Is the Voice Really Lost?

by Walter Marzilli, choral conductor and teacher

By paraphrasing here the title of a popular text on the castrati[1] we ask whether we need to broaden the definition of the lost voice to include not only the voice of the castrati singers, but perhaps even of the Renaissance choir in general. In other words, will it ever be possible to reconstruct the sound of a Renaissance choir that is faithful to the original? Removing the plaster overlaying a Renaissance fresco restores the original colours and the authentic brush strokes; but the dust collected on an old music manuscript seems to hide only traces of ink surrounded by an abysmal silence. How can those lost voices be brought back? Did the voices die with their singers never to rise again? Or did they perhaps leave some trace by which they can be reconstructed?

To this goal, it is obviously necessary to continue pursuing the path of research, reviewing their repertoire, and studying the treatises of the period. It is especially in this last area that we seek opportunities to attempt a reconstruction of the ancient sound, despite a difficulty, which ought not be underestimated. We have to admit, on reflection, that seeking to reconstruct a *lost* sound[2] by reading a paper description may raise the same concerns voiced about those who want to study singing by correspondence.

In addition, the authors of the Renaissance treatises could not have had the slightest idea that between their and our musical experience would come the cyclone of the Romantic era,

with the enormous consequent changes in musical style and both vocal and instrumental techniques.[3] Perhaps that is why they felt it enough to say only “We would have the singers heed this warning, that there is one way to sing in the church, and in the public chapels, and another way to sing in private chambers: since one sings with a *full voice* […]”[4] without knowing that in the meantime, their idea of a *full voice* would have been completely altered by the techniques of the *passaggio* (the changing of vocal register) and by the *copertura dei suoni* (covering of the sound) which intervened in the Romantic period[5].

Regarding voices and vocal timbres it must be added that – beyond the styles of the *church* or *private chambers,* which apparently differ more in the depth of sound than in specific characterizations of timbre – the Renaissance period could count on a cohesive singleness of voice, which made it unlikely that there would be any possibility of misunderstanding. We can therefore imagine the treatise-writers of the period intent on describing the characteristics of the voices of their time without specifically intending to provide applicable explanation, and moreover without feeling any need to describe unambiguously and unequivocally the characteristics of the sounds of their time. This greatly complicates our task.

Despite this necessary premise, which requires us to examine the texts of the time cautiously and thoughtfully, we wish nonetheless to see what help we can draw from them. Let us consider, in this light, a very important paragraph of Biagio Rossetti (known as *Rossetto),* in which the theorist of Verona uses four adjectives to define the parameters of timbre that make the ideal beautiful voice of his time[6]:

Perfecta vox est alta, suavis, fortis et clara. Alta ut in sublime sufficiat, clara ut aures impleat, fortis ne trepidet, aut deficiat. Suavis, ut auditum non deterreat, sed potius, ut aures demulceat et ad audiendum [= audientium. Cfr. Is., E., III, 20] animos blandiendo ad se alliciat et confortet. Si ex his aliquid defuerit, vox perfecta (ut dicit Ysidorus) nequiquam erit. [English translation provided in footnote]

Alta (High). As we all know the particular formation of the Renaissance choir, which did not admit women, required the use of male voices and/or children, in the high parts. For this reason Renaissance compositions could not exceed certain limits of the tessitura. The result of this is that when a modern choir – which relies on women to perform the two high parts – performs a piece from the Renaissance period, it sings a third or a fourth higher than was the practice five hundred years ago. To put it another way, in our case, we would say that a Renaissance choir sang these pieces a fourth lower than we do now. The concept then of a *high* voice, takes on a very different meaning compared to that we usually think of now.

And this is not all. The absence of the technique of *passaggio* (the changing of vocal register) prevented any change in timbre within the sections, limiting the emission to the characteristic vocal range: the deep voices were deep and the high voices were high, the low parts always using chest resonance, the others always using a head and falsetto voices[7]. In the modern choir, however, when singers are asked to sing in the higher reaches of their vocal range, they seem to add a new section to the choir, so dissimilar in timbre and colour compared with their central notes as to seem a completely different sound substance .

Then there is another question, this time strictly physical and acoustical. How can we relate the term *alta* 'high' to Camillo Maffei's seventh rule, which suggests that singers should " … open their mouths correctly and not more than is necessary to converse with friends"?[8] Although apparently unrelated to our study, this statement becomes much more meaningful if placed within Helmholtz's Law[9], which relates the frequency of a sound to the resonance chamber and its aperture. We need not enter into actual numerical calculations; an examination of the relationship between the various factors will suffice. We can therefore considerably simplify the mathematical equation, taking away the square root and the constants[10], and defining the frequency f of a sound with the equation $f = s/v$, where the cross-sectional area of the resonator is the numerator and its internal volume the denominator. Considering the case of the human voice, and consequently applying suitable parameters, we will consider the volume v of the resonator as being constituted of – in declining size order – the chest cavity, the oral cavity and the sinuses in the area known as the mask[11]. We will consider the cross section s to be the aperture that allows contact between the resonator and the external environment, in this case the mouth. It follows that, in order to obtain the high frequencies of high-pitched sounds, the factor in the numerator (cross-section mouth) must be large, while that used as the denominator (the volume of the resonance chamber) must be small[12]. At this point, aside from the timbral and expressive characteristics of the Renaissance vocal style, we can affirm that contemporary choristers' posture, in which they would, as previously mentioned, "… open their mouths correctly and not more than is necessary to converse with friends", would have impeded the production of sounds any more high-pitched than those possible in the medium, or at most the medium-high tessitura. We must conclude that our understanding of the 'high voice' may lead us away from the true qualities

of Renaissance music.

