of approximately A−2.[5]

The second variable concerns a given pipe's width, which affects pitch no less than length does. For example, two open pipes exactly one foot long whose respective widths are 0.95 inches and 1.2 inches will differ in pitch by approximately 10 Hz.[6] Pipes of the same length whose widths differ more drastically have been reported to sound nearly an octave apart.[7]

(Both variables are complicated by an arcane yet indispensable aspect of the organ-builder's art, the factor of pipe-scale. If all pipes belonging to a single stop were equally scaled (any given pipe being exactly twice the length and twice the width of the pipe sounding an octave above it), then every pipe would sound slightly louder than its smaller neighbour. This undesirable effect is rectified by making each pipe slightly narrower in scale than its smaller neighbour, the pitch being corrected by a proportional increase in length. Hence in the case of two pipes sounding an octave apart, the larger, owing to its altered dimensions, will be more than twice the length of the smaller.)

Given these variables (and not to mention others such as temperature, wind pressure, and a pipe's position within the organ), the Tomkins addendum is not nearly informative enough to stand as self-contained evidence of a performing pitch standard. Why, then, when presumably all surviving copies of the *Musica Deo Sacra* organ part except the Bodleian one had already been printed, was the addendum deemed necessary? The reason is not hard to surmise, for in the decades following the Restoration English organs were variously tuned to several different pitch standards, meaning that Nathaniel Tomkins must eventually have felt obliged to state which of those pitch standards corresponded to the notation of the organ accompaniments as he had printed them.

The addendum refers to a two-and-a-half-foot pipe not to specify a pipe of exactly that length but because prior to the Civil War English organ pipes had been measured—nominally, that is—not in factors of sixteen but in factors of ten. Though played by 'C' keys, these ten-, five- and two-and-a-half-foot open pipes respectively corresponded to *F′*, *F* and *f* as notated for and sung by choirs, a circumstance established

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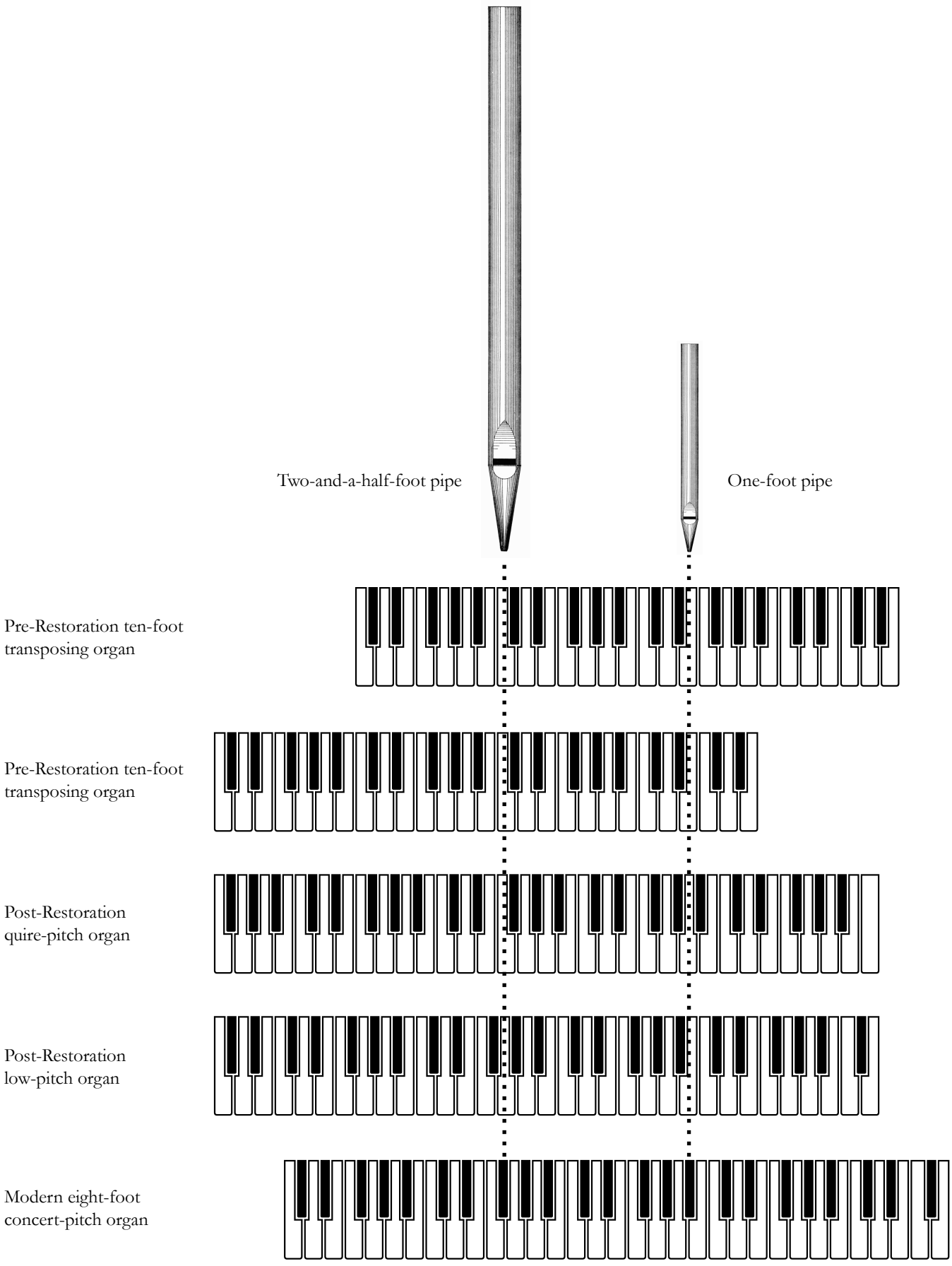
5 Alexander John Ellis, 'The History of Musical Pitch', *Journal of the Society of Arts*, 28 (1880), 293–336.

