

## Concerning Such Mechanism.....

This is a transcription of pages 67 to 108 of "*A Description concerning such Mechanism as will afford a nice, or true Mensuration of Time; together with Some Account of the Attempts for the Discovery of the Longitude by the Moon; and also An Account of the Discovery of the Scale of Musick*". by John Harrison, London 1775. A special copy containing an Appendix is in the Clockmakers' Library under the Guildhall in the City of London.

This transcription, of the musical parts of this book, is not a totally faithful copy. The original uses the same letter *f*, to represent both *s*'s and *f*'s, and has many foot and margin notes. It uses a contemporary system of spelling and punctuation. Nevertheless this rendition should be considerably easier for late twentieth century readers to comprehend than a photocopy or facsimile of the original.  
C.E.H.L. 3/90.

Now, in the former part of this book, I have treated about matters pertaining to the strictness of measuring time; and have shewn the deficiencies of such means as Mr. Graham had taken or made use of for that purpose; and I have also treated of the improper, troublesome, erroneous - tedious method, which the professors at Cambridge and Oxford would have to be for the longitude at sea: And now I am about to treat of another concern, the which happened to fall in my way, and the which [at least to the Royal Society of London, for in every respect] must be well worth regarding when rightly considered [at least I think I thought to be so] as being so secret a discovery; and that is the really true scale, or basis of musick; since for which knowledge musicians might have played, or fiddled for ever, and tuned, or have had the organ turned wrong in the church for ever, and the musical part of the mathematicians might have reasoned as they have done, and wrote about it forever, and never have found upon what foundation the truth of the matter existed; and here, as in the first place, it may not be improper as in particular to remark, that Mr. Huygens was in his conjecture, a great deal wrong; and my friend Dr. Smith [Master of Trinity College, Cambridge] not knowing that I had had any thing to do in the matter, though he and I had been pretty intimately acquainted for two years, and had known each other much longer, and as Mr. Graham afterwards told me, that he (the Doctor) had then had his book, Viz. upon this subject the scale of musick under hand for longer than this time; but as finding reason to think, viz. as from or upon an accidental conference which betwixt him and me, that I was in the right, said, that he would drop his book, and that I might make the best of mine, but instead of that, did some time after, alter (viz. rather than perhaps to lose his labour) from what he has grounded his work upon, and so as to come as near to me, as he himself told me demonstration would let him, and then published it; whenas it is certain, that if he had not happened to converse with me upon the matter, he had printed his book upon his first ground or principle, and then had been demonstratively sure of its being right,

whenas it was far from being so, though not so far as Mr. Huygens's conjecture was before him; and it is certain that neither theory, demonstration, nor algebraic reasoning can have anything to do in the matter, his own proceeding being even a proof to the contrary, for had such in the case been fact, why did he alter? or rather, how could he have found room or occasion to have altered? And as still farther to remain a little wrong, notwithstanding his alteration or amendment; and as moreover to express what passed betwixt him and me, in his preface to his book, much wrong, instead of his being pleased that there was, or is indeed, a firm and true foundation of musick; but that, or all this, was not the worst jarr that happened betwixt him and me, for as I could not adhere to him in the case, he afterwards turned from being my friend in the longitude affair, to his being therein no better than an enemy, and perhaps (as already hinted in fearing that he should through me lose his labour, or that he should become of low esteem, viz. from my foundation or discovery of the scale of musick, as being indeed the only right one, and should therefore in consequence be stronger than his; [Footnote: So he seemed, as it were, determined to keep me weak, if he could] for indeed his neither is, nor can be, any better than an arbitrary conclusion, for, as touching melody, the chief matter, it will not afford a tune, when strictly put in executuion, to any right or true content; neither, as touching harmony, will the fine chords, the sharp 6ths and flat 3rds, rightly bear with his division or allotment (this is meaning after his alternation) whatever he might judge in either respect from mean or false experiments to the contrary, and his saying as near as demonstration would let him; the whole matter [as I have verified, and can at any time verify] being as otherwise established by providence, for I am very sure [and was then] from the most strict experience that can possibly be made or had, that my foundation is true, and that it is impossible [from the nature and niceness of the subject] for any thing else in the world to define the matter; nay, besides myself, it has been allowed or attested by several musical gentlemen, organists, &c. who heard the result [of, or upon what it is grounded] to be in reality perfection itself, whenas he [the doctor] was so obstinate in the matter as not to be prevailed upon -- by all the inviting, or entreating speeches that I could make, to come to hear it! viz. after I had sufficiently provided the truth of the thing! [viz. more sufficiently than what I had done from the first!] And indeed, the chief head or consequence in the scale of musick, viz. the intervals of melody, are as I may assert them truly sweet, or mathematically perfect, though never before were thought to be so, or that there was such a field in nature as wherein they could be so, but a foolish imagination sure! Since a good voice never fails, but can always, and without any difficulty, turn off a tune, or even a piece of tune, truly, viz. as without any regard to the key, as hath been foolishly advanced, and as even by Dr. Smith could not be; or indeed could it be, if the perfection of the intervals of the melody were as the musical part of the mathematicians have thought they would be best, could they be so had or admitted; as for instance, was the perfection of the 5th [as an interval of melody] to be as 3 to 2 exact, the thing [objection or supposition] would be right, but as so a good voice never yet took it, nor never will nor can, because, if it did, it would be very unpleasant, or even ugly, viz. too wide considerably, [Footnote: But then (as in supporting that the case) the out-of-tune ugliness or