Soave (Sweet). We must first of all ask ourselves how ‘sweet’ the voices of the bass (bassus) and baritone (tenor) singers would have been; we imagine them as being endowed with an intense and decisive texture, if they were singing a fourth lower than the equivalent section of a modern choir. A look at the theorists’ extremely frequent criticisms and bitter condemnations of the sound produced by choristers will help us better to understand the situation, and to see that the ideal of the ‘sweet voice’ was often very far from being realised. The list of defects demonstrated by these voices is as long as it is varied, and is easily found in practically every historical treatise. These range from nasal sounds to those produced “with beast-like violence and fury”[13], from “raucous sounds, like those of a hornet shut inside a leather bag”[14] to “barbaric cries”[15] and sounds produced with imprecise intonation. According to Luigi Dentice, who expresses himself through the words of one of the two main characters in his *Duo dialoghi della musica*, Paolo Soardo and Giovanni Antonio Serone: “Everyone errs in something, be it in intonation or pronunciation, in singing, in *passaggio*, or in projecting and strengthening the voice when needed …”[16] Of particular interest is the reply of the other protagonist of the dialogue, who affirms that “At this rate no-one will be to your liking”[17], implying that all singers suffer from at least one of these defects, or that his companion is too much of a perfectionist, and should simply learn to make do. It is reasonable to imagine that any ‘sweetness’ must have been affected by the inaccuracies, omissions and errors (not to say horrors) of the singers.

Forte (Strong). As regards secular music, we know that it was performed by very few singers and that, according to Zarlino

(quoted above): “In the chamber one sings with a softer, sweeter voice, without making too much noise.”[18] On the other hand, the choirs of the epoch were generally made up of only a dozen or so people, and so the sound they produced would clearly have been diluted and lost inside the great basilicas. Again regarding sacred music, it is worth emphasising that the depth of the sound was further muffled by the fact that choirs sang facing the altar, conforming to a strongly theocentric approach to liturgical theology. The altar was the fulcrum of sacred activity and, above all, it was here that whoever supported and paid the choir presided over proceedings. As we can see from various surviving examples of musical iconography, the choristers turned their backs on the congregation/audience, directing their voices towards the sanctuary. It was not until the arrival of polychorality that the perceptive value of the audience as a useful target for the performers would come to be recognised. Even in this case, though, one can well imagine the auditory impact of a limited number of singers on a small, raised platform inside one of the great basilicas,[19] or perhaps they were obliged to climb up to the towering parapet of the lantern dome in St Peter’s Basilica in Rome[20].

In addition, when a Renaissance chorister sang in falsetto, the sound he produced, given the characteristic physiology of the human voice, was powered through only a partial vibration of the vocal cords. Using this technique, the singer’s vocal cords either vibrate only on the edges, without involving the entire *conus elasticus*, or else only in the front, longitudinal part. In both cases the sound depth, especially with regard to the main sounds of the tessitura, will have been much less when compared to that obtained through complete cord vibration, which was regularly the case with the sounds produced by the bass and tenor sections. Furthermore, it follows not only that within the general auditory structure of

the choir the sound produced by the falsetto voice would have been quite faint, but that the other singers would have had to conform to it in order to make the various layers of sound audible, regulating and balancing the sound levels produced. This search for equilibrium, assigned to them by the theorists of the day, was among the most important of the choristers' tasks and duties. Finally, and for the same reason, we can be sure that the refined improvisational abilities of the singers and their sought-after embellishments would not have had to contend with the full force of the other voices, which would have been thinned and softened in order to make room for their precious and much-appreciated virtuosity.

Chiara (Clear). There seem to be few doubts on this point. The conjecture that the Renaissance sound tended to be clear is supported by evidence of an acoustic and physiological nature, which we will examine here.

The practice of singing in front of a *librone* (choir book) obliged singers to keep their heads raised, with their necks bent back and tilted upwards, as is shown in the numerous prints depicting choirs performing. In this position the hyoid bone[21], and specifically the thyrohyoid muscle that connects it to the larynx, elevates the larynx, reducing the distance of the source of sound from the oral resonator. The immediate result is the production of a relatively clear sound, which does not become rounded or darkened[22]. Furthermore, it was impossible for singers to make use of the downward elasticity of the cricothyroid muscle (as the lengthening of the neck causes it to be pulled in the opposite direction), which would otherwise cause a lengthening of the vocal chords, and this prevents the sound from being muffled and hence allows the production of a clear tone.

