

The English Choral Tradition and the Secular Trend in Boys' Pubertal Timing

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Abstract

A so-called "secular trend" (meaning a slow drift in measurement over time) in stature and pubertal timing in boys has been reported with increasing frequency by the press. English choir directors have also complained that boys' voices are "breaking" sooner, with consequent difficulties for more complex repertoire. This investigation sought to establish whether a trend to earlier pubertal timing exists among a cross-sectional sample of 127 boys from seven all-male English cathedral choirs. A review of the medical literature on pubertal timing yielded conflicting results and a case not yet fully proven.

Results from quantitative acoustic and perceptual measures appeared to support the belief in earlier "voice break". Advanced voice change associated with completing puberty status was commonly found during what is most frequently the top year of English cathedral choirs (Y8, age 12.5 - 13.5 years). Interview and observational data suggested the presence of differing practices and approaches to choral pedagogy. Some cathedral choirs dismissed boys once noticeable voice change had set in. Others appeared to pay little attention to the vocal health of boys in late puberty. While further medical evidence is required, these particular results may suggest a need for two precautionary measures: (a) all boys over the age of twelve years should be regularly assessed, and (b) all-male cathedral choirs might consider planning for a lowering of the age demographic for choristers.

Keywords

boys, choirs, choristers, puberty, vocal health, voice change

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The cultivation of a high soprano or “treble” voice in young male singers has been a tradition in Western choral music for substantially more than a thousand years. Relatively young boys achieve remarkably high standards through intensive training, often in specialist choir or music schools. Although primarily a phenomenon of sacred music, this vocal resource has been equally prized in secular settings, for example the Drakensberg Boys Choir of South Africa and the United Kingdom based *Libera* singing group. In Germany, the Thomanerchor of Leipzig, which was founded in 1212, includes the composer J.S. Bach among its former directors. The choir of St. Thomas Church, Fifth Avenue, New York exemplifies the spread of the tradition across the Atlantic. Other European countries such as France have lost the tradition (Lurton, 2010), but it has experienced particular resilience in the UK. Choral singing by professional choirs of boys and men can still be heard daily in some 44 English cathedrals and collegiate chapels (Friends of Cathedral Music, 2009). These choirs continue to set a standard to which other conductors aspire in creating the chorister sound.

The current decade, however, has witnessed an increasing number of anecdotal reports that choirs are experiencing difficulty with boys’ voices “breaking” earlier than anticipated. A letter appeared in the September/October 2007 edition of the *Journal of Singing* in which it was confidently stated that it was no longer possible for children’s choirs to rely on boy trebles. The reason given was that the average age of onset of voice change is now 12.5 years (Williams, 2007).

Subsequent press reports in the UK, such as the one authored by Copping and Mole (2010), have fuelled growing speculation that the boys’ singing tradition may indeed be threatened by the premature loss of older boys. Such boys possess the musical maturity, knowledge of repertoire and leadership capacity that choirs traditionally have relied upon. The problem appears not to be confined to the UK. A more

recent report in *The Washington Post* described in some detail the difficulties faced by the Thomanerchor and its response in establishing a nursery and primary division to train boys at younger ages (Birnbaum, 2012). The most commonly given explanation is that puberty, the main cause of voice “break,” is coming earlier. However, to the author’s knowledge, no systematic investigation has yet been conducted to ascertain to what extent such may actually be the case among boys enrolled in English choirs.

The English choral tradition differs in certain important ways from comparable traditions elsewhere. Unlike practices in Germany and America, adult men almost invariably sing the lower parts; the use of adolescent alto, tenor or bass voices is rare. English boys sing only the top or “treble” line and may continue to do so for some time after their voice has begun to change. The English boys’ choral tone is usually also lighter, making little or no use of the lower registers of the voice in contrast to Germanic choirs where both “heavy” and “light” registers are used as soon as available (Brown, 2010). The sound produced in England is regularly described as “angelic” on account of its pure, ethereal quality (Libera, 2007; BBC, 2012). English choral directors tend to prize a boy’s ability to find what they refer to as a “head voice,” traditionally without the benefit of singing coaching. Boys who exhibit an apparently natural or easy ability to produce this tone quality are the ones sought out at audition.

For most of the twentieth century, it was believed that younger boys learned to sing simply through imitation of older boys and the “choirmaster’s sound” (Dakers, 1976). The relatively recent introduction of singing coaches to choirs has been regarded with suspicion by the older generation of choir directors, trained in organ playing rather than singing (Massey, as cited in Ashley & Martino, 2008, p. 103). However, as will be seen shortly, voice coaching and singing teaching have begun to have a growing and important impact on contemporary practice.

Philips (1996), in describing what he calls the

“English choirboy tradition,” refers to “this infamous English voice break” (p. 45). Belief in a necessary period of rest and adjustment before the singing career is resumed in early adult life has been quite tenacious in the UK. It is probable, however, that more pragmatic reasons account equally for this “break” in the singing career. The high treble voice is greatly valued in the English choral tradition, whereas a relatively dull and weak adolescent tenor or bass seldom finds use. Cooksey (2000) described such voices as lacking upper partials. This factor may be one reason. Another pragmatic reason is that older boys have to concentrate on examination studies and cannot spare the time for intensive chorister duties as can their younger peers. Although some cathedrals have recently introduced youth choirs that former choristers may join, the priority traditionally has been the choir’s needs, not the boy’s. This observation by Edward Bairstow from the 1930s would still be true in many choirs:

My experience is that if a boy uses his voice naturally and without forcing it, he never goes through a period when he cannot sing at all but, while in such cases it does very little harm for him to sing, it is no use him trying, as his voice is gradually changing in compass and in timbre (Bairstow, 1930, p. 14).

Still another important practical consideration, however, has to do with the organization of schooling in the UK. The majority of English choir schools are aligned to a system of independent, fee-paying schools. Transfer from junior or “preparatory” school to the confusingly named “public” (i.e., private) senior schools occurs during the year the boy attains his thirteenth birthday (Mould, 2007; Barrett, 2010). The most experienced singers are therefore generally aged around 13.5 years. Traditionally, most have left their choirs, not because their voices are no longer useful, but because they have come to the end of their time at the choir school. This circumstance is not the case in all English cathedrals. Some are attached to senior schools, while others recruit boys from

a number of local schools rather than their own choir school. In such cases, boys often do maintain the “upper voice” for “as long as possible” - well beyond their fourteenth year in some cases, particularly in parish churches (Ashley, 2009; Williams 2012).

Boys who continue to sing treble at ages 14 or 15 may impact public perception of when puberty occurs. Accounts by Harries, Walker, Williams, Hawkins and Hughes (1997) and Hughes and Kumanan (2006) have noted a widespread public misconception that puberty begins when the voice “breaks,” contrary to the fact that the attainment of the young adult voice is a late event of puberty. It is possible that when older adult singers reminisce about the time they reached puberty, they are confusing “technique with testosterone” (Ashley, 2010). Boy artists from the 1920s and 1930s, such as Ernest Lough and Denis Barthel, testified that their voices “broke” at the age of 16 or 17 years. This longevity has sometimes been attributed to the revered regime of London’s Temple Church where some of the most famous early recordings, including Lough’s *Hear My Prayer*, took place in 1927 and again in 1928. The late Denis Barthel explained in a personal communication to the author shortly before he died:

[T]he fact that the Temple chorister’s voices often did not break early was due to the “Temple tone” and the manner in which Dr Sir George Thalben-Ball (whom we all loved very much) taught us to project our voices. For example, my voice and that of Ernest Lough did not break until we were both seventeen (D. Barthel, personal communication, October 12, 2006).

It is important to note that Barthel attributes the fact that his voice did not “break early” to the training and technique of the highly influential Thalben-Ball. The younger son of Ernest Lough sang in the Temple choir towards the end of the Thalben-Ball era and spoke in greater depth of Thalben-Ball’s methods in an interview with the author:

The emphasis of his approach was the production of a full, well rounded tone, clear phrasing and a great attention to diction. As long as he had true treble voices in the choir that could get all the top notes, lower and often older voices would also be useful to create an even tone in the lower registers. Older trebles were additionally useful as they could bring a maturity of interpretation that the younger voices did not yet have.