6 Ellis, 'The History of Musical Pitch', 328.

7 Marin Mersenne, *Seconde partie de l'harmonie universelle*, Part II (Paris: Pierre Ballard, 1637), 331–2.



Diagram—English two-and-a-half-foot and one-foot organ pipes and their historical relationships with organ keyboards. As stated in the addendum to *Musica Deo Sacra*, the two-and-a-half-foot pipe sounds *f* of quire pitch.

by the transposed accompaniments found in certain seventeenth-century organ books.[8] Accompaniments notated at the same pitch as the corresponding choral parts—such as those printed in *Musica Deo Sacra*—thus had to be played either a fifth higher (on a ten-foot stop) or a fourth lower (on a five-foot stop).

Had these old transposition routines still been universal when *Musica Deo Sacra* was published, then the addendum would hardly have been needed. At that time, however, the English organ was undergoing an uneasy transition from being a transposing to a unison instrument, and if a rebuilt or new organ were available a Restoration organist might have to play the traditional choir *f* in other ways (see diagram). On organs such as the one built for Durham Cathedral by Bernard Smith in 1686, the ten-foot pipe was now sounded by an *F′* key, rendering transposition unnecessary. On organs built or rebuilt by Smith's rival Renatus Harris, however, the ten-foot pipe was sounded by a *G′* key, meaning that accompaniments had to be transposed a tone higher. As a direction to transpose up a fifth, down a fourth, up a tone or not at all, the Tomkins addendum could have been neither briefer nor clearer. As an indicator of historic performing pitch, however, it could do nothing more than point to a nominal pipe length that, by Ouseley's time, had been all but forgotten.

Surprisingly in view of subsequent events, the actual sounding pitch of the two-and-a-half-foot pipe was established only a few years after the addendum was brought to light. In 1880, the Victorian polymath Alexander Ellis published the first scientific study of historical European pitch standards, noting *inter alia* that Ouseley's estimation of the Tomkins *f* as a 'somewhat sharp' *g* was 'slightly incorrect'.[9] By measuring the pitch of old organ pipes and making convoluted but—as we shall see—reliable deductions as to the notes they had originally sounded, Ellis instead equated the Tomkins *f* with a 'somewhat sharp' *f*-sharp.