unpleasantness (I am speaking as with respect to melody) would be judged, as according to the common notion of the world [and that for want of accurate experiments in the affair] to be as then, from its not being as exactly as 3 to 2, but wider.] or as more especially to be notified, the 4th to be taken by the voice, or by voices quite out of tune wide, viz. as with regard to harmony, or to the harmony of 4 to 3 [it is not bearing in that respect so much as the 5th] and whereas true melody requires it so to be, and to which the voice naturally adheres, yea if it wanted to take no more than as the interval of one single 4th [Footnote: And here it may be notified, that four 4ths and a sharp 3rd, each in the state nonsensically stilted perfect, will not make two octaves, no not by a good deal; whenas four natural 4ths, and a natural sharp 3rd, both must and will exactly do it.] and still again as with respect to harmony, [viz. as in that extreme sharp state] to what amazing fineness it is when the sharp 6th [viz. as when also in its respective properness of latitude sharp] is founded co-temporaneous with it, as I can now at any time, and in each of these respects, certify from instrumental experience, viz. to any who may be proper to hear the same, and as thence consequently produce a proof, that there cannot be in the scale of musick, or that the voice can have any thing to do with such chimerical notes or intervals, as ones major or minor as imagined of old; so the symmetry therefore as implied, of all the true intervals of melody, and must in consequence thereof be also the most rational, or graceful chords of harmony, can have nothing to do with such arbitrary conjectures as have been advanced (viz. as according to Holder's harmonical nonsense in the affair, surfeiting stuff sure! though he speaks of it with great admiration) but are to the contrary, and as I have verified from due experience, secretly grounded upon the true relation, or as strictly touching this matter, may be said amazing proportion which the diameter and radius of a circle bear respectively to the circumference: viz. as thus, as the diameter and radius of a circle bear respectively to the circumference; so do the sharp 3rd, and as here properly speaking, larger note bear respectively to the octave (no tones major and minor being in nature, as of old imagined) and from hence all the others are generated, have you as many keys, viz. by flats and sharps, as you please; [Footnote: But here it may be noted, that there can be no occasion for so many flats and sharps in an organ for the church, viz. any farther than for what key the whimsies of the organists may want to play their voluntaries, &c. in, viz. Things that need to be played there at all; Time in Divine Service, being to be otherwise employed, and that, as not only more suitably, but even as more takingly to the purpose to be done. But indeed, a more suitable construction of the organ must be highly necessary, or else, a consort of good psalm-singers must ever be disobliged by it, or not come there, or to where it is at all, since there performances as thence, could but seldom be as it were truly genuine, or naturally good; but notwithstanding as in, or as such the said performances are not as now to be heard, neither to be remembered, that, viz. the congregations, with the charity children, and in their paltry piece-meal, hodge-podge manner, can bawl or squawl away along with the organ, as if such the said children were the most proper instruments, or assistants, for, or to the purpose, and are sometimes set at such a pitch, with, or by the organ (although but one part sung) as to be even fit to split one's head (an absurdity sure) yet