It's possible that as the vocal range gets lower, trebles start to develop a form of falsetto. However there was the additional incentive to stay singing at The Temple as everyone enjoyed singing under George Thalben-Ball and the camaraderie of being in the choir meant more to us than being in any social group at school or at home (G. Lough, personal communication, March 14, 2012).

Many authoritative listeners judge that Thalben-Ball's boys employed cultivated falsetto to prolong their careers. However, Beet (2005) contested this contention. Beet maintained that the adolescent soprano "head tone" differs from the untutored falsetto of a boy who is simply losing his childish treble. The old form of "head tone," used by singers such as Barthel, should not be called falsetto (Beet, 2005). Until recently, there has been little agreement in an often speculative literature as to what "head voice" and "falsetto voice" are in boys. Williams (2012) is now clear that both "chest" and "head" voice in boys are forms of the modal voice. While the vocal folds are thinned and elongated for "head" voice, they still collide with the characteristic modal mucosal waveform. In falsetto, the vocalis muscle becomes flaccid and the vocal ligament provides tension. A boy resorting to such a technique in order to preserve his treble voice will suffer a loss of dynamic range rendering expressive singing difficult. There can be further loss of control due to rapid and asymmetric growth of the vocal folds.

Crucially, falsetto is not usually possible at all for younger boys who lack the clearly defined vocal ligament of the adolescent

(Williams, 2012). Cooksey (1997) observed that the falsetto voice did not appear until the second stage of puberty. He also noted that in the untrained boy singer there was an abrupt change from modal to falsetto with an absence of "head register." He described this "head register" as a blending of the qualities of modal and falsetto (p. 6).

Further research is required to establish whether this is the same quality and technique as the kind of head tone described by Beet (2005). The bold and controversial argument put forward by Beet is that present day English choral directors no longer understand how to maintain the boy soprano voice throughout puberty. This assertion may have some purchase. It has been the author's experience to find very few English choral directors following Cooksey's advice to reduce the demands made on the Stage 2 (Midvoice I) boy for singing in the upper register. The true head voice as described by Cooksey is therefore never developed. Boys simply sing a childish treble throughout their range until a pubertal falsetto disrupts this practice.

Williams (2012) agrees that it is possible for boys whose speaking voice has descended to the baritone range to produce a "strong and musical soprano range" (p. 65) because of flexibility in the larynx and cartilages, which are still soft during the period of rapid growth. It is possible that older boys can produce a soprano head tone, and there is a case to revisit Cooksey's work on this point. There comes a time, however, when the whole system breaks down traumatically. It is this traumatic event that is commonly understood as "voice break." According to Williams (2012), this situation is not the consequence of a sudden growth spurt; rather, it is simply capitulation to the inevitable after a period of resistance. These considerations are important because it is possible that English boys have always sung treble for some time after voice change. A choir whose membership ranges in age from nine to thirteen or fourteen years is likely to contain

voices ranging from the pre-pubertal to mid or even late-pubertal.

The situation currently faced by the choral world is that the relative balance of such voices may be changing. If there is a secular trend to earlier puberty, there will be fewer pre-pubertal voices and more mid to late-pubertal voices, if the age at which cathedral choirs admit boy choristers remains constant. The author carried out previous research (Ashley, 2011) with boys for whom the treble voice represented significant cultural capital. The boys were, for example, leading soloists or recording artists. Such boys commonly attempted to disguise the fact that they were losing their treble voices. If boys in late puberty are encouraged to remain as trebles such active resistance to voice change may become more widespread.

The effect of this resistance may not be immediately apparent. Striny (2007) has shown that once voices are blended in chorus it becomes almost impossible to distinguish perceptually between a choir with some falsetto voices and a choir with none. Wayman (2009) has demonstrated that it is harder than is often imagined for listeners to distinguish between a boy singing falsetto and a boy with a genuinely unchanged voice. Welch and Howard (2002) have discussed the extent to which listeners generate a “perceptual stereotype” of the boy chorister sound, which obscures real differences in timbre. The blending effect of the usually resonant acoustic environment may also contribute to this phenomenon. Complications such as these do not necessarily render an early puberty hypothesis unfounded, but they clearly need to be considered in formulating a comprehensive account.

The term “secular trend” has no association with religious belief. Confusingly perhaps in the present context, when used by medical authorities such as J. M. Tanner, it refers to a gradual, unidirectional trend in measurements such as stature or pubertal onset over time (Tanner & Whitehouse, 1976). There can be very little doubt that there is a positive association between puberty and the time of

voice change, although some studies have cast doubt upon an assumed association between the secular trend to earlier puberty and the secular trend to increased stature (Karlberg, 2002). Frustratingly, an extensive literature review by the author and a colleague (Ashley & Mecke, 2013) revealed a lack of firm consensus within the medical and pediatric communities. A very recent and fairly large scale study in the United States claimed a clear trend (Herman-Giddens, Steffs, Harris, Slora, Hussey, Dowshen, Wasserman, Serwint, Smitherman & Reiter, 2012). However, a comprehensive expert meta-analysis published in 2008 reported that the data available until then were insufficient to evaluate secular trends in male pubertal development (Euling Herman-Giddens, Lee, Selvan, Juul, Sorensen, Dunkel, Himes, Teilmann & Swan, 2008).

Amselem, Carel, De Roux, MacCari, Prevot and Susane (2007) conducted another large scale expert meta-review. They similarly concluded that the sum of available evidence demanded further research and did not justify a confident conclusion that puberty is invariably coming sooner for all boys. This review gave particular attention to the wide variations in pubertal timing across ethnic groupings, social classes and geographical regions. Thus it may be inappropriate to draw a conclusion for a specific population (e.g., English chorister boys) from a synthesis of data that are both diverse and relatively rare. An important reason for all this uncertainty is that a large portion of the literature has addressed pubertal timing for children with developmental disorders and focused on menarche in girls. Most of the research associated with both boys and girls found more significant results with girls (Kahl, Schaffrath & Schlaud, 2007).

That there is no life event for a boy that corresponds to menarche for a girl is also an important fact to consider. Spermarche is the corresponding sexual event in boys' development, but it is harder to define, identify and interpret than menarche is for girls (Hirsch, Lunenfeld, Modan, Ovadia & Shemesh, 1985;

Neinstein & Kaufman, 2007). Other means of assessing boys' puberty, such as inspection of pubic hair growth (Marshall & Tanner, 1970; Tanner & Whitehouse, 1976; Swanson, 1961) are highly invasive, and thus act as a major disincentive to large-scale study. Most authorities agree that boys' puberty commences at the point when testicular volume exceeds 3 ml, but this condition, too, can only be identified through intimate physical examination. Consequently, definitive records are correspondingly sparse (Parent, Teilmann, Juul, Skakkebaek, & Bourguignon, 2003). Put simply, there is a dearth of adequate information on boys' puberty because it is difficult, inconvenient and unreliable to measure, and boys' puberty seems to be considered less important than girls' in health research and the epidemiological assessment of the secular trend.

Perhaps surprisingly, these considerations place a premium on voice research. Because voice assessment is relatively non-invasive compared with other assessments of puberty in boys, it may be that the best prospects of large scale, epidemiological assessment of the secular trend entail plotting over time any significant trends in the timing of pubertal vocal events.

The so-called "eclectic scheme" of six stages proposed by John Cooksey (see Table 1) remains one of the most widely cited models. Cooksey's (1992) scheme cannot be ignored in any study of voice change in boys. In the table below the abbreviation SF₀ refers to speaking fundamental frequency. SF₀ measures are most meaningful in longitudinal studies, where a fall in SF₀ in any individual is clearly indicative of pubertal change. It is less useful in cross-sectional study because of the large variations in speaking voice pitch found across a population.

