

Ex observationibus autem secunda et quarta *Martii* habitis certo constat, cometam die tertia *Martii* circa horam sextam matutinam ad æquatorem pertigisse, eumque transivisse in ascensione recta $282^{\circ} 30'$, cum inclinatione suæ ad æquatorem semitæ $84^{\circ} 30'$ quam proximè; adeoque tum obtinuisse longitudinem $13^{\circ} 35'$ in ϖ , cum latitudine boreali $22^{\circ} 54'$. Exinde etiam colligere est, eandem semitam cometicam (quæ apparentiæ decursu a circulo maximo haud deviasse visa est) occurrisse eclipticæ quidem in ϖ et $\S 9^{\circ} 19'$ cum inclinatione 80 omnino graduum. Coluro verò æquinoctiorum in distantia $5^{\circ} 37'\frac{1}{2}$ a polis mundi versus puncta æquinoctialia, cum angulo inclinationis $77^{\circ} 33'\frac{1}{2}$: Coluro demum solstitiorum in distantia $23^{\circ} 57'\frac{1}{2}$ a polis mundi, versus puncta solstitialia cum angulo inclinationis $13^{\circ} 38'$ æquali maximæ elongationi orbitæ ab eodem coluro in parte averfa, ac distantia polorum orbitæ a punctis æquinoctialibus.

III. *Of the various Genera and Species of Music among the Ancients, with some Observations concerning their Scale; in a Letter from John Christoph. Pepusch, Music. D. & F. R. S. to Mr. Abraham de Moivre, F. R. S.*

S I R,

*Read Nov 13. 1746.
here printed with
Alterations.*

IN Compliance with your Request, I here send you some of my Thoughts on the various *Genera* and *Species* of the *Greek Music*,

fic. What they were, and how far the Doctrine of the Ancients in this respect is reconcileable with the true Nature of musical Sounds, are, you know, Questions which have not a little perplexed the Learned.

That musical Intervals are founded on certain *Ratio's* or Proportions expressible in Numbers, is an old Discovery. Nobody is better acquainted with these Proportions than yourself; and I am not a little obliged to you for the Light you have herein given me. It is well known, that all musical *Ratio's* may be analysed into the prime Numbers 2, 3, and 5; and that all Intervals may be found from the Octave, Fifth and Third *Major*; which respectively correspond to those Numbers. These are the Musicians Elements, from the various Combinations of which all the agreeable Variety of Relations of Sounds result. This System is so well founded on Experience, that we may look upon it as the Standard of Truth. Every Interval that occurs in Music is good or bad, as it approaches to, or deviates from, what it ought to be on these Principles. The Doctrine of some of the Ancients seems different. Whoever looks into the Numbers given us by *Ptolemy*, will not only find the Primes 2, 3, and 5, but 7, 11, &c. introduced. Nay he seems to think all Fourths good, provided their component Intervals may be expressed by superparticular *Ratio's*. But these are justly exploded Conceits; and it seems not improbable, that the Contradictions of different numerical Hypotheses, even in the Age of *Aristoxenus*, and their Inconsistency with Experience, might lead him to reject their Numbers altogether. It is Pity he did: Had he made a proper Use of them, we should have had a clearer Insight into

into the Music of his Times. However, what remains of the Writings of this great Musician, joined to my own Observation and Experience, has enabled me, I hope, to throw some Light upon the obscure Subject of the ancient Species of Music.

By the Manner in which *Euclid* and others find the Notes of their Scale, it must have been composed of Tones *Major*, and *Limma's*. Hence the seven Intervals of one Octave would be thus expressed in Numbers, $\frac{9}{8}$, $\frac{256}{243}$, $\frac{9}{8}$, $\frac{9}{8}$, $\frac{256}{243}$, $\frac{9}{8}$, $\frac{9}{8}$.

Some modern Authors have from this inferred the Imperfection of the *Greek Music*. They alledge we here find the *Ditonus*, or an Interval equal to two Tones *Major* expressed by $\frac{81}{64}$, instead of the true Third *Major* expressed by $\frac{4}{3}$. As there can be no Question of the Beauty and Elegance of the latter, the former therefore must be out of Tune, and out of Tune by a whole Comma, which is very shocking to the Ear. In like manner the Trihemitone of the Ancients falls short of the third *Minor* by a Comma; which is also the Deficiency of their Hemitone or *Limma*, from the true Semitone *Major*, so essential to good Melody. These Errors would make their Scale appear much out of Tune to us. This I readily grant; and add, that it appeared out of Tune to them; since they expressly tell us, that the Intervals less than the *Diateffaron* or Fourth, as also the Intervals between the Fifth and Octave were dissonant and disagreeable to the Ear. Their Scale, which has been called by some the *Scala maxima*, was not intended to form the Voice to sing accurately, but was designed to represent the System of their Modes and Tones, and to give the true Fourths and