still I say, to be as so thought the most proper; but it is not so thought to be the case at the play-house, viz. as with children there; but certainly, God Almighty never intended that the latter should ever excel or over-set the former.] I say. as thence in the whole, [and that as from the most strict experience, viz. as by or from the most strict apparatuses to the purpose,] are generated to a mathematical degree of sweetness, if I may so term it, as well as to be a surprising mathematical degree in proportion, as being seemingly from a thing quite foreign to the matter, yet still a wonderfully strong, and stable foundation indeed! But certainly, as the works of God are in all respects perfect, so his praise, as far as may ever be in relation to this [not meaning the play-house] must require it to be so too; [Footnote: And to such purpose as it must be, that in or from his completion of humane voices, they do not want as I have shewn to take or make use of such nonsensically perfect intervals as have been so weakly or foolishly imagined; for certainly, any one note, whether taken in any tune or lesson of musick, and that whether by the voice or upon an instrument, ought always to be at exactly the same pitch as with respect to the rest, whereas, if such weakness is intimated could take place, that would not be, nor consequently musick to any scale at all; but still, for the sake as it were of such that as that, it all along hitherto so happened, the violence, as with respect to natural harmony, was in some measure put [as thought for the better] to prey upon nature in tuning the organ, &c. And whereas or as when, what was done for the best, as with quite a contrary drift thereto, the whole being thereby for the worse affected, and that as not in a very small degree, and yet the great Mr. Handel among the rest [as not discovering the matter] had his organ and harpsichord so tuned.] but still so long as the foundation of musick lay hid in secret, unknown of to the world, as also the knowledge of such nice preparations or ways of proceeding as might or must be required, in or for its verification, i.e. so as whereby to know whether, or if ever that was, or could be deemed as likely to be the case; but I say, so long as it lay hid, the consequence was, that it did not seem to have any absolute or real foundation at all, for as in the musical part of the mathematicians, finding in computation, or in what they called theory, a defect of what they denominated a comma, and to be as a thing unavoidable in the matter, they thought that the beauty, or perfection of musick, must in some measure be as thereby lost or prevented; whereas it is through the same that it is indeed musick, and that to perfection, yea far surpassing our imagination, as from the whole of this description is manifestly to be perceived, and consequently the world to be but little obliged to philosophy here, viz. in condemning the perfection of the thing, lor the wisdom of God therein; but however they wanted to cloak that deficiency [as they thought it to be] as much as they could, as thinking that it was, or must be always in some measure, nay in great measure, so done by [or that it permitted so to be done by] or else the thing [save only as thereafter through mistake upon the violin and violincello] could not be so fine or taking as it was, viz. to be cloaked by various distributions of such and such parts of the said comma, to such and such chords of harmony, and as at the same time, without knowing what portion of which, each chord respectively, as touching the matter, would bear; nay thought indeed, that such and such a chord as with respect to harmony [not regarding, or notifying what might belong to the melody altho' the chief] would bear the most

[or the greatest share in that defect, as was thought to be the case by Dr. Robert Smith, viz. before he conversed with me] whereas the which in reality [or as on the contrary, under that supposition] will bear the least. Strange conjuring sure! As being in consequence without any suitable experience to the purpose! and yet to prevail through the ages! and as moreover, with the respective bearing of the sharp 3rd, or the result of that as with respect to melody [or as even to the destruction of melody] quite the contrary way. viz. sharp instead of flat! But indeed the most part took it from the rest for granted, as so and so be, viz. without thinking, or properly experiencing the matters at all; nay, indeed to make experiments, as thoroughly to the purpose, was quite out of the way or power of any of them [or of all the learning or knowledge heretofore in the world]; but to proceed, and though ever so far beyond the reason, I do again certify, nay avouch or affirm, and that as without any notice at all of the feigned term of a comma, that the intervals of melody [the principal matter] are from the circle &c. as here above advanced, turned off exactly true, or strictly true, or strictly perfect, i.e. as without any the least bearing, defect or infringement at all, viz. as with respect to the most true, or natural steps of any tune; whenas on the contrary, in the taking a few of them [viz. by a true constructed monochord] according to what we should think would, or ought to be perfect [I say a few of them, for all cannot be so] each sure one in itself, as with respect to melody, will then have such a bearing, or be so untrue as not to be bore withal, yea so, besides the utter destruction of all the rest; hence if the tuning of an instrument, but as most to be notified the tuning of an organ, be false or varied from the result of the circle as I have shewn [as indeed it has hitherto all along been, and that in a pretty good degree, excepting through me, as of late, that some tuners have altered] it is not at least fit for a psalm-tune or anthem; for I am very sure, in its differing there from it cannot afford a tune any more or better than a viol, &c. otherwise fretted can do, and that is as nothing to the purpose, viz. in either anthem, psalm, or song tune; but still, as without the proof, assistance or application of a perfect monochord, [Footnote: Nay, for this purpose or all true purposes, there must as in the first place be two monochords, in order as whence, by proper means or trials to prove the truth of the string, or of each string.] viz. of such a one as I have constructed, and divided upon the true foundation here shewn; or rather as the more easy, or as the most conveniently to be done, viz. as by the help of a proper set of forks tuned the most strictly to such a monochord, for by which, the said forks or each fork can be tuned to the thousandth part of a note or less; [Footnote: Nay, if a set of forks so tuned, could be properly, or duly struck, how sweetly they play a psalm-tune slowly; nay if in two, three, or four parts, nothing in the world so beat them; a monochord or monochords, as under the same or such-like circumstances, to be expected.] and I think that by a proper use of fire, viz. at a proper distance from the organ, and as hence by means of a thermometer near, or not far from the organ, that the same may be kept to the temperate heat [viz. to 55] for during such a time as may be required for tuning, by the forks [meaning the same to be of a sufficiently large size for the purpose] all the pipes included in the octave, viz. in what is called the principal; or at so long as by proper or due management of the fire [as from strictly observing the thermometer] as that some of