Though, since the end of the seventeenth century, the nominal length of open *C* pipes has been universally eight feet, Ellis observed that English organs typically sounded at one of three pitch levels depending on which key played the primary open pipe that was precisely one foot in length (see diagram above). In organs tuned close to concert pitch—Ellis described the vicinity of *a′* = 440 Hz as the 'favourite pitch of modern organ builders'—the one-foot pipe was played by the *b′*-flat key. In older organs, however, it was played in some cases by the *b′*-natural key (the resulting pitch being a semitone lower or A−1) and in others by the *a′* key (the resulting pitch being a semitone higher or A+1).[10]

Ellis's model of *b′*-foot, *b′*-flat-foot and *a′*-foot instruments is necessarily a simplification, and represents only three points on the pitch spectrum from A−1 to A+1 spanned by English organs of the seventeenth and eighteenth centuries. It nonetheless led him to the conclusion that Smith's 1686 Durham organ—on which, as we have seen, the *f* key played a two-and-a-half-foot pipe—was an *a′*-foot instrument whose then-surviving pipes yielded a pitch measurement of *a′* = 474.1 Hz, roughly a quarter of an semitone higher than A+1 (*a′* = 466.2 Hz).[11]

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8 See Johnstone, "'As it was in the beginning'", 511–16.

9 'The History of Musical Pitch', 330.

10 'The History of Musical Pitch', 307–8, 312.

11 'The History of Musical Pitch', 330–31.

In connecting the Durham pitch measurement with the Tomkins addendum Ellis was frustratingly laconic ('Durham was an A-foot organ, and this leads directly to Tomkins's pitch. … On the Durham organ, … such a pipe as Tomkins described existed'). Yet the unstated reasoning is easily inferred: if the *f*-pipe cited in the addendum were nominally two and a half feet long, then the *f′*-pipe an octave above it would be nominally one and a quarter feet long, and—given that the ratio of a pure major third is 5:4—the *a′*-pipe actually one foot in length.

(Owing to the effect of pipe scale described above, we may observe that, relative to the one-foot *a′* pipe, the *f′* pipe would be very slightly longer than one and a quarter feet, and the *f* pipe more considerably longer than two and a half feet. Hence, in contrast to the shorter actual lengths of nominal eight-foot pipes, pipes nominally two and a half, five and ten feet long were actually longer, a fact that obliged sixteenth-century organ builders to word their contracts to the effect that a certain pipe would 'contain the length of five feet' while the longest pipe would measure 'ten feet or more'.[12])

Ellis published his findings at a time when historical musicology and the mechanical measurement of pitch were in their infancy. He thus had no way of knowing that in the original notation of Renaissance vocal polyphony certain combinations of clefs signalled downward transposition by a fourth,[13] and the conclusion he drew from partsongs by Gibbons that are notated in such clefs is wildly erroneous. Nor were his own pitch measurements—obtained with tuning forks and a ship's chronometer, and by counting audible beats—free from a certain degree of human error.[14] For these reasons, those twentieth-century scholars who troubled to read Ellis's seminal paper may have looked askance at his conclusions.

Nevertheless, the organological research of recent decades has removed all possible doubt as to Ellis's reckoning of the Tomkins *f*.. The relevant evidence, which was unknown to Ellis, is supplied by pipes originally from the organ built by Robert Dallam for Magdalen College Oxford around 1630. When part of that organ was moved to the church of St Nicholas at Stanford on Avon in Northamptonshire, three robust pipes (which consist of more than 96% tin and are clearly marked *D*, *E* and *F*) were redeployed as façade dummies and have thus escaped subsequent alteration. Measured in 1992 by Charles Padgham, and in 2002 by Dominic Gwynn and the late Martin Goetze, their sounding pitch is in the region of *a′* = 475.2–476.8 Hz, roughly a third of a semitone above A+1 and as close a corroboration of Ellis's 474.1 Hz as could reasonably be hoped for.[15]

It is tempting to imagine that twentieth-century performances of pre-Restoration English church music would have sounded very different if Ellis's relevant findings had been expressed more limpidly, read more widely and taken more seriously. Yet it was to be Ouseley's 'slightly incorrect' estimation of the Tomkins *f* that would better fit the pragmatic objectives of Edmund Fellowes and those who followed him in the revival of Tudor and Stuart repertoire. First touching on the pitch question in 1921, Fellowes

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12 Stephen Bicknell, *The History of the English Organ*. Cambridge: Cambridge University Press, 1996), 28–30.