In this context, the suggestion made by Giovanni Camillo Maffei concerning the position of the tongue is very interesting. In his Sixth Rule he says that it must be kept distended and forward “in such a way that the tip arrives at and touches the roots of the lower teeth”[23]. This position seems perfectly in line with Renaissance vocal practice (which, as we have already seen, did not contemplate any mechanism for covering the sounds) and it consistently pursues the same objective. The advice to keep one’s tongue distended until it touches the roots of the lower teeth is, in fact, also given to modern-day singers as a simple means of achieving a clearer tone, without running the risk of affecting the sound. In order to maximise the effect, the consonant ‘L’ can be added before vowels or added to all the consonants in a work. This makes the tongue touch the roots of the upper teeth and lengthens it further, resulting in the achievement of a remarkably clear brightening effect[24].

Another interesting consideration can once again be linked to a number of important recommendations made to singers by theorists. Though they are harsh reproaches, they certainly provide us with food for thought. We repeatedly encounter a firm condemnation of the habit of changing vowels, replacing dark vowels with bright ones. As an example we will look at a passage from Zarlino on this very subject, though there are numerous similar examples in contemporary theoretical literature, which all convey the same concept[25]:

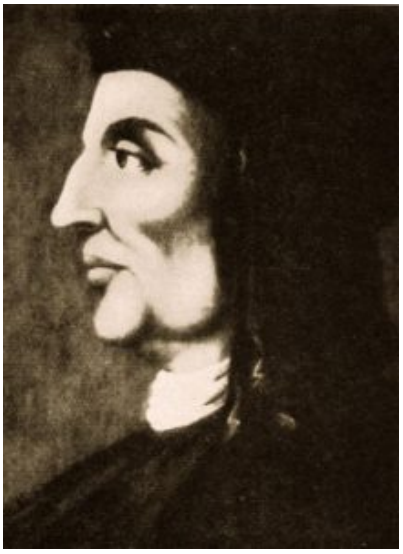
[…] But above all (so that the singer’s words can be understood) they must avoid an error that is made by many, that of changing the vowels of the words.

As would be done, for example, by pronouncing A instead of

E, I instead of O, or U instead of another. But they must pronounce them correctly

[…] At times we have heard some shriek (I cannot say sing) songs in very uncouth voices, using actions and manners that are so artificial that they truly seem like monkeys, and saying things such as *Aspra cara, e salvaggia e croda vaglia* when they should say *Aspro core, e selvaggio, e cruda voglia*: who would not laugh? Or rather, who would not be enraged upon hearing something so artificial, so ugly and so horrid?

Despite the seriousness of this bad style which Zarlino describes as “so artificial, so ugly and so horrid”, singers obstinately continued to receive such criticism rather than abandon the habit of changing dark, round vowels for the bright ones, particularly the A, the clearest of all[26]. Clearly we can conclude that it was not just a trend or widespread fashion, but must instead have been a physiological-phonatory necessity linked to the factors we have been discussing. The need to sing with a clear tone must have been so essential to singers that they were willing to be subjected to humiliating criticism; above all, this deeply-felt need led them to betray the words and meaning of the texts which they were singing (and it is widely accepted that rhetoric, dialectics and the *ars oratoria* were closely linked to the art of polyphonic music)[27].



Gioseffo Zarlino
(1517-1590)

Given the particular madrigal quoted by Zarlino as his example, one might deduce that all of this occurred exclusively in the domain of secular music, where it would be reasonable to assume that there was greater freedom of expression and behaviour. Instead, from 1471 onwards, this comforting idea is contradicted by what can be explicitly read in an interesting essay by Conrad von Zabern[28]. He claims to have heard singers sing “Dominos vabiscum, aremus”, then mockingly comments on the image of ‘ploughing the fields’[29]. In the same passage he adds that from Frankfurt to Coblenz and from there to Trier he very often heard the same thing, particularly from students. This means that the trend of misrepresenting sounds by brightening them was already well-rooted in the previous century and was not restricted to Italy.

It is also interesting to note that things have remained unchanged across the centuries. After the historical period of Romanticism, certain opera singers continued to modify vowels, darkening them considerably by covering the sounds. This was

because they felt the need to achieve a particularly marked increase in the resonance of certain harmonic sounds, which occurs around 2500 Hertz and is called a formant. This ensures the singer can be heard over the orchestra by the audience, a single voice rising over 80-120 orchestral players[30]. As we know, when pushed to its extremes, this tended to result in the text becoming incomprehensible. As before, this was once again done in the name of vocal technique.

The configuration of the Renaissance choir with respect to its sound also goes to confirm that our predecessors tended to pursue the idea of brightness in sound. If on the one hand it is true that the early choir pitched its music much lower than the present day choir, on the other hand it can be seen that the development of the timbre of the voices in the Renaissance choir proceeded smoothly from lower to higher, moving from one timbre to another to obtain an ever greater degree of brightness. From the dark tone of the *bassus* to the bright one of the *cantus*, the early choir clearly tended towards the bright timbre. The *tenor* was a male voice with the timbre of a baritone[31], above which, in this sense particularly characteristic, the voice of the *altus* continued to tend towards brightness. This was entrusted not to the dark voice of the modern contralto, but to the bright, ringing ones of the falsettists and the high voices[32]. The *cantus* line, obviously, completed the rising order of timbres, being entrusted to boys, high falsettists or castrati.