and Fifths of every Key a Composer might choose. Now if, instead of Tones *Major* and *Limma's*, we take the Tones *Major* and *Minor*, with the Semitone *Major*, as the Moderns contend we should, we shall have a good Scale indeed, but a Scale adapted only to the concinnous Constitution of one Key ; and whenever we proceed from that into another, we find some Fourth or Fifth erroneous by a Comma. This the Ancients did not admit of. If, to diminish such Errors, we introduce a Temperature, we shall have nothing in Tune but the Octave. We see then the Scale of the Ancients was not destitute of Reason ; and that no good Argument against the Accuracy of their Practice can from thence be formed.

It was usual among the *Greeks* to consider a descending as well as an ascending Scale ; the former proceeding from acute to grave, precisely by the same Intervals as the latter did from grave to acute. The first Sound in each was the *Proslambanomenos*. The not distinguishing these two Scales has led several learned Moderns to suppose, that the *Greeks*, in some Centuries, took the *Proslambanomenos* to be the lowest Note in their System ; and, in other Centuries, to be the highest. But the Truth of the Matter is, that the *Proslambanomenos* was the lowest, or highest Note, according as they considered the ascending, or descending Scale. The Distinction of these is conducive to the Variety and Perfection of Melody ; but I never yet met with above one Piece of Music, where the Composer appeared to have any Intelligence of this kind. The Composition is about 150, or more, Years old, for four Voices ; and the Words are, *Vobis datum est noscere Mysterium regni Dei, cæteris autem*
 Author

in Parabolis; ut videntes non videant, et audientes non intelligent. By the Choice of the Words, the Author seems to allude to his having performed something not commonly understood.

I shall here give you an Octave only of the ascending and descending Scales of the diatonic *Genus* of the Ancients, with the Names for their several Sounds, as also the corresponding modern Letters.

Ascending.		Descending.	
<i>A</i>	$\frac{9}{8}$	Proslambanomenos	$\frac{8}{9}$ <i>g</i>
<i>B</i>	$\frac{256}{243}$	Hypate Hypaton	$\frac{243}{256}$ <i>f</i>
<i>C</i>	$\frac{9}{8}$	Parhypate Hypaton	$\frac{8}{9}$ <i>e</i>
<i>D</i>	$\frac{256}{243}$	Lychanos Hypaton	$\frac{243}{256}$ <i>d</i>
<i>E</i>	$\frac{9}{8}$	Hypate Meson	$\frac{8}{9}$ <i>c</i>
<i>F</i>	$\frac{256}{243}$	Parhypate Meson	$\frac{243}{256}$ <i>b</i>
<i>G</i>	$\frac{9}{8}$	Lychanos Meson	$\frac{8}{9}$ <i>a</i>
<i>a</i>	$\frac{9}{8}$	Mese	$\frac{8}{9}$ <i>G</i>

Where you see the same *Greek* Names serve for the Sounds in the ascending and descending Scales.

In the Octave here given, four Sounds, *viz.* the *Proslambanomenos*, *Hypate Hypaton*, *Hypate Meson*, and *Mese*, were called *Stabiles*, from their remaining fixed throughout all the *Genera* and *Species*.

The other four Sounds being the *Parhypate Hypaton*, *Lychanos Hypaton*, *Parhypate Meson*, and the *Lychanos*

Lychnos Meson, were called *Mobiles*, because they varied according to the different Species and Varieties of Music.

I come now to determine the Question, What these different *Genera* and *Species* were. You know, that by *Genus* and *Species* was understood a Division of the *Diateffaron*, containing four Sounds, into three Intervals. The *Greeks* constituted three *Genera*, known by the Names of *enharmonic*, *chromatic*, and *diatonic*. The *chromatic* was subdivided into three Species, and the *diatonic* into two. The three *chromatic* Species were the *Chromaticum molle*, the *Sesquialterum*, and the *Tonicum*. The two *diatonic* Species were the *Diatonicum molle*, and the *Intensum*; so that they had six Species in all. Some of these are in Use among the Moderns, but others are as yet unknown in Theory or Practice.

I now proceed to define all these Species, by determining the Intervals, of which they severally consisted; beginning by the *Diatonicum intensum*, as the most easy and familiar.

The *Diatonicum intensum* was composed of two Tones, and a Semitone: But, to speak exactly, it consists of a Semitone *Major*, a Tone *Minor*, and a Tone *Major*. This is in daily Practice; and we find it accurately defined by *Didymus*, in *Ptolemy's Harmonics* published by Dr. Wallis.