Table 1. Cooksey's "Eclectic" Scheme

Stage	Mean SF ₀	SF ₀ Range	Tessitura	Full range	Quality
0	259	220-260	D4-C5 (seventh)	A3->F5	Full, rich soprano. The "pinnacle of development"
1	226	220-247	B3-G4 (sixth)	A3-D5	Breathy, strained upper range; little resonance or "body" in lower range
2	210	196-233	A3-F4 (sixth)	E3-C5	Loss of agility, falsetto emerges, uniquely beautiful and rich if in range
3	186	175-185	F3-D4 (sixth)	D3-A4	Evolution of modal register into baritone range, retention of Stage 2 quality
4	151	131-165	D3-A3 (fifth)	A#2-D#4	Light and husky, approximating mid-baritone, difficulties with fourths and fifths
5	120	110-139	C3-B3 (seventh)	<A2-D4	Body, resonance and power increase, agility recovered, adult qualities emerge

Cooksey's scheme describes in some detail six different stages of vocal characteristics. Although Cooksey made extensive anthropometric measurements, he did not make the crucial definitive measurement of testes volume. Neither did he set out to render normative age tables for the stages, stressing instead the inappropriateness of chronological age as a potential indicator of voice part.

A widely cited, small-scale study by Harries, Walker, Williams, Hawkins, Hughes (1997) found a strong positive correlation between the voice and testes volume ($r = 0.884$). Correlations with voice and other measures such as testosterone concentration were weaker in this study. Nevertheless, the authors concluded there was a clear relation between Cooksey's stages and the five Tanner stages (Marshall &

Tanner, 1970) that remain in general use as pubertal milestones in medical assessment. Few other studies have attempted correlations between vocal status and definitive medical markers of puberty.

Pedersen (1997) conducted one such study. She used electroglottography to compare the fundamental voice frequency (SF₀) of 48 boys aged 8.7 to 19.5 years reading a text with other parameters including height, pubic hair, testes volume and testosterone concentration. Pedersen concluded that the process merited further investigation and development. She found that a speaking fundamental frequency (SF₀) of 200Hz represented a potentially meaningful cut-off point associated with a critical serum testosterone concentration of >10nmols/l. Raising the cut-off point to an SF₀ of 251Hz resulted in an association with a testis volume of <3ml. This increase is meaningful in that puberty is said to start when a testis volume of 3 ml is attained (Largo & Prader, 1983; Parent et al., 2003). Unfortunately, studies such as Harries, et al. (1997) and Pedersen, et al. (1986) represent an early stage of a potential body of research. Surprisingly little is really known about the timing of boys' puberty. Still less is known about the relationship between such important parameters as testis volume and the speaking and singing voices.

Although there are indications that any future studies looking at vocal characteristics and definitive medical characteristics of puberty will confirm a positive relationship between the two, the really pressing need is for a reliable baseline that allows comparison of the present day vocal situation with the past. There is again disappointment in the literature. In their comprehensive review (Ashley & Mecke, 2013), the author and his colleague concluded that the methods used prior to landmark studies by Curry (1940), Cooksey (1977) and Hollien, Green and Massey (1994) were poorly described and often too idiosyncratic and anecdotal to provide the necessary reliable baseline. In sum, this review did point tentatively toward the age of fourteen as the time of change of voice for

the majority of boys. Superficially, there was apparent stability over a two thousand year period until the late twentieth century. The age of 14, however, was simply the mean of 26 studies that gave ages ranging between 11 and 15 years, with no trend discernible through the dates of publication of the studies. The terms "break" and "change" were often used synonymously and were ill defined in many studies.

One possible meaning relevant for the present report is that the term "break" signifies the time a boy's choir membership as a treble ceases. Data from three relatively recent studies may address this matter. Pfützner (2001) used exclusion data from the Kreuzchor Dresden for the period 1956 to 1993. He found that the mean age for the beginning of mutation was the end of German Grade 8 (age approximately 14.0 years) in 1956 and the middle of Grade 7 in 1993 (age approximately 12.5 years). Unfortunately, he did not record the exact age of the singers and gave insufficient information on the meaning of mutation to reconcile his data with those of Cooksey (1977). He also provided insufficient information on the process of decision making by the choir director. Nevertheless, the age of 12.5 years corresponds to the assertion made by Williams (2007).

Fuchs, Froehlich, Hentschel, Stuermer, Kruse and Knauft, (2007) examined the boys of the Thomanerchor in Leipzig between May 1992 and November 1995. Their main concern was to predict the age at which boys would have to cease using their unchanged voices in order to remain vocally healthy. This research divided pubertal voice change into three time periods: the premutation period, the mutation period as the specific period of vocal instability, and the postmutation period. Various parameters including jitter, shimmer and additive noise content were processed and found to be independent of SF₀. The protocol adopted was called the Goettingen Hoarseness Diagram (GHD). Fuchs et al. were confident that their method could accurately predict the timing of the mutation onset. Their study confirmed much

of Cooksey's writing, particularly with regard to the small descent of the lower terminal pitch (LTP) and associated loss of quality in the upper range during early puberty. It added to our knowledge of aurally imperceptible but important change at this time. Unfortunately, the authors did not relate these findings to other pubertal assessments such as Tanner staging, testosterone sampling or testes measurement. The choir director's decision about the boy's dismissal was the actual event recorded to mark the high mutation point. The mean age of dismissal was 14.2 years during the period of this longitudinal study.

Juul, Magnusdottir, Scheike, Prytz, and Skakkebaek (2007) examined members of the Copenhagen Royal Boys' Choir in Denmark. This study compared retrospective anthropometric data (the boys' heights and weights) from the time of joining the choir at age eight with the point of exclusion. The exclusion point was described as "unintentional falsetto notes and changes in singing tone as observed by the conductor of the choir in weekly voice assessments of the boys" (p.538). Results indicated a mean exclusion age of 14.2 years for the boys who had joined the choir at the age of eight between 1993 and 1994. However, for the boys who joined the choir between 1997 and 1999, the mean exclusion age had fallen to 13.7 years. Two other cohorts were examined. For the 1990-92 cohort the age was 14.0 years and for the 1995-96 cohort it was 14.2 years. A statistically significant downward trend between 1994 and 2003 was computed by means of a log-rank test. The overall median exclusion age for the ten-year period was 14.0 years (range 13.9 – 14.6 years).

Possibly the greatest difficulty in monitoring such trends is that their importance was probably not fully appreciated at the time the first truly scientific measurements of boys' voices began to be made. Cooksey's 1977 study quoting a mean of 13.5 years is often considered seminal. However Cooksey did not set out specifically to investigate the secular trend.

Killian (1999) reported that Cooksey noted in 1984 an apparent advance in the timing of onset between 1939, 1972 and 1978 (see Table 2).

Table 2. *Mean Age at Onset of Voice Change (Cooksey)*

1939	14.3
1972	13.8
1978	13.5

Note. Derived from Killian, 1999

Unfortunately, Cooksey was no more able to identify exactly how the onset of voice change had been defined by these sources than were the present author and his colleague in their own historical review (Author & Mecke, 2013). Cooksey's stated age of 13.5 years in 1978 is probably the nearest to a serviceable base line that might be obtained (Cooksey, 1977, 1978). Clearly this age does not accord with the ages of 14.0 and 14.2 years in the later Juul studies, so the problem of exactly what to measure is a matter of continuing concern.

In 1992, Cooksey produced a new summary (see Table 3) that might also serve as a baseline. This summary covered the period immediately prior to when press reports of choir directors' concerns with early voice break began to appear. The 1992 summary gives a mean age of 13.6 years for the Midvoice IIA stage, which Cooksey describes as mutational climax. It may be presumed that at that time he attached particular significance to this figure because it is the only stage for which he quotes an actual mean age. He also gives somewhat less precisely the "normal mean age of 14" as the "end of the most dramatic stage of voice change" or the commencement of the new baritone stage (Cooksey, 1992, p. 61).