This particular advance towards brightness in timbre is, however, completely destroyed by the phonic composition of the modern choir. As we see, the presence of the dark voices of the contraltos next to the bright timbre of modern tenors represents an inevitable inversion of colours. This causes an unstable progression, passing from the dark sound of the

basses to the bright one of the tenors, returning to a dark sound with the arrival of the contraltos before becoming bright again with the sopranos. It is the rounded, enveloping timbre of the contraltos which is mainly responsible (for better and for worse) for the sound of the modern choir. This is excellent and necessary when modern music is involved, but less opportune for the Renaissance period. It is well known how the performance of a motet by an early-music formation can arouse sensations of brilliance and lucidity of timbre which are notably greater than those produced by a modern group's performance – and this is in spite of the latter being able to pitch the composition as much as a fourth higher than the early-music formation could.

As to the formation of the early choir, it might be useful to consider an aspect which could be significant, and probably has more substance than the parallel question of whether or not it is a good idea to perform early music with modern instruments. The Renaissance composer, it must be remembered, adopted certain solutions when composing, or chose certain contrapuntal figurations instead of others, because he had a clear idea of the sound of the voices of his times, and above all of the phonic effect which they would have produced in that particular situation. We know that a harmonic dissonance is much more effective the more similar the timbre of the parts by which it is produced. Starting from this assumption, for example, it would be interesting to carry out a statistical study to find out how often the Renaissance composer assigned his dissonances, suspension, and harmonic clashes to the *tenor* with the *altus*, and how often he gave them to the *tenor* and the *cantus*. In other words, we can study which of the two sections of the early choir are given the majority of the harmonic dissonances and deduce that their timbre must have been fairly similar. It would be particularly interesting to find the results in the two hypothetical

situations: logically, it should be the *tenor-altus* combination which would cover most instances of dissonance, rather than the *tenor-cantus* type, which seems to be more used in the case of modern choir pieces.

As we can see above, the particular structure of the early choir with regard to timbre determined an interesting colour assonance between the *tenor* and the *altus*. We must bear in mind that both were allotted to male voices, close to one other in terms of timbre, the latter being a development of the former into a higher range. In this way they seem completely different from the *tenor-contralto* pairing to be found in the present day choir, a pairing in which the voices belong to two timbral worlds extremely distant from each other: a dissonance between them would have no appreciable effect[33]. We can also suppose that the *altus-cantus* pairing may have produced questionable results when rendering dissonances and blending, if we were to hypothesize the juxtaposition of a castrato altus and a boy soprano, because of the powerful sound of the former compared to the latter.

We could clearly continue *ad infinitum* to analyse the many possibilities of the inter-weaving of polyphony and timbre available to the pens of early composers, but this is not our aim. Rather, as a consequence of these premises, we would prefer to hypothesise a conclusion: the use of modern voices with a timbre different from those of the Renaissance can distort the whole construction of the musical work, because it undermines the basis of its contrapuntal construction, the movement of the vocal parts, the distribution of dissonances, the entries of the different sections, in fact the entire framework of the composition. In other words, we may reasonably ask ourselves: if Giovanni Pierluigi da Palestrina had been able to use the phonic forces available to the modern

mixed voice choir, would the contrapuntal choices which he made when composing his many masterpieces have been any different? Would we then have a *Missa Papae Marcelli* very different from the one which has been handed down to us? It must be said that the answer to our question is affirmative, and we can say (jokingly) that we have run the risk of losing many masterpieces … [34].

But there are two sides to every question. To perceive the real effect that the composer was seeking using the sounds of Renaissance voices, should we use the same voices as in the sixteenth century?

Over and above the distortions mentioned and the (human) exaggerations of Renaissance singers, and leaving aside the question whether the lost voice of emasculated singers can be substituted by that of falsettists and present-day countertenors, from the strictly vocal point of view we might conclude that the distance between modern performances and the *authentic* Renaissance performance must be considerable because of certain physiological transformations which have altered vocal parameters over the five centuries separating us from the Renaissance.

It is reasonable to suppose that modern man's average height, so much greater than that of Renaissance man[35], might have had a considerable effect on vocal timbre. The vocal chords have obviously increased in length because of the increased impact of the hypophysis – and above all of the hormones regulated by it – on the bones and cartilage of the larynx which determine its size. We may consequently suppose that timbre may have darkened to a certain extent, while the average frequency of sound has become lower[36].

We have not even mentioned the voices of the *pueri.* Unlike Renaissance children, boys today are bombarded with hormones because they eat foods rich in such substances. This has a profound influence not only on bone development but also on lymphatic-metabolic development. We know that there is an ongoing process of transformation of the human voice; there seems to be an increasing masculinisation of frequency and timbre, so we may suppose that the transparent sound of the preadolescent voices of the Renaissance could at present be turning into something different. Boys´ voices today have greater body and a rather *woolly* texture, having lost the brilliant, light and *silky* consistency which characterized them even a few decades ago. Moreover, the sexual and vocal change occurs much sooner than it used to, and the period in which the preadolescent voice can be used is much shorter, meaning that all the efforts needed to train a boy's voice to its proper maturity are of little use.