them, as in chief may be so truly tuned, viz. so as whence or whereby to be checks upon such proceedings as may be thought necessary, or more expedient to the purpose; [Footnote: And by the said forks [viz. of a lesser size] the harpsichord and spinet can also be so truly tuned, that some players as well as others, have said, that they never did hear the harpsichord, &c. before.] but I say, that without something in this way it must be a very difficult matter to have it right, or exactly tuned, yea though what is here above treated be the very voice of nature, it is not being to be expected, was there nothing else in the matter, but that variations, or falsenes, must arise or happen in the proceedings by 5ths, as according to Dr. Smith; but the doctor says in his book that the voice part of the anthem ought not to be played upon the organ, whereas I should think it the most material, or else it might be very immaterial to have an organ in a church, and there for a psalm-tune, which requires the greatest truth of all: but however, be it as it will, our organists generally there take care to blind imperfections with such stuff as does not at all belong to the matter; but certainly a tune ought, as in the first place, to be distinctly a tune, and consequently in a special manner, for from such nonsense is as usually played before they begin to sing, viz. as from whence but hardly to be known what tune they are to sing, and therefore it would be much better if imperfections did not want blinding, or to be blinded! But indeed the psalms in general, upon other accounts [viz. for want of better discipline than that there is, and in which defect the persons are much in fault] are no better than smothered, as will fairly appear when I publish the treatise, which I have, as more particularly, drawn up about the scale and use of musick, as therein unvieling that abuse or obscurity! [Footnote Viz. If, as according to Royal David's Declarations, as touching his deliverences, as also of them of the Israelites out of Egypt, as well as others the works of Almighty God, his Dispensations, &c. and as with praises, &c. thereupon pertaining, as in the psalms, be as still to be in remembrance or veneration, and that as by the words or lines of the psalms to be [as now in the new version] right duly handled, and as therein implying, for the most part, by the going on in succession, with proper portions or divisions of each, or any psalm in hand, viz. as when as so to be done, or as so to be permitted by the parsons, viz. from a skilful delivery of the clerk [meaning, the same as then, to be as fitly chosen for the purpose, as it was for a playhouse], i.e. if their dignity [viz. that of the priests] will so admit it; [Footnote: of footnote: I say their dignity, not thinking the clerk to take any of their business say their dignity, not thinking the clerk to take any of their business from off their hands; notwithstanding, singing men and boys in cathedrals have surplices: But as a tenor to this, Dr. Smith [upon our discoursing] said to me that they sould send us parsons, but where might we get good clerks? And indeed to have a good clerk, must to great part be a gift of providence, whenas the other is only as it were from learning] whenas if not, they ought, and as with a suitable grace [or affinity to the tune, as well as at the same time, by proper accents, &c. to enhance the nature of the psalm] to do it themselves, but perhaps they might think it to be as a thing almost repugnant to their preaching; but, no matter for that, they ought not to thing of it so, but otherwise, and that as truly becoming thereto, viz. to be, as it were, with lower thought -- but higher esteem, consequently without any the least pride in the