Table 3. Indicative Age Norms from Cooksey's 1992 Revision

Stage No.	Stage Name	Grade level (US)	NC Year (UK)	Age Range	Mean Age
0	Unchanged	5, 6, 7	6, 7, 8	10 – 11	Not given
1	Midvoice I	6, 7, 8	7, 8, 9	12 – 13	Not given
2	Midvoice II	5, 6, 7-8, 9	6, 7, 8-9, 10	13 – 14	Not given
3	Midvoice IIA	7, 8, 9	8, 9, 10	13 – 14	13.6
4	New baritone	7, 8 & 9	8, 9 & 10	13 – 15	Approx. 14
5	Developing baritone	9	10	14 – 15	Not given

The correspondence of Cooksey's terms "mutational climax" and "most dramatic stage" with the "unintentional falsetto notes and changes in singing tone" of the Juul studies has yet to be established. It is clearly a question of pressing significance for the present topic. There would seem good grounds, nevertheless, to suggest that the ages of 13.5 years and 14.0 years were for most boys during the 1990s the time of greatest vocal upheaval. At the age of 13.5 years a boy experienced significant disruption to his treble voice (Cooksey), and at the age of 14.0 years, a majority of boys began to attempt baritone (Juul, et al.).

It is important to note that Cooksey never set out to provide definitive norms. He often pointed out that the development of individuals is highly idiosyncratic and hugely variable. Hollein, Green and Massey (1994) made a similar point when they expressed a strong preference for longitudinal studies over cross-sectional investigations. By the year 2000, Cooksey observed that "many" voices were in change by the criterion of diminishing singing range before the seventh grade (UK Y8), i.e. between the ages of 12.5 and 13.5 years. He also observed a strong shift toward settling baritone during the summer holiday. This development occurred at the time UK pupils would transition between Y8 and Y9 with little singing for several weeks (Cooksey, 2000, p. 730). These important observations suggest that English cathedral choirs might expect "many" of their Y8 choristers to be experiencing a diminishing range and to lose their treble voices altogether during that year's summer holiday. This was the situation in the year 2000, ten years before the

present surge of doom laden press reports alleging "voices breaking early."

Given the significance attached by so many writers to Cooksey's work, his observations, together with the 1992 Table 3 will serve as a reference point for the present study. There are two important caveats. First, the link between the definitive medical criterion of testis size and voice stage is not sufficiently well established to make a firm claim that the cause of boys leaving choirs earlier than expected is due to changes in pubertal timing. Second, Cooksey's writing is opaque on the subject of how a possible singing range intermediate between the emerging modal "chest" register and the falsetto register might be exploited. Cooksey gives the ranges F3 – B4 as modal, C5 – B5 as falsetto, and C6 – C7 as whistle (Cooksey, 2000, p. 727) for the important stage (Midvoice II) when this negotiation might be possible. There are undoubted difficulties in applying Cooksey's work to English boy trebles because of the presence of boys at Midvoice II continuing on the treble line (Williams, 2010). It will later be seen that this was found to be the case in the present study. Alternative views such as Leck (2009) or Beet (2005) are thus not easy to dismiss in spite of the comprehensive protocol and large sample of Cooksey. Brown (2010) points out the continuing lack of agreement with regard to the registration terminology in boys' voices.

There are clearly still frustrating gaps in our knowledge of the boy chorister voice. The topic of puberty and voice "break" is one that presents the danger of unhelpful speculation filling this vacuum. With this possibility in mind, the

purpose of the present study was to describe and analyse systematically the extent, if any, to which the secular trend to earlier puberty has impacted the English choral tradition in its current manifestation. I sought to create demographic maps of a representative selection of English cathedral choirs based on the Cooksey voice classification system. I also sought to capture the boys' own understandings of voice change through interviews. It would not be possible to settle in any conclusive manner the question of the secular trend in puberty because of the difficulty of finding an entirely reliable baseline from the past (Ashley & Mecke, 2013). However, this study did seek to establish such a baseline for the year 2012 in order that future research might monitor the trend more accurately. In so doing, the following specific questions were addressed:

- What speaking fundamental frequencies (SF₀) could be found in boy choristers?
- How did these change as the age of the boys increased?
- What singing ranges could be found in boy choristers?
- How did these change as the age of the boys increased?
- What voice qualities could be found in boy choristers?
- At what age were changes in voice quality perceptually detectable?
- What was the impact of these changes on the practice of the choirs studied?
- How did the boy choristers understand and interpret these changes?

Method

Participants

Seven choirs, representing the full spread of English practice were visited in order to collect

a cross-sectional sample of chorister voices. The English choral tradition is maintained mainly by the cathedrals, but similar choirs are found in the collegiate chapels of certain universities and in a small number of so-called “greater parish churches.” At one extreme, large prestigious cathedrals maintain a choir school that all the boys attend. Such choir schools are also likely to be boarding schools. Some choirs comprise exclusively boarding pupils, though mixed boarding/day or day only is more common. At the other extreme, smaller provincial cathedrals or greater parish churches may recruit only day pupils from a range of local schools. The majority of choir schools educate boys up to the age of 13.5 years, but in some cases the age range is continuous until 18 years of age. Significantly in these choirs, boys are free to remain beyond the age of 13.5 years until it is determined that their voice has “broken”. There are regional variations of intake. Cathedrals in large urban areas or cities associated with prestigious universities tend to attract larger numbers of applicants, often from musical families. The research was designed so that each of these types of choir would be purposively sampled.

Once choirs had been selected, the request was made to test either every boy in the choir or every boy in the two senior years of the choir. This process was largely a matter of negotiation with each choir according to how much time could be spared. Where there was pressure on time, I selected the two oldest years, because these were the most likely to contain boys at some stage into puberty. The result was a total of 127 boys between the ages of nine and fourteen years being seen. These boys came from five cathedral choirs, one university collegiate chapel choir and one greater parish church choir not having cathedral status. See Table 4. The choirs are identified by pseudonyms.

Table 4. Sources of Chorister Participants

No.	Pseudonym	Location	Source of Choristers
1	Saint Petroch	Capital city	7 – 13 choir school
2	Corpus Christi	Southern University city	7 – 13 choir school
	Emmerford RC	Metropolitan NW city	7 – 13 choir school + senior school
4	Anglia College Chapel	Southern University city	7 – 13 choir school
5	Irontown	Provincial NW city	Local schools
6	Bridgminster	Provincial SE city	7 – 13 choir school
7	St Anselm	Large SW city	Local schools

Procedures

Ethical approval for the work was granted by a full University Ethics Committee. The protocol was derived from the BERA (British Educational Research Association) and the 1983 Helsinki Declaration on Human Experimentation. In order to ensure that full consideration was given to UN Convention on Rights of the Child, Article 12, requiring that children be facilitated to give fully informed consent, versions of the BERA guidelines and an illustrated description of the work to take place were prepared in language accessible to ten to fifteen year old boys. Letters to parents requesting that the research be discussed with the boy at home were circulated via the schools. The letters fully explained the work and its purpose, assuring anonymity and advising of the right to withdraw and the right to review data. Boys were reminded of these rights on the day and given a further verbal explanation with opportunity for questions before work commenced. None opted to withdraw.

I saw the boys individually in a room provided by the relevant choir school or church. A second adult known to the boy was present in the room, but did not participate. Date of birth, age, standing height (cm) and weight (kg) were recorded and the boys completed the following protocol for speaking and singing voices:

- Recite the day's date and the date of their own birth.
- Read approximately ninety seconds of the phonetic speech passage "Arthur the Rat."