13 'The Performing Pitch of William Byrd's Latin Liturgical Polyphony: A Guide for Historically Minded Interpreters', *REA: A Journal of Religion, Education and the Arts*, 10 (2016), 79–107 (82–90).

14 'The History of Musical Pitch, 299–300, 333.

15 Martin Goetze, *St Nicholas, Stanford on Avon: Remains of the c.1631 Organ*. Harley Foundation Technical Report no.5 (revised edn, 2002), 8–9, 14–15.

echoed the 'somewhat sharp' *g* theory, which—now with a lower reference pitch of *a′* = 435.4 Hz—he was confident to locate 'between G and A-flat'.[16] On the basis of no further evidence whatsoever, his assertion would re-echo throughout the subsequent literature, the Tomkins *f* being described as:

> 'almost a minor 3rd higher than [the pitch] now in use'[17]
>
> 'about a tone to a minor third higher'[18]
>
> 'somewhere between *g* and *a*-flat'[19]
>
> 'approximately "A flat"'[20]
>
> 'a note fractionally lower than "A-flat"'[21]
>
> 'approximately *A* flat'[22]
>
> 'about a minor third (or perhaps between a tone and a minor third) higher than present pitch'[23]
>
> 'theoretically about "A flat" at modern pitch'[24]

Though in interpreting the Tomkins addendum Fellowes did not go as far as an unqualified *a*-flat, in editing the repertoire for modern performance he did not hesitate to set his editions typically at A+3 and in some cases at A+4. Nor was any secret made of the motivation for these inconsistent transpositions. The back matter from several entries in the Tudor Church Music Octavo series states plainly that 'to facilitate performance, the Editors have freely transposed the music to suit the compass of modern voices', while one of Fellowes's own editions, though in the conservative transposition of A+2, is authorised to be performed 'a semitone higher still if good tenors are available'.[25] Clearly in the 1920s it was not historical authenticity, but vocal pragmatism, that was of the essence.

Perhaps because it represented a *via media* between A+2 and A+4, and since it was in any case the most common transposition of the 1920s, A+3 gradually acquired an authority which even the sceptical H. K. Andrews felt obliged to accept 'as a working hypothesis

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16 *The English Madrigal Composers* (Oxford: Clarendon Press, 1921), 70, 72.

17 *Thomas Tomkins, 1575(?)–1656, Part 1: Services*, ed. Percy Buck, Edmund H. Fellowes, Alick Ramsbotham and Sylvia Townsend Warner, Tudor Church Music, vol. 8 (London: Oxford University Press, 1928), p. xvi.

18 H. K. Andrews, 'Transposition of Byrd's Vocal Polyphony', *Music & Letters*, 43 (1962), 25–37.

19 Peter le Huray, *Music and the Reformation in England* (London: Herbert Jenkins, 1967; rev. edn Cambridge: Cambridge University Press, 1978), 112.

20 John Caldwell, 'The Pitch of Early Tudor Organ Music', *Music & Letters*, 50 (1970), 156–63 (156).

21 Hugh Benham, *Latin Church Music in England* (London: Barrie & Jenkins, 1977), 32.

22 Roger Bray, 'More Light on Early Tudor Pitch', *Early Music*, 8 (1980), 35–42.

23 David Wulstan, *Tudor Music* (London: Dent, 1985), 200.

24 Ian Spink, *Restoration Cathedral Music, 1660–1714* (Oxford: Clarendon Press, 1995), 60.

25 *Te Deum, Jubilate Deo, Magnificat and Nunc dimittis by John Farrant*, ed. Edmund H. Fellowes, Tudor Church Music Octavo Edition, no. 54 (London: Oxford University Press, 1928), p. 1.