matter, so that as thence according to their drifts [viz. the whole sacred drift, scope, or meaning of each psalm] as from their contents, &c. as the which contents ought indeed to be, and that as to a full intellegence, at the head of each psalm, that so the same might, as at least with reason, vie with the musick, and that, as the most highly becoming such, that same part of the divine service, as therein to do, or rather as in other words, as the most highly fitting for such the highest part of the divine service, and as under the gospel's dispensation to be handled, or so as to be for the better regarded: [Footnote of footnote: Not meaning the lines of the 148th and 149th psalms; nor them of the latter end of each verse of the 136th, to be given out; neither do we sing the old 148th tune, nor old 113th, such tunes being several others as of old being very unsuitable to the purpose; neither as farther, do we use the 100th psalm tune for any psalm but the 100th, having tune enough to suit all other psalms, and their measures, as in the new version [and as not over-looking therein the 96th and 87th, but for which psalms to have fine and suitable tunes] and indeed it fitting that the 100th should have a tune to itself, and none can suit it better than its old tune, viz. as when sung eloquently or laudably, i.e. as when at a truly right or natural pitch, with good strength of voices -- in four parts rightly adapted.] no voices withal being to be played [or in anywise to found] but what the voices sing, excepting the octave below the bass: no repugnancy of thorough bass nonsense to be used in psalm singing. I speak from due experience, [Footnote of footnote: That being no other, as with respect to psalmody, and as I have seen fairly tried by a company of good singers, that as the devil's invention, for they esteemed it as no better, as being, with regard to them, a debar to any beauty in the matter.] and if at any time, any of the three or four notes, the which the voices may sometimes sing, cannot be reached or touched upon the organ, such an omission would be no fault at all, because the voices may or can, do so well without it; or if, instead of playing so many parts, they touch (at least in the tenor) all the notes which the voices sometimes, or in some places use, as in their passing from one note to another, i.e. to act or to do in that point as doing in nature, and as letting the upper parts be sung by the voices only, and as when in them, for a verse or more, as best to suit the matter, or subject matter in hand [and as to be instructed before-hand by the clerk] the treble to be wholly omitted; I say in this matter the thing would be much better, or they might do or act much better than to affect the making such a strange confused noise, so foriegn to the matter, as they always do, and therefore as in consequence of which [or of the whole I have shewn] not the subject to remain, as under disguise, a mere nothing. [Footnote of footnote : viz. as my the taking for singing [to the praise and glory of God] here and there three or four verses, in a nonsensical manner, as to be without any right drift or reason, and as so, no matter in what version because, for such a going on; Dr. Brady and Mr. Tate need not have made a new one, nor needs any parish deficient in the matter ever to choose it, but as still to their shame keep on; I say as still to their shame, for it must be certain that such proceeding can for the most part signify nothing, save only for making a noise, or sham with organ, and thence putting as it were a slur upon David, just as if a psalm, though ever so well handled, must or could be, as with respect to a sermon, nothing! But as notwithstanding such impertinency, as with respect to the royal

psalmist, it may perhaps serve [as according to the paltry meaning of such adrift] to make the parson go up somewhere more brisk or cheerful into the pulpit. &c. and as when it cannot be said, that there is, or can be now, quite so much occasion here for preaching, as when St. Paul &c. had to convert the world from such heathenism as was grown upon it, and whereas the praising of God (that everlasting gospel) is to hold to eternity, and according to St. John, they sing the song of Moses in heaven, as not being out of fashion there.] but that as on the contrary by custom, the commendable matter here imply'd to be rendered familiar, as the same, [viz. custom] has done the badness of the play-house: for a psalm when at so low a degree as to be taken or handled as a nothing; and who can say the case is now any better? Well may the play-house prevail, or even the buzzing things in the street! Wherefore I say, if such as this, or the contents of this, be to be regarded more than a play, then it is certain that the smothering, as here above signified, will by my writing be unviold: but if the case here be not reasoned aright, then David, who was a type of Christ, must be inferior to a priest; for as farther, if Christ in the main contradicted David, [viz. as touching the substance of his psalmody, as with respect to religion] they could not both be as according to that same spirit of God, which was yesterday, to-day, and must be the same forever; but as in consequence, if so, the best way would be to give religion over; but still even from philosophy, God Almighty ought to be praised, or highly praised for his works [yea, assuredly as from astronomy, stupendous works indeed]; consequently if David's motives and ways be not sufficient, so as whereby to keep up his praise, there ought as then to be others taken, but as in supposing it to be (as above) reasoned aright, then, as in consequence of which, was this the highest piece of worship, as here advanced, as with proper tunes and compositions once to be right duly performed in churches [viz. as with more proper taking, or suitable compositions, as well as to be more properly used or handled, than as hitherto common in churches, viz. as there to be performed by some proper choice of men in each parish, and that as to their pleasure without any salaries, yea more to their pleasure than running about in the fields, and as with their having a proper loft or gallery in the church - as supposing by a company of about fifty young men so situated, but that some of them may be married men, [Footnote of footnote: and for which purpose entire we had a loft erected.] and as to be right duly instructed by the clerk, as I have known, and as whence in the whole, any one of them would have almost thought himself half dead, if he could not have got hmself to the church [footnote of footnote And I am very sure that had there been an organ, and withal used in such a manner, as hitherto used in churches, it would have been impossible in any of singers, ever for that to have been the case.] and as so, together with some boys for the upper parts of such compositions] how wonderfully strange it will be! yea even to where unknown, or accustomed thereto, as if they were Barbarians to it!