- Count slowly and monotonously backwards from twenty.
- Engage in a short piece of casual conversation.
- Sing the words "You owe me five pounds" to the tune of "Happy Birthday" in the singer's choice of pitch range without a starting note given.
- Perform ascending and descending glides throughout the pitch range from highest to lowest notes as estimated by the singer.
- Perform pitched scales, ascending and descending in G major and C major, sung unaccompanied for two octaves (G) or one octave (C), with extensions to highest and lowest clearly realisable pitches by keyboard matching.
- Perform a six note vocalise in various keys covering the main registers of the voice and possible passaggio regions.
- Perform a messa di voce on D3 and D4.
- Sing the hymn tune *St Botolph* as a test piece.
- Indicate on a VAS their degree of satisfaction with their current treble voice.

Fairly critical to this protocol was Cooksey's 1977 observation that throughout the entire singing range of the unchanged voice, only modal sound of soprano-like quality was heard. The present author confirmed this factor in pilot work for this study. Cooksey used the term "lift point" to describe the change between modal and head registers (Cooksey, 1977, p. 6). The term "passaggio" is used in the above protocol

to refer to the same phenomenon. Such transitions are not always readily detectable by the ear in the early stages of change, but become very obvious once the boy begins to develop a new voice in the tenor octave. On an acoustic spectrogram, *passaggio* or lift points are easily seen as breaks in the patterns of spectral lines. This visual reference was used to aid observation by the ear. Falsetto can also be established by the *messa di voce* test. The boy has to sing a sustained note commencing very quietly, reaching a crescendo and fading away again. He should not alter other qualities such as pitch or vowel sound. A boy in falsetto would find this hard to do, while an accomplished chorister at the height of his powers before the treble voice gives way to falsetto will probably exhibit good control and a wide dynamic range.

Qualitative data were also gathered. On completion of the test protocol, each boy was asked questions about his current status and progress in the choir. Four of the boys in one of the choir schools had been dismissed from the choir by the time of the interview. No other instances of early dismissal were recorded. These four boys were asked to give the time of their dismissal and to describe the circumstances surrounding it. The qualitative data were transcribed and coded for analysis. As will be seen, they are quite revealing of the above points.

Equipment

High quality acoustic recordings were made with linear equipment, deviating less than ± 2 dB over the range of 20 Hz-40 kHz, the limiting factors being the microphone itself and the acoustic qualities of the room provided by the choir school or cathedral. The equipment chosen did not impose any kind of bandpass filtering. A DPA 4007 omnidirectional reference microphone was chosen for its quality and forgiving nature; having an omnidirectional pattern it does not suffer from proximity effect, and its high SPL handling made it ideal for these recordings. The microphone was mounted

on a Rycote Invision-7 shock mount, and with an SE Reflexion Filter to act as an acoustic barrier, decreasing the amount of unintended sound reaching the microphone. The cable used was Van Damme Starquad terminated in Neutrix NC3XX connectors. Audio was captured in 24 bit resolution at a 96 kHz sample rate. No other dynamic processors or other changes to the signal were applied at the recording stage.

A key reason for using high quality acoustic recordings was the desire to archive the voices so that representative recordings made in the years 2011 and 2012 could be accessed by future researchers for comparison purposes. In this way, it is hoped, the secular trend in chorister voices might be mapped across decades or even centuries forwards. Analysis was through a display driven by the VoceVista software which provided a 10 kHz color spectrogram, power spectrum and audio envelope. The average SF₀, highest and lowest terminal glide pitches, highest and lowest keyboard matched pitches, location of self-selected tessitura (i.e., the key and octave instinctively chosen to perform "You Owe Me Five Pounds") were obtained through the VoceVista display cross-checked where possible by audio matching to keyboard. EGG recordings by VoceVista (Bridgminster) and Laryngograph (Irontown) were also made for reference purposes and use in further study. The audio spectrogram was used to identify and plot the frequency of *passaggio* points in the voice and the accuracy of pitched intervals. High quality audio reproduction was also used in the subjective analysis of voice quality according to the descriptions given by Cooksey (see Table 1 above), supplemented by visual inspection of spectrogram and power spectrum.

Results

The results are presented in three sections. First, the quantitative results describe what was found through analysis based on the Cooksey scheme. It was possible to identify three

different categories of singer through perceptual acoustic analysis. These categories are described below. The distribution of the voice types across the seven choirs is also described. In the second section, further description of the main categories is given and illustrated by audio example. Finally, some of the qualitative interview data are presented in order to illustrate the boys' self-perceptions of the voice types.

Quantitative Findings

Many of the choristers were found to have extended singing ranges well into what Cooksey determines to be "whistle". C6 (1046Hz) was common for boys in Y6 and Y7 as the top end of a usable treble range, with G6 (1578Hz) being reached by one eleven year old with little difficulty. Cooksey gives no indication of the top limit of the treble range, preferring simply to indicate that it is above F5. However, Welch, Saunders, Rinta, Stewart, Preti and Hill (2009) indicate only E5 as the top of the comfortable singing range for unchanged voices that do not sing in the intensive chorister context. A notable contraction of range did occur in Y8 (age 12.5 – 13.5 years). Most of the younger boys (Y5 and in some cases Y4, age range 8.5 – 10.5 years) had smaller ranges and less accurate pitch matching than the Y6 boys.

Estimates of Cooksey stages in the tables below are based on a primary indicator of range, as suggested by Cooksey (1977). Lowest terminal pitch (LTP), speaking fundamental frequency (SF₀) and pitching of the tessitura exercise ("You Owe Me Five Pounds") were used as qualifying indicators. LTP was taken as a useful acoustic indicator since a boy can extend his range upwards but not downwards. Generally, LTP fell in line with SF₀ across the study, the two measures being three to six semitones apart as confirmed by other workers (Welch, 2006; Williams, 2012). SF₀ is an important measure but insufficient on its own to allocate boys to stages because the ranges given by Cooksey (220 – 260Hz for Stage 0 and 220-247Hz for Stage 1) are wide and overlapping.

There is also a degree of uncertainty with regard to how SF₀ is assessed across the literature. The data tabulated here are based on counting backwards from 20 although data on running (continuous) speech and reading are also available. Comparison of the data from the Irontown choir obtained by Laryngograph revealed that the counting method gave a reading averaging 17.82Hz lower than the "Arthur the Rat" passage. A SF₀ based on counting is therefore given with the caveats that the figures may be a little lower than norms reported by other researchers, that researchers need to be clearer about how they obtain SF₀, and that the counting method should be more clearly understood for what it is.

Across the reported sample of 127 choristers, 26% of boys have counting SF₀ > 220 Hz, 35% between 219 Hz and 200 Hz and 38% < 200 Hz, indicating that only a minority of the choristers tested would be less mature than the critical testosterone level suggested by Pedersen (1997). SF₀ ranges between 200 Hz and 220 Hz would seem fairly critical as they are below the bottom of Cooksey's ranges for Stages 0 and 1. These ranges are associated with a medical indicator of mid-puberty (Harries et al, 1997) but possibly calculated lower by this study than some others.

Perceptual acoustic classification of the choristers proved highly challenging and revealed telling differences of opinion when other listeners were asked to comment. No reliable distinction could be made between boys at Stage 0 or Stage 1. The analysis therefore groups these boys together as "Boys at stage 0 or 0/1 who sing a true treble without difficulty." However, Stage 2 boys were more easily identified by a contracting range and perceptible quality changes. Such changes were visible on the acoustic spectrogram, which showed emergent passaggio points and sudden changes in breath noise not present in the Stage 0 or 1 boys. Stages 3 and 4 were also easy to identify perceptually through obvious signs of strain and weakness of treble tone. Boys at these stages were able to complete some of the tests in the tenor register.

Figure 1 displays the percentages of boys in three vocal stage groups per school year across the seven choirs.