We have referred in passing to the possibility of replacing the castrati with the voices of falsettists. We should not dismiss the complicated question without some thought, but we must admit that the larynx of a castrato must have been completely different from that of a falsettist, which in most cases belongs to a baritone. Because of the revolutionary hormonal changes which coincide with puberty, but which were almost completely impeded by the act of castration ,[37] the larynx of a castrato remained reduced in size, similar to that of a prepubescent child. Furthermore it remained at a shorter distance from the mouth resonator than that of a non-castrated singer (if only because of the lighter weight of the singer), giving its owner a most particular timbre, capable of literally enrapturing the audience[38]. The vocal chords, shorter and thinner than those of a man, allowed great agility not only in phrasing but also in the actual sound itself,

placing the castrati in the Olympus of music (and not only music). The plain fact was that their vocal chords were active throughout their full length and breadth, involving in the vibration the entire mucous membrane of the *conus elasticus*. With the support of notable air pressure sustained by a particularly large lung capacity determined by intense vocal-muscular training, but above all – for this very reason – propelled by considerable elasticity of the diaphragm, the voice emitted must have been full, long, penetrating, fascinating and disquieting[39].

If we now turn to reading ancient treatises on the subject, we become exhausted by the number of times that the verb *to offend* appears in reference to perception (*to offend hearing; to bring offence to the listener*). Let us resist the easy temptation to see it as a simple archaism, and try to ask ourselves if the constant repetition of this verb, so strong and so specific, may not have a justification of a purely perceptive nature. Let us consider our own ears and look inside, observing the *eardrum*, the three tiny bones – the stirrup, the anvil and the hammer, the smallest and most delicate bones in our body – which transmit the vibrations to the oval window. Then we see the precious cochlea, the organ of Corti … and we reflect on a very significant fact: our hearing organ, so important that it is the first to develop during prenatal life, is the only one of all the organs of the senses which is unable to close itself in order to protect itself from the outside world[40]. In conclusion, unlike the eye, the ear does not have lids and when there are loud sounds cannot defend itself. Now let us take another step forward, and acknowledge that the world in which we live is extremely noisy, or at least much noisier than five hundred years ago[41]. We can, therefore, imagine our very delicate eardrum constantly attempting to preserve and protect itself from so many outside noises. It can only do this by hardening its

fibres and stiffening its muscle tensors to reduce the range of the vibrations. The result: we are equipped with a less refined aural capacity than that of our ancestors. And this explains the exorbitant number of scales and tuning that existed in antiquity, whereas now we are able to appreciate and recognize only two: the major and minor scales[42]. And if we have become so inured and acquiescent to that collection of discordant sounds which make up the tempered scale, then our auditory sensibility has greatly weakened. How then can we appreciate the refinement that ancient music provides, even only from the perspective of intonation?[43] And how can we fully grasp the expressive persuasion of a *deuterus*, without limiting ourselves to saying that "it serves to set melancholy texts to music"?

This is indeed a very serious conditioning if we compare the musical situation with that of painting, as at the beginning of this article[44]. The limitation imposed by using only the seven notes of the scale, without being able to adopt any nuance of intonation, is something to which we have now become perfectly accustomed by the use of the said tempered scale; indeed, the contrary would appear strange to us. But the dramatic quality of this constriction would become immediately evident if we were to imagine a painter obliged to paint his pictures using only the seven pure colours of the rainbow without being able to mix them, thus impeding those miraculous shadings which give life to the masterpieces of painting[45]. No painter, of any historic period, would agree to submit to such a punishment. And so, while on the one hand we have Rossini who succeeded in writing his masterpieces using only the seven notes/colours (we are now entirely in the tempered period), on the other hand there are the Renaissance composers who, on the contrary, wrote all their works keeping a palette rich in the greatest variety of notes/colours in front of their eyes/ears; a palette that we have sadly lost[46].

In conclusion, it seems that the question should not be restricted to isolated subjects, such as the debate regarding the presence of women as opposed to the use of falsettists, or the search for ancient intonation as opposed to modern temperament. In the debate between ancient and modern choirs, between lost voices and sounds to rediscover, let us conclude with a last provocative reflection. Let us imagine that some cosmic radiation or extreme thermal phenomenon, or perhaps a change in the atmosphere, succeeded in altering the cells of wood, hardening its fibres and rendering it useless for the construction of musical instruments. What would we do then with all our instrumental music? Would we abandon all our orchestras, left without whole families of strings, woodwinds, and harps? Would we neglect all the trios and quartets, silencing all the pianos of the world? Would we be willing to destroy forever such a great cultural treasure? Or would we decide to reconstruct instruments with an excellent synthetic wood, easily obtained perhaps from polymers of particular alloys, and try to get used to the new sound that these would emit?

This is just what we did when we lost forever the singers of the Renaissance. And this is what we must continue to do.

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[1] Sandro Cappelletto, *La voce perduta. Vita di Farinelli, evirato cantore,* Torino, ed 1995

[2] At this point we must wait before defining the sound as

lost, and it is for this reason that the word appears in italics. It appears, however, more reasonable to speak of "trying to get as close as possible to it," rather than of a true reconstruction itself.