The psalms not being as only properly adapted to private meditation or contemplation, were they, as now, in that way to be regarded, but as, in chief David made use of their subject drifts and that to the greatest advantage, in public singing; and who can, or dare say, that there is no occasion for any such method, or course, now to be observed or taken, as there was in the royal psalmist's days? But

that as to the contrary, the drifts of the psalms, as with respect to singing, to lie under disguise above. So now, as in the whole, ought not to be considered, whether it be not shame that these sacred things should not be more punctually handled or better regarded, than what they are as now? or whether it was not a shame that David &c. ever wrote them at all, viz. as in behalf of a public worship? as the which latter, indeed seems to be -- by the parsons, tacitly thought to be the case, or otherwise one would think that better care would have been taken about them, viz. about such divine or sacred precepts, yea even if less care was to be taken about a sermon.] But to return Dr. Smith says that the voice-part of an anthem ought not to be played upon the organ: [Footnote: Not that I greatly mind what we call an anthem; but a psalm, viz. with its tune or composition of musick properly adapted (not such composition as according to Mr. Handel's taste, of or for a psalm tune) and so to be pitch'd, as that exactly to suit the voices, and sung in three or four parts by a company of singers as above - what a noble thing it is! But it is to be notified, that a little bit too high or too low in pitch, as the 1/8th part of a larger note, will greatly disoblige the voices [viz. more than one would imagine]; I speak from the experience of twenty years, and as with proper instrumental care of pitching; and as in the same time [or long experience] I strictly found or conformed [as in the time of divine service, or as therein the best to suit] that one tune required to be pitched a little flatter or sharper than another, and as when, without experience, one would have thought that the same pitch might have done right well; nay and that any one, the same tune required to be pitch'd a little flatter in the afternoon than in the forenoon; but still it must be allowed that good voices for psalmody must have the preference before all other instruments; but then [and as here exhibited] they must require to be exactly humour'd; [Footnote of footnote: not knowing how it might be with the Hebrew musick, nor perhaps if we did, should we be therewith content.] but that is what the organ cannot do, save only as in here or there a tune, and as at now and then? a season to be expected, and as still with supposing it to be exactly in tune to itself, or that it would keep so exact there to as to what it might be set, and that they could touch or play thereon such notes, and only such notes, as the voices sing, or rather as may, to the greatest importance or enhancement by them be sung; and so as we had not an organ, neither to help us, not to hinder us, [Footnote of footnote: Viz. Not as in the main, - an organ instead of a psalm.] we had not our notes pitch'd to the fixed notes of an organ, nor of any other instrument, but as only from an instrument whole pitch might be set exactly to where it was at any time required, and the which [as from properly same divisions upon it] I noted, as from experience, to each note respectively, [Footnote of footnote: The instrument laid in its case untouch'd, save only for the time or times of its using] in order that we might not, in the least, ever be disoblige'd on that account, viz. by being at all either too flat or too sharp: and here it may be worthy remark, that an organist, who was out of place, came on purpose to hear our singing on three different Sundays, and attended the church both fore-noon and after-noon, and said [or owned] that it was impossible for a psalm [or the psalms] to be so well handled by any instrumental musick whatever, and wondered how the singers [the which consisted of plough-men, shoe-makers, carpenters, smiths, taylors, weavers, &c. and as with some boys,

singing with their voices small, for the treble or highest part, and with only two boys at full strength for the contra-part, viz. in such tunes as we used such a part] could ever be brought to such perfection; for the first time he heard them; and upon the very first note he was astonished: [Footnote of footnote: And here it may be notified, that nothing can be more handsome than for the parson to sing bass along with the singers (and not to sit gazing about him, as knowing nothing of the matter); neither will it hurt or strain his voice: as also here or there a man in the congregation who can not so well sing tenor.] Now I would instance of other gentlemen - strangers to us, besides this organist, who were also taken with our singing, but I will only here mention one, who after the evening service, was pleased to give the singers a treat and that because neither at St. Paul's, the King's Chapel Royal, nor at the play-house had he heard the like, though he had oft time frequented those places; and he also admired the decency of our singers, all standing when singing [facing the congregation] with their basses in the front, and in the next pews the tenors, &c. and the trebles up behind; yea certainly a finer, or a more graceful sight, than to see our gentry at the play-house - a sight never designed by the dispensation of providence; consequently, never [as a ceremony] for any pretended psalmody - there to be sung in Lent.]