The next Species is the *Diatonicum molle*, as yet undiscovered, as far as appears to me, by any modern Author. Its component Intervals are, the Semitone *Major*, an Interval composed of two Semitones *Minor*, and the Complement of these two to the fourth,
being

being an Interval equal to a Tone *Major*, and an *enharmonic Diesis*.

The third Species is the *Chromaticum Tonieum*. Its component Intervals are, a Semitone *Major*, succeeded by another Semitone *Major*; and, lastly, the Complement of these two to the fourth, commonly called a superfluous Tone.

The fourth Species is the *Chromaticum Sesquialterum*, which is constituted by the Progression of a Semitone *Major*, a Semitone *Minor*, and a Third *Minor*. This is mentioned by *Ptolemy*, as the *Chromatic* of *Didymus*. Examples among the Moderns are frequent.

The fifth Species is the *Chromaticum molle*. Its Intervals are two subsequent Semitones *Minor*, and the Complements of these two to the fourth; that is, an Interval compounded of a Third *Minor*, and an *enharmonic Diesis*. This Species I never met with among the Moderns.

The sixth and last Species is the *enharmonic*. *Salinas* and others have determined this accurately. Its Intervals are, the Semitone *Minor*, the *enharmonica, Diesis* and the Third *Major*.

Examples of four of these Species may be found in modern Practice. But I do not know of any Theorist who ever yet determined what the *Chromaticum Tonieum* of the Ancients was: Nor have any of them perceived the Analogy between the *Chromaticum Sesquialterum* and our modern *Chromatic*. The *Enharmonic*, so much admired by the Ancients, has been little in Use among our Musicians as yet. As to the *Diatonicum intensum*, it is too obvious to be mistaken.

Aristoxenus and others often mention the Tone as divided into four Parts, and the Semitone into two; thereby making ten Divisions or *Dieses* in the fourth. And this is true, if we consider these Sounds in one Tension; that is, either ascending or descending: But, accurately speaking, when we consider all the *Dieses* or Divisions of the fourth, both ascending and descending, we shall find thirteen; five to each Tone, and three to the Semitone *Major*. But then it is to be observed, that some of these Divisions will be less than the *enharmonic Diesis*: For, if we divide the Semitone *Major* into the Semitone *Minor*, and *enharmonic Diesis*, ascending, for Instance, *E*, $\times E$, *F*, and then divide in like manner descending, *F*, $\flat F$, *E*, we shall have the Semitone *Major* divided into three Parts thus, *E*, $\flat F$, $\times E$, *F*; where the Interval between $\flat F$ and $\times E$ is less than the *enharmonic Diesis* between *E* and $\flat F$, and between $\times E$ and *F*, as is easily proved.

Now, if we suppose these small Intervals equal, by increasing the least Division, and diminishing the true *enharmonic Diesis*, we shall then have a fourth divided into thirteen equal Parts; and, consequently, the Octave divided into three such equal Parts; which gives us the celebrated Temperature of *Huygens*, the most perfect of all.

From this it appears, that the Division of the Octave into 31 Parts, was necessarily implied in the Doctrine of the Ancients. The first of the Moderns who mentioned such a Division was Don *Vincentino*, in his Book intitled *L'Antica Musica ridotta alla moderna Prattica*, printed at Rome, 1555. folio. An Instrument had been made according to his Notion; which was condemned by *Zarlino* and *Salinas*, with-

out sufficient Reason. But Mr. *Huygens*, having more accurately examined the Matter, found it to be the best Temperature that could be contrived. Tho' neither this great Mathematician, nor *Zarlino*, *Salinas*, nor even Don *Vincentino*, seem to have had a distinct Notion of all these thirty-one Intervals, nor of their Names, nor of their Necessity to the Perfection of Music.

I must observe to you, that I received, some time ago, a Manuscript from *Florence*, where a Musician of that City had rightly named these Intervals of the Octave. I found their Names, you know, many Years ago.

In *Huygens's* Temperature the Tones are all equal: But, in a true and accurate Practice of Singing, they are not so. And I must add, that the Tone divided in every Species must be the Tone *Minor*; for the Division of the Tone *Major* is harsh and inelegant. So that, in the Division of the fourth, it is to be observed, that in every Species, the Tone *Major* must either be an undivided Interval, or make Part of one.

You may perhaps wonder how the foregoing Doctrine can be found in the Writings of the Ancients, since the Distinction of Tones into *Major* and *Minor* is no where mention'd in their Writings. But it is to be observed, that though the Terms do not occur, yet the Thing itself was not unknown to them. I own, they have not expressed themselves fully; yet, from the Whole of their Writings come to our Hands, I think the Doctrine before laid down may be well supported. But, as it would require some time to put this in a just Light, I must defer it to another Opportunity.

I am, &c.

IV.