[3] The two techniques cannot be separated. The orchestras became larger, and the strings changed permanently from the soft velvety sound of gut strings to that of powerful metal ones. The bridge was forced to endure much greater pressure, and this forced instrument makers to strengthen the entire structure of the instrument, at the expense of the lightness of sound and the tone colour. Meanwhile, the sound of the brass also underwent substantial changes, but most importantly an increase in their use in the scores because of the improvements obtained through the adoption of cylinders and especially pistons. The same occurred with the woodwinds with the introduction of a greater number of keys. All this has not only changed the sound of instruments, as can easily be imagined; the necessity to keep the vital balance between voices and instruments did the rest.

[4] Gioseffo Zarlino, *Le Istitutioni harmoniche,* Venice, 1558, Part III, ch. 45, p. 204 (facsimile reprint New York, Broude Brothers, 1965 (Monuments of Music and Music Literature in Facsimile. Second Series: Music Literature, 1).

[5] The beginning of the techniques of the *passaggio* (or changing of register) and the *copertura dei suoni* (covering of sound) can be traced back to the 18th century, but the most evident episode appears to be the so-called chest "Do" adopted by tenor Gilbert Duprez performing the part of Arnold from Rossini's opera *William Tell*. It is not the episode itself, but rather the sensation we know this sound caused when it exploded and blazed over a world still used to the castrated singers' great heights, and to the sounds of men singing falsetto. The infamous C5 is a sound that can be safely delivered by a falsetto singer from any male of any amateur choir. In this case, it certainly does not raise the same

admiration of the people as when it is delivered in a *full voice,* and assumes the contours of an exuberant and powerful chest “Do”.

[6] Biagio Rossetti, *Libellus de rudimentis musices,* Verona, Stephen Sabio brothers and Nicolini, 1529, [4]: “The perfect voice is high, sweet, loud and clear; high that it may be sufficiently acute, clear that it fills the ears, strong that it neither trembles nor lacks, sweet that it frightens not when heard, but rather to caress the ears, and that by coaxing the minds of the listeners it may draw them to itself and comfort them. If any of these elements is missing the voice cannot in any way be perfect, as Isidoro affirms. “

Please note that in Pietro Aaron, *Toscanello in Musica* […] *nuovamente stampato con l’aggiunta da lui fatta et con diligentia corretto ,* published by Venizia, Bernardino, and Matteo de Vitali, 1529, Book I, chapter V, p.Bii, there is an almost identical passage: “The perfect voice, high, sweet, and clear: high that it be sufficiently sublime; sweet that it caresses the minds of the listeners; clear so that it fill the ears. If any of these are missing, it will not be called perfect voice. ” In truth, the authorship of the passage, as Rossetti mentions, must be attributed to Isidoro of Seville (560-636): “Perfecta autem vox est alta, suavis et clara: alta, ut in sublime sufficiat; clara, ut aures adimpleat; suavis, ut animos audientium blandiat. Si ex his aliquid defuerit, vox perfecta non est.” (See Isidoro, *Etymologiarum sive originum libri,* Book III, chapter 20). It can be seen how Aaron’s version perfectly mirrors Isidoro’s original, while Rossetti’s seems more elaborated, including the addition of the adjective *forte.*

[7] I hope my readers will understand why I have included this limited and somewhat inaccurate simplistic cataloguing of the ancient voices. It would be desirable to include a more relevant discussion given their importance, but it would

occupy considerable space in this paper, making a fair treatment of the subject not possible on this occasion.

[8] Giovanni Camillo Maffei, Delle lettere del Signor Gio. Camillo Maffei da Solofra, libri due […], Napoli, Raymundo Amato, 1562, p. 34. Maffei's suggestion to singers that they keep their mouths only half-open – which he defines categorically as a rule – may seem unusual, but almost all of the treatise writers are notoriously united in their condemnation of singing with the mouth wide open. We can therefore state that all are in agreement, Maffei directly and the others indirectly, on the appropriateness of not opening the mouth too much when singing.

[9] German physiologist and physicist who lived from 1821 to 1894, who wrote an interesting treatise on the physiology of music: Hermann von Helmholtz, Die Lehre von den Tonempfindungen als physiologische Grundlage für die Theorie der Musik, Braunschweig, Vieweg, 1863.

[10] For the sake of completeness, this is the law in full: fHz = v × s / 2 π √U×√u, where v = speed of sound; s = cross section of resonator; 2π = 6,28; U = volume of resonator, u = volume of resonator aperture. It will be noted that the constants v and 2π, and the square roots, have been omitted (and would obviously be included in a more exact calculation) and the factors 'U' and 'u' united into a single value v.

[11] There are eight air-filled spaces, known as paranasal sinuses: two frontal sinuses, two maxillary, two ethmoid and two sphenoid. They carry out two phonetic functions: heating and humidifying air, and allowing the production of high-pitched sounds. The other proposed functions, namely those of insulating the cranium and cushioning the brain, do not appear to be have been sufficiently justified.

[12] This second condition is assured by the lowering of the soft palate, which results from pushing forward/raising of the

tongue, in turn due to the fact that singers of the period kept their tongue in contact with the lower dental alveolus (cf paragraph cited in note 23).

[13] Zarlino, Le Istitutioni harmoniche, cit., part three, ch. 45, p. 204.