But why does he say so? Why the reason must be, because he never found it to be rightly in tune [or to agree with what the voice and ear wanted it to be; I am not speaking here about pitch] whereas I am very sure it can be so, or may be so, viz. if consisting only of such stops as may be said to be rightly proper for the purpose, [consequently, not such stops, or musick thereon to be played, as to be even repugnant to the design or nature of psalmody] [Footnote: No such deficiency, and as hath been shewn in more respects than that, surely wanting a great a regularity, as was instrumentally wanted in the mensuration of time for the longitude.] but still needed to have it exactly so, nothing more nice in the world! [Footnote: each interval of melody requiring, if possible, to be even to a mathematical point of exactness, and the same to be from or accordingly (as I will once again affirm) to the result of the circumference, diameter, and radius of a circle, for I am very sure that no other points or stations will truly afford a tune; a most surprizing, stupendious matter indeed! Consequently such stops as call 10ths and 12ths [it tuned as they denominate perfect] can have nothing to do with psalmody, nor rightly with any thing, save only so as whereby to help the organist to make a vast great, confused noise.] And besides, as or without the foundation of the true or perfect intervals of musick, as here spoken of [and as ought certainly to be, nay must as in consequence be, the chief, or primary matter], it would have been a thing quite impossible, as with respect to consonancy, ever to have brought the respective bearings [as denominated of the chords] to such and such their most proper or respective distances or latitudes, viz. from each such ratio, as from which respectively they may be said to be generated [or, as unqualified thence to issue]; and so as whence, not only to become as in the first place, as already avouched, true intervals of melody, but also as at the same time, viz. from each, as it were their then correspondent seasonings to afford the most lofty, or the most elegant degrees of harmony; yea so I say, as touching this latter point, as well as the other, and the which as otherwise would never

have been possible ever to have been brought to a true decision! whenas, from the circumference, diameter, and radius of a circle, that matter is withal undoubtedly, nay I am very sure undeniably, decided, the chords having as thence, or from the allotment exactly as thence, [viz. no one respectively to be in the least degree either flatter or sharper than as so allotted] they have, I say, as thence, a much better relish, or a more lofty warbling, viz. in tunes or lessons of musick, but if they could be had from what is thought would be perfect, but still it is to be understood, that, to tune an organ &c, only by the harmony of the chords, viz. as without any other assistance (and although the common method hither to practised) must be quite insufficient for the matter of exactness, or as a beginning at the wrong end of the work, and that for a want of a more proper means so as thereby to set out the steps, or to gauge the matters more exactly, since as thence, by a good tuner, as without such a proper gauging, all the chords may seemingly be had or obtained to what they ought to be, and as at the same time not the true intervals of tune; the intervals of melody being in themselves much more nice or delicate than the consonances of harmony! As for instance the 5th upon an instrument, may as a single consonance, be thought to be very fine [nay, is indeed the most fine] when there set or taken exactly as 3 to 2, although voices never take it so [nor can ever take it so, that being only a foolish imagination, quite out of the course of nature], and it may be thought to be good [viz. upon a spinet, &c.] when anywhere taken betwixt that and the flat latitude, at which it is as only, or as rightly to perfection to be admitted, viz. as with regard to its mathematical point, or points of melody; and the same may be said of all the rest, i.e. as strictly touching their flat or sharp latitudes respectively, viz. from what has thought would be perfect [could such have been their admittance]; consequently, it must be the true intervals or tune, or as in other words, the true stepp'd passages among the different parts of melody [though not to be fathomed by our reason] that gives to harmony its true or fitness of relish, yea so, as well as to melody in itself, as in a single part tune or solo; Footnote: A meat pie (as here by the by) will not be good, truly sweet, or relished, without some pepper and salt: nay in a peal of five bells, i.e. where there is but one 5th, it, viz. that 5th, although seemingly under no restriction of being otherwise than what we would think to be truly perfect, yet will not be right truly sweet, unless it be no wider, but exactly according to the result of the circle as above, as I the most strictly know from experience, viz. by such means as by which, indeed it was right truly to be known; consequently, as even from thence alone, was there nothing else, a full proof is had [as was also by my apparatus, testified by others as well as by me], viz. of what wrong imaginations about the matter there has all along been, or prevailed, in the world! the true foundation of musick being unknown; but, as on the contrary, divers opinions and nonsense about it.] and as so, and that that should be the case, what ought therefore, as once again, to be said of the foundation or existance of the natural notes, or intervals of melody? and to what chief purpose must the same, as thence, be said to be? But Dr. Smith speaks of perfection being in the violin and violincello, as if upon them [at random] the inconsistency, as hath been shewn, could be so truly humoured, as whereby the chords and intervals to be rendered perfect [as according to what has foolishly been so styled], whenas, it is only their sort