[notwithstanding that] the evidence is not very strong, and contemporary theoretical writing does very little to help'.[26]

Ultimately, though, it was the advocacy of David Wulstan that conferred A+3 with a widely accepted aura of historical fact. By associating the two-and-a-half-foot pipe with the five- and ten-foot pipes mentioned in early sixteenth-century organ contracts, Wulstan reasoned that organ pitch a 'a minor third higher above modern pitch' was a 'known factor' applicable to music dating not only from after the Reformation but also from before it.[27] The results, amply documented by Wulstan's recordings with his hand-picked choir The Clerkes of Oxenford, are well known: the pragmatism of the 1920s had metamorphosed into the historicism of the 1960s and '70s, with the decidedly un-pragmatic side-effect that treble parts now routinely ascended to *b*″-flat.

Controversy provoked by Wulstan's methods was not centred on the interpretation of the Tomkins addendum, which in the opinion of Roger Bray was 'settled as far as it ever will be'.[28] Rather, it was the addendum's supposed applicability to church music from before 1559 that came under fire, notably from Roger Bowers. Without questioning the A+3 rule for later church music, Bowers pragmatically advocated A+0 for early Tudor polyphony, postulating at the time of the Reformation a 'decisive break' in performance practice that 'caused the principles of vocal pitch and scoring established by the composers of Latin music to be replaced by others more appropriate to the setting of vernacular texts'.[29]

These academic controversies were naturally of no avail to the performing community. Scepticism about the general applicability of the A+3 theory to Tudor and Stuart polyphony engendered a period of experimentation that is exemplified by the recordings by The Cardinall's Musick of Byrd's complete Latin-texted works, issued on thirteen CDs from 1999 to 2010. Some two hundred items were recorded,[30] roughly a quarter of them at A+0, another quarter at A−2, and a sixth variously at A−3, A−1, A+1, A+2 and A+3; the remaining third comprised items requiring clef transposition and their treatment was equally diverse (the most frequent method being to transpose the written notation down a major second). If historical authority is to be claimed for this approach, then it can only be on the assumption that, for Byrd himself, the correct pitch was the one that suited the available voices.

The alternative approach, of course, is to choose voices that conform to a known pitch standard. The possibility that this will be increasingly a guiding principle in the interpretation of English polyphony is strengthened not only by the organological evidence for quire pitch itself. The adult male falsetto voice, an indispensable adjunct of the early music revival in general and of A+3 transpositions in particular, can no longer

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26 'Transposition of Byrd's Vocal Polyphony', 26.

27 'The Problem of Pitch in Sixteenth-Century English Vocal Music', *Proceedings of the Royal Musical Association*, 93 (1966), 97–112 (97).

28 'More Light on Early Tudor Pitch', 35.

29 'The Vocal Scoring, Choral Balance and Performing Pitch of Latin Church Polyphony in England, *c.*1500–58', *Journal of the Royal Musical Association*, 112 (1986), 38–76 (39); see also Bowers, 'To Chorus from Quartet: The Performing Resource for English Church Polyphony, *c.*1390–1559' in *English Choral Practice, 1400–1650*, ed. John Morehen (Cambridge: Cambridge University Press, 1995), 1–47 (45).

30 This figure was reached by counting the three mass ordinaries as five items each and the *secunda*, *tertia* and *quarta* partes of motets as separate items when they are so numbered in Byrd's publications.

safely be assumed to have been integral to performance practice in the Tudor and early Stuart periods.[31] And Byrd's three Latin masses, when sung a perfect fourth lower according to the rule of clef transposition, are now known to have been written with vocal ranges virtually identical to those of the same composer's vernacular Great Service, a work firmly associable with organ pitch.[32] To whatever extent the English polyphonic soundscape can be recreated for the present moment, it will be done all the more truthfully without the myth of A+3.

[31] See Simon Ravens, *The Supernatural Voice* (Woodbridge: Boydell Press, 2014), 71–89.

[32] Johnstone, 'The Performing Pitch of William Byrd's Latin Liturgical Polyphony', 102–104.