[14] Hermann Finck, Practica musica, Wittenberg, G. Rhau Erben 1556; facsimile copy Bologna, Forni, 1969.

[15] *Ibid.*

[16] *Ibid.*

[17] *Ibid.*

[18] Zarlino, Le Istitutioni harmoniche, cit., part three, ch. 45, p. 204.

[19] Zarlino, Le Istitutioni harmoniche, cit., part three, ch. 45, p. 204.

[20] Wolfgang Witzenmann, Otto tesi per la policoralità, in La policoralità in Italia nei secoli XVI e XVII. Testi della giornata internazionale di studi, Messina 27 dicembre 1980, edited by Giuseppe Donato, Roma, Torre d'Orfeo, 1987 (Miscellanea musicologica; 3), p. 8; see also Arnaldo Morelli, "La vista dell'apparato superbo, l'udito della musica eccellente a più cori". Spazio chiesastico e dimensione sonora, in Roma barocca. Bernini, Borromini, Pietro da Cortona, edited by Marcello Fagiolo e Paolo Portoghesi, Milano, Electa, 2006, pp. 294-301.

[21] This is a small but very important horseshoe-shaped osseous ligament, which is found on top of the larynx through the connection with the thyrohyoid membrane and joined to the inside base of the tongue.

[22] A degree of darkening could be obtained by using the retreat of the oropharyngeal wall, but the sound would be

inexorably coloured by an undesirable guttural component.

[23] Giovanni Camillo Maffei, *Delle lettere del Signor Gio. Camillo Maffei da Solofra*, p. 34.

[24] Certain procedures of a logopaedic nature, aimed at improving guttural emissions and shifting retroflected resonances forward, call for particular exercises in which the patient must follow the movements of a pencil moved by the operator with the tip of the tongue. The movements on a perpendicular plane outside the patient's lips help him to flex the tongue outwards, triggering the distant resonances of the retropharyngeal cavity (which are otherwise the cause of guttural sounds) and also those not sufficiently projected outwards.

[25] Zarlino, *Le Istitutioni harmoniche*, part three, ch.45, p. 204. Formatted according to the original, with punctuation and italics added by revisor.

[26] It is worth remembering that, when discussing madrigals used by composers to emphasise a degree of harshness expressed by a text, Vincenzo Galilei also refers, like Zarlino, to the same madrigal title: "[…] i nostri prattici Contrapuntisti […] Aspro core e selvaggio, e cruda voglia […] haveranno fatto tra le parti nel cantarlo di molte settime, quarte, seconde e seste maggiori; e cagionato con questi mezzi negli orecchi degli ascoltatori un suono rozzo, aspro e poco grato". See Vincenzo Galilei, *Dialogo […] della musica antica e della moderna*, Firenze, Giorgio Marescotti, 1581, p. 88. In Zarlino's case, however, it seems unlikely that replacing the vowels with As was used by the singers solely as a method to stress the explicit meaning of the text. Although it is perfectly plausible in this particular case, this practice, as we shall see below, was often also applied to sacred texts without any intention of colouring the words, but merely for phonic and timbral needs.

[27] A somewhat provocative question: is it not perhaps possible that the vocal practice of the Renaissance favoured clear sounds simply because traditionalists were used to this colour, obliged and restricted by use of the *librone*? Could this habit have been pushed to the point of wanting to pursue an aesthetic clarity to such an extent as to aim to replicate the style of the *castrati*, who may be considered as the absolute extreme of this tendency towards high pitches?

[28] Conrad von Zabern, De modo bene cantandi choralem cantum in multitudine personarum, Mainz, Peter Schöffer, 1474, p. 61.

[29] Ibid. "[…] ita ut audiverim aliquos cantantes: Daminus vabiscum, aremus …, ut ego dicerem ad mihi proximos: absit a nobis arare. Et revera a Francofortia usque ad Confluentiam, et ab inde usque ad Treverim cognovi hoc praecipue in scolaribus saepissime". The mocking comment about "ploughing the fields" derives from the substitution of "aremus", from the verb meaning "to plough", for the correct form of the verb "orare", meaning "to pray".,

[30] This became absolutely necessary following the increase in the mass of sound associated with the advent of the Romantic orchestra, as mentioned above.

[31] In former times the tenor held the Gregorian chant in the cantus firmus; hence the desirability to entrust it to a voice of the middle range, in such a way that it would not depart from the aesthetic and timbral-vocal canons characteristic of the Gregorian melodies.

[32] The etymology of the word is clear. It was a high-pitched voice derived from the archaic custom of counterpointing the melody of the *cantus firmus* entrusted to the *tenor* with a second, original melody: the *contratenor altus* (if placed above the *tenor*) or the *contratenor bassus* (if placed below the *tenor*). Most likely the present-day names derive from this.

[33] Let us conjecture a dissonance distributed between the tenors and altos: the former engaged in the high emission of g’ (real sound), and the latter comfortably distended on the f’ before resolving the clash by descending to e’. In this case the diversity of timbre notably weakens the impact of the dissonance. The same situation entrusted to the tenor-altus pair of the early choir would have produced a much more striking effect.

[34] On the other hand we can be absolutely sure that such geniuses of composition would have known how to create as many masterpieces if our own modern choir had been available to them.