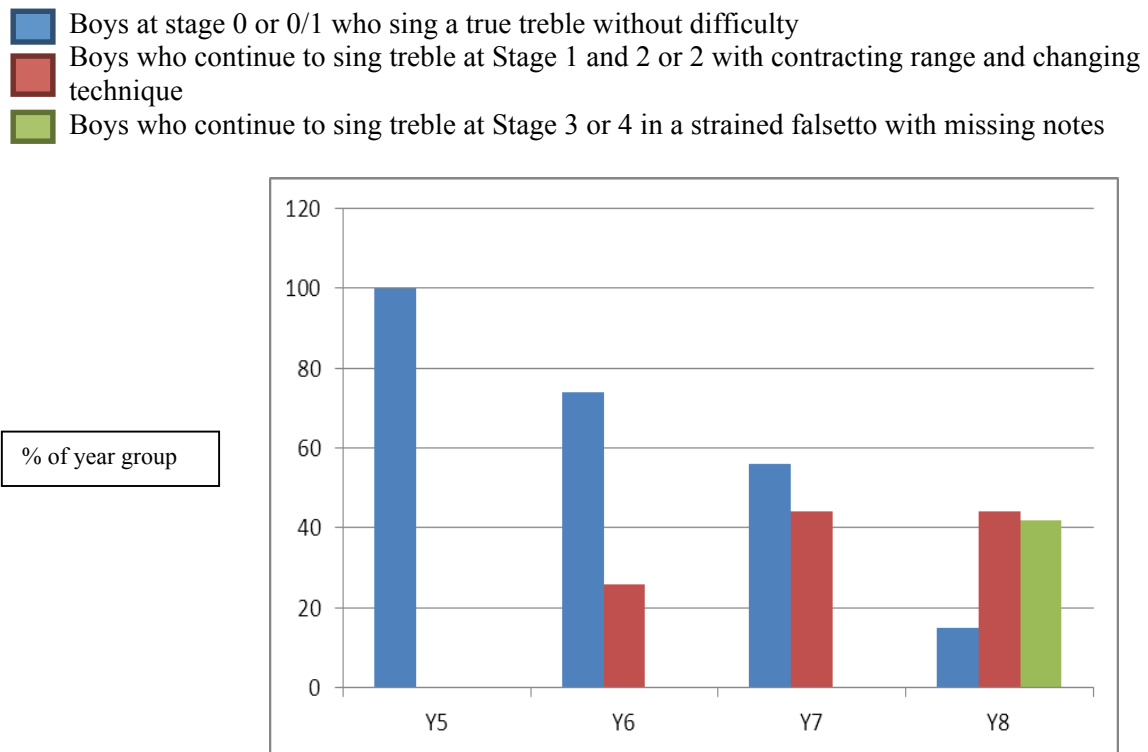


Figure 1. Voice stage of boys in seven choirs

This graph shows clear patterns across the four main age groups with a distinctive change occurring in Y8. All boys in Y5 have either unchanged or Stage 1 voices and they sing treble with little difficulty. However, when asked to demonstrate competency by performing “You Owe Me Five Pounds” to the tune of “Happy Birthday,” few of these youngest boys matched the older boys in Y6 upwards. Misjudgement or compression of the key intervals of a fifth and an octave were common in Y5 but rare in Y6 upwards. In Y6, the majority of boys still have unchanged or Stage 1 voices although 26% of them are beginning to experience the first signs of perceptible change in their voices. In Y7, there

are still a majority with unchanged or Stage 1 voices, but this is almost matched by the number with Stage 2 voices.

In Y8, however, only a small minority (15%) still have unchanged or Stage 1 voices. For the first time, larger percentages of Stage 3 and Stage 4 voices appear, and these percentages almost match the percentage of Stage 2 voices (42% and 44%, respectively). Year 8 is therefore a time of notable voice change. This circumstance seems consistent with Cooksey’s (2000) suggestion that “many” voices will have a diminishing singing range between the ages of 12.5 and 13.5 years. Table 5 disaggregates the frequency of voice stage groups found in each of the seven choirs.

Table 5. Frequency Table for Boy Vocal Stage Groups According to Choir

	Stages 0 and 1				Stage 2				Stages 3 and 4			
	Y5-	Y6	Y7	Y8	Y5	Y6	Y7	Y8	Y5	Y6	Y7	Y8+
Saint Petroch	-	-	6	0	-	-	2	4	-	-	0	4
Corpus Christi	2	3	3	0	0	1	2	2	0	0	0	2
Emmerford RC	5	5	2	2	0	2	3	2	0	0	0	0
Anglia College	4	3	1	0	0	1	1	1	0	0	0	4
Irontown	3	2	1	3	0	0	0	1	0	0	0	3
Bridgminster	-	4	0	0	-	1	1	2	-	0	0	0
St Anselm	1	-	0	0	-	-	1	3	-	-	0	1
Total as % of age group	100	74	56	15	0	26	44	44	0	0	0	42

The consequent responses varied between the choirs, as did the distribution of boys at different voice stages. No generalised statement was possible; thus, Cooksey's objection to the use of chronological age was upheld. Whereas some choirs tended to tolerate or even encourage boys at Stage 2/3 (and 3/4 in a few cases) to remain as trebles, one choir (St Petroch) appeared to have a dismissal process for boys once clearly perceptual changes in voice had set in. These varying practices appeared to have quite a marked effect on the highest terminal pitch (HTP) of the older boys. Thus in the St Petroch choir the mean HTP of the four oldest boys (mean age 13.2 years) who had ceased singing was only 335 Hz (E4). However, Bridgminster had a 12.9 year old with a SF0 of 185 Hz (range 164.8 Hz (E3) – 1008 Hz (B5)), while Irontown had a 13.6 year old with a SF0 of 141 Hz and a full range of 119 Hz (A#2) – 1052 Hz (C6).

Illustrations of the Voice Types

The following audio examples illustrate voice characteristics of representative boys according to three vocal stage groups.

Audio sample 1: A boy with a well-developed but unchanged voice. [*Editor's Note:* Readers may access this audio file from the contents page for this issue of IJRCS.]

The boy in this sample is aged 9.9 years and of good stature for that age (height 145.1 cm, weight 32.5Kg). He has an SF0 of 251 Hz (reading) and 225 Hz (counting). His glide range was C6 – G3 and his pitch matching to keyboard range E6 – G3. He pitches “You Owe Me Five Pounds” in the key of E4 (range B3 – B4) indicating a near perfect fit with the tessitura given by Cooksey (C#4 – A#4). Spectrographic analysis revealed a completely pure voice with minimal noise component throughout the range and no passaggio points.

Audio sample 2: Two boys who continue to sing treble at Stages 1 to 2, sometimes with contracting range, but who have found a means of maintaining a usable treble range and producing a tone that still sounds to most ears relatively pure. [*Editor's Note:* Readers may access this audio file from the contents page for this issue of IJRCS.]

The first boy in this audio sample is aged 13.2 years and has an SF0 of 180 Hz (reading) and 165 Hz (counting). He pitched “You Owe Me Five Pounds” apparently comfortably in the treble range three semitones higher than the boy above with the unchanged voice (key G4, range D3 to D4). His glide range was A5 – E3 and his pitch matching to keyboard range A#5 – D#3. These measures gave a mean singing fundamental frequency of 523 Hz (C5), which is only possible if the extended falsetto range is

included in the calculation. Spectrographic analysis of “You Owe Me Five Pounds” appeared to suggest that a *passaggio* had been passed to reach D5 when a significant noise component appeared. This event was found at 323 Hz (crossing E4 – D#4) on the downward glide. The boy appeared therefore to be producing a treble tone sounding relatively pure to the ear but predominantly with the use of registers that appear only some way into voice change.

The second boy is aged 13.5 years and has an SF₀ of 185 Hz (reading) and 179 Hz (counting). He pitched “You Owe Me Five Pounds” lower in the key of C4 (range G3 – G4) thus indicating an inclination toward *cambiata* rather than treble range. His glide range was A#5 – E3 and his pitch matching to keyboard range was G5 – C#3. The mean singing fundamental frequency derived from this calculation is 461.3 Hz. The highest pitch sung in “You Owe Me Five Pounds” was 392 Hz (G4) indicating that he has pitched the song just below the range of transition to falsetto that Cooksey suggests for the majority of Midvoice II boys (G4 – D5) and has successfully chosen a Stage 2 tessitura. Cooksey gives this tessitura as G#3 – F4 for Midvoice II. This boy, therefore, would be comfortable as a *Cambiata* in a changing voice choir, however his extended range to G5 still sounds relatively pure. Paradoxically, exactly the same increase in noise component was indicated on the octave leap to G4 as occurred for the other voice in this sample leaping higher to D4, yet the change in tone might be readily perceived by lay listeners.