[35] The evidence includes the length of the tombs, the heights of the doorways in 16th-century palaces, the sizes of armour, and the descriptions and testimony of contemporaries.

[36] One could hold that the increase in height may have had repercussions also on the blood pressure and hence on the heart frequency. Indeed the 60 beats a minute of the human pulse, identified in the treatises as the typical speed of the *tactus*, now seem to be over 70 beats. It would be interesting to consider whether this fact may have had an influence also on vocal timbre: for example, connecting it to a likely greater flow of blood to the vocal chords, which may plausibly have caused greater tonicity and greater thickness.

[37] The production of testosterone by the testicles is impeded, but a small part of the hormonal substance was secreted from the adrenal glands, which were obviously not removed.

[38] Of the legends that surround the castrati, some can be re-evaluated. The stupefying length of the breaths which we often hear about were only partially caused by the disequilibrium between the small vocal chords the size of a child’s and the large thoracic cage of a man (but more elastic

due to the lack of ossification of the cartilage that connects the spine to the sternum). The rest was determined by the enormous quantity of exercise and vocal training, which the castrati underwent in order to maintain the highest artistic level that was requested of them. Also, the skill in vocal acrobatics can be connected to this fact. Finally, their intense and licentious amorous life can be questioned, along with their attributed charm: the hormonal imbalance, the absence of testosterone (a hormone for the general development of the organism and metabolism of protein) and the consequent almost total elimination of inhibin from their bodies (another hormone that balances growth through its opposition to the pituitary gland) endowed the castrati with bodies somewhat disproportionate, pear-shaped (dysfunction of the pituitary), practically hairless and suffering from numerous lymphatic-hormonal problems.

[39] For this reason, their asexual voice must have been unmistakable. When one listens to the famous recording of Alessandro Moreschi's voice, a castrato singer of the Sistine Chapel, made between 1902 and 1904, setting aside the unacceptable aesthetic aberrations, we find in certain short high passages (and only in this tessitura) a substance and colour that are particularly fascinating, that cannot be judged by any existing aesthetic canons.

[40] In case of danger from the outside, the eyes can defend themselves by closing the eye lids, the tongue can protect itself by sealing the lips, the hands can close itself to a fist and the nose can stop breathing, at least for a short time. The ear cannot: it is condemned to hear incessantly. Is this why we have a field of hearing that is extremely restricted compared to that of the majority of animals? We do not have to defend ourselves from predators, we …

[41] It is only right to quote an amusing passage from Grazioso Uberti's *Contrasto musico*, which describes the sounds of the city and seems to contradict what has been written

above: “The bells are discordant, offending the ear drums of shopkeepers, making the viscera fear the squeaks of the saw; the commotion from the streets and squares is loud; the passage of carriages and wagons deafening the head.” But when he speaks of life in the country, he equally laments the lack of noise, so we understand we should not take his words seriously: “[…] one hears dogs barking there; other animal sounds; workers shouting; peasants singing; the cicadas are deafening; the owls disquieting; the crickets irritating; the frogs an annoyance.” But in addition to the laughable presence of owls, of frogs, and of crickets, that it is all just a joke is revealed when he affirms that “even the friends of solitude in the hermitages and caverns suffer the importunity of the echo.” Besides the speaker, one of the two protagonists is called Giocondo (Joyful). The other is Severo (Severe). See Grazioso Uberti, *Contrasto musico, opera dilettevole*, Rome, Lodouico Grignani, 1630, first part, pages 5-6, (facsimile reprint edited by Giancarlo Rostirolla, Lucca, Libreria Musicale Italiana Editrice, 1991 (Musurgiana; 5)).

[42] It is amazing how many different tunings were used in the past. For an example see Patrizio Barbieri, *Acustica accordatura e temperament nell’Illuminismo Veneto. Con scritti inediti di Alessandro Barca, Giordano Riccati e altri autori*, Rome, Torre d’Orfeo, 1987 (Istituto di Paelografia musciale. Serie I: Studi e testi; 5).

[43] Eastern musicians, as well as those from the Middle East, not far from us, are able to perform and appreciate the most polished variations of harmonies to the order of one or two *cents*. These delicate modifications are also applied to the ‘tonic’, which appears with different intonational angles, depending on its position in the composition.

[44] I have already made this observation, but would like to take the opportunity to raise briefly this concept. See Walter Marzilli, “Musica, pittura e cinema: interazioni,” *Lo spettacolo*, XLVII, no. 3, July – September 1997, pp. 285-299.

[45] And the painter would still have an advantage over the musician, since of the seven colours of the rainbow, some are the result of the fusion of two others, thus already well amalgamated.

[46] In this sense we would like to add a further consideration. After the tempered scale replaced the ancient scale we have the testimony of numerous criticisms of composers, accusing them of the prejudice of modernism, of audacious behaviour regarding the use of dissonance, of harshness of harmonies … Could we not attribute this also to the conflict of two incompatible factions? On the one hand, the composers, who could have adopted each new harmonic-melodic solutions allowed them by the adoption of equalized and equivalent steps of the tempered scale (modulations, transitions, dissonant harmonies, etc.); on the other hand the instruments and the instrumentalists who continued to tune the intervals according to previous scales …

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