Audio sample 3: A boy who continues to sing treble during or after the high mutation period in a falsetto voice across the whole range with obvious strain and weak tone. [*Editor’s Note: Readers may access this audio file from the contents page for this issue of IJRCS.*]

These boys were each able to sing “You Owe Me Five Pounds” comfortably in the tenor octave but resorted to a very obvious falsetto to

reach the treble octave with which they still identified as choristers. Billy, the boy in the sample, had no modal register at all when gliding downward and singing descending scales. His falsetto production simply fell away to nothing just below middle C, which he seemed to think was his lowest terminal pitch. His first experience of a new baritone modal register, much to his surprise, appeared to be during the test encounter itself (see qualitative data below).

Qualitative Findings

The understandings and perspectives of three Y8 boys (pseudonyms Ollie, Ralph, and Billy) as gathered from the interview data are now given. Ollie from Saint Petroch is one of the boys dismissed from the choir before reaching the end of Y8:

Ollie: Well, um, my voice began to get lower. I ended up having to sing falsetto in the choir. And, um it ended up with voice not actually, my voice didn’t exactly fit in with the rest of the choir so I had a discussion with my parents about it, and Mr [Director].

Researcher: Did he ever say anything during a rehearsal? Did he say your voice is sounding a bit off today or something?

No.

So...he wasn’t listening to you individually?

He was occasionally.

Right. And you were confident you were singing falsetto were you?

Yes.

How are you confident? What makes you think ‘that’s falsetto’?

Um, well, it was the fact that it was a lot weaker than it was before, and I had to use a different part of my voice and a different part of my brain to actually sing.

That’s interesting. Were you aware of a particular note where you came out of falsetto into normal voice?

It was about, sort of, E just above middle C, to about G, that's sort of the break point.

OK. And were there any notes you couldn't sing at all? Where no sound would come out?

Um, sometimes around my break point I wouldn't be able to sing any notes.

And when you were singing in falsetto, could you control the volume? Could you crescendo and decrescendo?

Um, not, not that well, not that well.

Ollie's experience can be contrasted with that of Ralph in Corpus Christi choir, where it appeared that less attention was given to the individual development of the boys. No boys in this choir had been dismissed. Ralph was aged only 12.5 years so a Stage 3 or 4 "broken" voice might not have been expected. However, Ralph was 7 cm taller and 4 kg heavier than the fiftieth percentile for his age and his LTP was C#3. He sang "You Owe Me Five Pounds" instinctively in the tenor register and experienced significant difficulty in matching G4 to the keyboard. At first he was unable to phonate at all, but eventually produced the note with a clear falsetto tone to the vowel /u/. He appeared unable to reproduce the /ah/ vowel on this note.

Researcher: And do you say you sing falsetto in choir?

Ralph: Yeah.

Is that what you think or is that what somebody's told you?

Well, Dr. [Director] told me to, well, he told me to keep trying to sing, um and falsetto seems to work OK actually at the moment, so I keep doing it.

Mm...

I mean it wears my voice out quite quickly so I have to rest it quite often but...

Mm, it will wear your voice out. It'll dry your vocal folds. Do you drink a lot of water?

Yeh, I do drink a lot.

It was a doubly unfortunate chance occurrence for this choir that a boy had clearly reached a fairly advanced stage of puberty well before his thirteenth birthday and a second Y8 boy, aged 13.1 years, had also reached a similar high mutation point. This latter boy was unable to complete the singing test protocol at all and explained how he regularly "mimed" during rehearsal and performance.

Finally, Billy from Irontown, aged 13.4 years represents those boys who have clearly reached or passed high mutation point and continue to sing treble only by means of a very obvious falsetto an octave above their true voice. During the backwards counting from 20, Billy's voice cracked and flipped into involuntary falsetto on the numbers six and four. He was heard to utter a barely audible cry of exasperation after the four.

Researcher: What happened on the number four?

Billy: Ooh, don' know, it just went high up, a bit

Does that ever happen when you're talking at school?

Yeah, a little.

How do you feel when that happens?

Dunno. A bit annoyed sometimes.

Yeah, that's a crack, because your voice is changing. OK stand up and sing me "You Owe Me Five Pounds."

[The first attempt does not phonate. He starts again on the note E4 in falsetto (key A major treble octave). The top E5 does not phonate at the octave leap.]

Oh, Ah, God!

Keep going.

[He restarts and succeeds in phonating the E5 in falsetto. Then stops again and completes the song a tone lower.]

O God, that was fail!

That was what?

Fail.

A fail?

[Second adult clarifies – a fail]

A fail? Oh! Why was it a fail?

I don't know. Just, [sighs quietly] rubbish.

Why do you think it was rubbish?

My voice is changing.

Stand up again and sing it like a man [imitates a robust baritone voice].

Billy copies and successfully sings the whole song in the tenor octave. There is then much relieved laughter and joking.

Discussion

The newly gathered empirical data from this study appear to lend some credence to the anecdotal evidence regarding pubertal timing in boys. Further systematic measurement would appear to be justified. The cases of Billy and Ralph present a clear wake-up call to choirs. In spite of the increased prevalence of singing teaching and voice coaching, these boys would not seem to be receiving regular attention to their voices and are being allowed to sing (or mime) in ways which most singing teachers would regard as unhealthy. The possibility of serious or long term damage to voices or the condition of puberphonia is probably slight. The need for good vocal pedagogy seems to be mostly related to the correction of poor technique developed by choristers who sing treble up to the point of traumatic break (J. Chapman, personal communication, October 28, 2008) or who erroneously believe that a boy's falsetto will lead to an adult counter-tenor (Williams, 2012).

The absence of conclusive medical evidence is troubling. Interpretation of the data does require a balance to be struck. There are the anecdotal but scientifically unconfirmed reports from choir directors that boys are being lost at earlier ages and the scientific literature, which cumulatively leaves open the question of

whether the timing of boys' puberty has advanced. There may also be a case to revisit the question of the old boy soprano "head tone" referred to in the literature review. The extent to which such techniques contributed to past understandings of the time of voice change could not really be answered by the present data. A clearer statement from singing teachers at least prepared to recognise the technique would be helpful. However, there are also issues of identity confusion. A boy's need to justify his "girl like" singing to peers who may suspect that "they've screwed his balls up" (Ashley, 2006, p. 200) is now a significant challenge for older choristers (Ashley, 2009). To place a boy in such circumstances when it would not appear justified by his contribution to the choir might be seen as inconsiderate at the very least.

It is tempting to conclude that an advance in pubertal timing is responsible, particularly because several of the choristers assessed during the present study were taller and heavier than their peers. External signs such as acne or proto-facial hair commensurate with the medical stage of advanced or completing puberty were also observed. However, against this possibility must be balanced the observations that in three of the choirs studied boys continued as trebles in spite of reaching the high mutation (Tanner Stage 3) or the completing puberty stage (Tanner Stage 4 to 5). Here the data might tentatively support an alternative possibility that Ollie and boys like him might be dismissed too soon from their choirs. What appeared to be happening was that boys in other choirs were losing range and quality mostly during Y8 as predicted by Cooksey in 2000, but remaining in the choirs as useful leaders. Further dialogue with voice coaches and choir directors might open up valuable insights into what registration the boys were using habitually in performance and how often they were omitting notes. Billy did appear to be somewhat distressed vocally during his assessment. The falsetto was not a comfortable one and it would be instructive to know the balance between singing like this and not singing at all during normal choir activity.

In two of the other choirs, it was impossible to say what would have happened because no boys had reached the completing puberty stage. Given that Cooksey quoted a mean age of 13.6 years for the attainment of Stage 3 in 1992 (data gathered some time before that year) there are overall no real surprises in the study.

Possibly more important changes than pubertal timing over the last three decades are the increasingly widespread introduction of singing teachers or voice coaches to English cathedral choirs and the preference for more child-like tone than that achieved earlier in the twentieth century by trainers such as Thalben-Ball. It is likely that at least some singing teachers, with their access to boys for individual lessons and their knowledge of voice change processes, will have raised awareness. Loss of boys at earlier ages may thus also be explained by greater knowledge and changes to vocal pedagogy resulting from the influence of these teachers. For example, at Saint Petroch Cathedral where boys such as Ollie regularly saw a well-qualified singing teacher, there had been four exclusions. In other cathedrals similar boys continued to sing. One such cathedral was Emmerford where, although it was claimed that the boys were given “individual singing lessons” these periods turned out to be training by the assistant organist for a chorister award scheme. The boys did not receive actual voice coaching by a qualified singing teacher. Such factors must be considered alongside any small changes in pubertal timing. Perhaps there is a positive association between early exclusion and the nature of singing coaching received. Such an association could usefully be tested by a larger sample study addressing this question exclusively.

The evidence for earlier puberty alongside other explanations currently lacks the robust support of corroborating medical evidence. The medical literature is contradictory, inconclusive, and has been slow to present a clear case. Using Cooksey’s publications from 1992 and 2000, there is little evidence of an advance in puberty over the last two decades. Indeed, Cooksey’s

work tends to support the greater awareness hypothesis. It was quite clear that two decades ago “many” Y8 boys were expected to be where the Y8 boys in the present study were found. The secular trend in puberty, if it exists, may not operate at a constant rate. It is possible that going back further in time, the trend was faster. Certainly the evidence of a secular trend to greater stature across the twentieth century is robust (Hollien, H., Malcik & Hollien, B, 1969, Killian, 1999) although the assumption that this trend correlates with a similar trend in puberty may be less so. When time periods such as from the era of William Byrd or J.S. Bach are considered, it is highly frustrating that the available data are too unreliable and invalid to be used as a trustworthy baseline.

Nevertheless, when voice data reported by authors such as Killian (1999), Rutkowski (1984), Moore (1995) or Cooksey (1992) are compared with reports from previous centuries there does seem to have been at least a small, secular trend. A small trend during the 1970s and 1980s does not, of course, account for the present day press reports, which may have something of a media engineered “moral panic” about them. Thus repertoire simplification, as was reported by one cathedral music director, may be an alarmist response. The ability to soar comfortably to G5 or C6 is not the only desired attribute of a boy chorister. Musicianship, repertoire knowledge, and leadership are also important. These characteristics, not unnaturally, tend to be found more in the Y8 or Y9 boys. The author was led to consider that it may be boys in Y6 (10.5 – 11.5 years) and Y7 (11.5 – 12.5 years) who were carrying these choirs in singing tone. Possibly the older boys contributed more through musicianship and leadership. Conversations with the music directors tended to confirm that the desire to retain the oldest boys for as long as possible was often on account of their ability to give secure, reliable leads, even if they could not sing the highest notes.

Another pressure on choir directors is the recruitment of new boys. Recruitment appears

to be more of a problem for some choirs than others. In the present study, Saint Petroch, being a prestigious choir with an international reputation and Bridgminster, being located in a prosperous part of the South East, reported little difficulty. Irontown and St Anselm, however, reported ongoing difficulties. Such difficulty in recruiting younger boys can result in a reluctance to release older boys, with a consequent upward pressure on the age demographic in some choirs, particularly those that are not structurally confined by the age ranges of a 7 to 13 choir school. A key issue here is how quickly younger boys can assume a useful role in the choir. The present study found that while Y6 boys (aged 10.5 – 11.5 years) and Y7 boys (aged 11.5 – 12.5 years) were often similar, there were more noticeable differences in ability between the Y6 boys and the Y5 boys (aged 9.5 – 10.5 years). The Y6 boys had all developed the full range and capability of a chorister, whereas several Y5 boys had smaller singing ranges with less accurate interval pitching nearer to those of boys who did not sing regularly. The abilities of the youngest boys to read difficult psalm passages, learn complex new music quickly, and sustain the often very demanding time and work pressures of being an English chorister are likely to be the limiting factors. Future research might usefully look at the experiences of choirs that have attempted to lower their age demographic, particularly any that have introduced junior training choirs.

On the topic of vocal pedagogy, the present author is reluctant to offer a firm opinion. An earlier study (Ashley, 2010a) reported conflict between singing teachers and choir directors. Further examples of such conflict have subsequently been encountered in the author's daily practice. Problems are most likely to occur when a boy has singing lessons with a knowledgeable teacher unconnected with the choir, or the boy sings temporarily with another choir where voice testing for allocation to parts is part of the practice. In the author's personal experience, these problems are more likely to

arise when the singing teacher has an unbending approach to the application of Cooksey's guidelines and the choir director, by contrast, may be unaware of or skeptical of Cooksey's work. Williams (2012) seeks reconciliation when she suggests that there is merit both in schemes such as *Cambiata* (McClung, 1984) that stress use of the lower modal voice only and schemes such as expanding voice (Leck, 2009; Phillips, 1996), which suggest that the three or more octave range accessible by boys during puberty be fully exploited. The latter would seem better aligned to the English choral tradition. There is arguably a strong warrant to test these speculations, not least because of the possible implications for vocal health suggested by the present study. Other research by the present author suggests that assuming boys invariably gravitate to the lowest available range as the most "masculine" is by no means always warranted. Boys who have grown up within the English choral tradition are more likely to shed tears at the loss of the treble voice, or even behave as though it were a bereavement (Ashley, 2009).

Conclusion

This study is a systematic investigation in response to a growing belief that the time of puberty is advancing with the consequent early loss of experienced boy trebles from the English choral tradition. Although the medical evidence is inconclusive and Cooksey's publications from 1992 and 2000 do not appear to indicate it, the data gathered from the 127 participants in this study suggest that physical puberty has advanced slightly. However, this advance may be relative to what have been the established normative expectations within the English choral tradition. Until the present time, it has not been thought necessary to justify these expectations through objective measurement. The present study has attempted to do so and may serve as a reference point for future studies.

A confounding possibility in more recent times may be that the observations reported here

might also be explained simply by greater awareness of voice change. Developments in vocal pedagogy also offer an explanation of how the situation may have changed between 1990 and the present. Physical puberty, moreover, is not the same as social puberty and the cultural expectations of what boys should and will do (see Ashley, 2009; 2010b). It may be that earlier puberty changed pedagogy and changed social norms all combine to necessitate a downward revision of the expected age norms for boys' singing within the English choral tradition. More research is required here. Although the English choral tradition remains strong in the cathedrals, outside the cathedrals alternatives such as "cambiata" or changing voice choirs are being promoted by influential organisations such as the National Youth Choirs of Great Britain, the National Youth Choir of Scotland and the Association of British Choral Directors.

In the interests of better vocal health and the future singing careers of boy choristers, all choirs should adopt the best practice of regularly hearing boys individually from the age of twelve upwards, being prepared where necessary to release such boys or find them roles that do not strain young falsetto voices. Recruitment of younger boys must be vigorous enough to ensure that older boys can be released comfortably when their time comes. Future research needs to examine the response of choirs to this agenda.

There is also a need for further medical research to establish more reliably the connections between the observed vocal events and actual pubertal status. This line of investigation needs to be undertaken with social puberty simultaneously in mind because a boy's singing is not determined by biology alone. There are nevertheless good reasons from studies that have already looked at the relationship between medical and vocal puberty to believe that vocal pubertal status is a reliable surrogate measure of medical pubertal status. However the size and scope of any such studies,

past or future, is limited by the invasive nature of the pubertal examination of boys. © IJRCS

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