of sound [or, as in part, surge] that is indeed excellent, or even very excellent, for concealing the faults of musick; a famous property indeed! And as when at the same time [as without fretts duly placed, viz. as according to the foundation from the circle as here advanced, and the farther consequence of the truth of the strings, as to be acquired there from, and to be corrected, if or when occasion] there can be no real perfection in them, no humouring to be in the case (excepting as when, in a long note, they hear it wrong, and flip their finger a little to make it better for (as above) it is certain, that [as well as by the voice] any one note whatever, when taken in any tune, ought always to be exactly at the same pitch as with respect to the rest, or else (and still as above) no scale of musick at all; and it is not possible, as pursuant to what has been said, that the fingers can stop at all the sundry places at which they are, or ought at any time, to stop, and especially so, as with regard to their playing in different keys, viz. so nearly hardly as to the 20th part of an inch, whereas to perfection much nearer, nay very much nearer than so, is or must be required, as most especially on the violin, where the strings are but short; or otherwise, and as chiefly touching any sort of psalmody, as an anthem, &c. there can be no such perfection in them as Dr. Smith seems, from these sort of instruments, without fretts, to maintain; [Footnote: For supposing a psalm-tune [viz. its tenor and bass] to be played slowly upon them, and never in the least, at anytime, to flip the finger [or any finger] from where at first stopp'd down, or pitch'd, what a bad piece of work would be made! For even without fretts, they cannot (as above) right truly set their open notes at 5ths in tune, a 5th as a single consonance, and chiefly upon them instruments, being good any where, viz. betwixt and including where it is falsely said to be perfect, and the flat latitude at which in tunes, or lessons of musick, it only be as so, can be said to be; not but that they may set them truer [viz. the open strings as 5ths] than they can always stop other notes [the hand having withal sometimes a great way to shift] but I am reasoning about perfection; and towards which (the said perfection) in tuning by the use of fretts, mathematically placed, and as a result of the circumference, diameter, &c. of a circle, and thence on course, or as a very material matter in the affair, the true or certain distance of the whole length of the strings, viz. from the nut to the foreside of the top of the bridge, to be, as by a lath or gauge, the most strictly kept or observed [Footnote: of footnote: Now that is not to be done by hawling the whole bridge at once, but as by discreetly jerking or pinching, at the bridge, string by string.] and as together with such proper dentings or small lengthenings respectively of the strings into the nut [in the first string excepted] the whole length of a thick string not being rightly concerned in sounding close up to the nut [meaning as from the thickness of the gut, viz, as without notifying when stretched, the wire upon it, as in a covered string.] but that a little bit of it, from its stiffness and lying flat in the notch, will still as were remains at rest, or not (as again) be fairly concerned in sounding; but, from the softness of the fingers, that is not the case at the fretts; I say as thus, and as together with Mr. Bentinck's screws; for indeed without such screws, such experiments on them instruments, as I am here about to speak of, could not well be tried, whenas, as only then, in the making use of the larger note, or flat third fret from the nut, the strings in the first place being

made correct [no easy matter to be done by musicians, at least at present, it being as it were quite foreign to them; but I am still talking about perfection] a touch or trial of the sharp 6th [the which, as a single consonance, must be as sharp as the ear will permit] as also of the 4th [the which must as still be sharper, or as rather with respect to consonance, out of tune wide or sharp] will greatly rectify or decide the matter. viz. about the open 5ths &c. nay, as not amiss, a touch of the fourth and first strings with the bow under the strings, will, as a sharp 6th, [compound of the octave] as sharp or wide as ever the ear will permit -- give some confirmation of the whole, nay sometimes by these, a small fault, or faults in the string, if towards or near the nut end, may when skilled in the matter, be discovered; and even hence it is withal (as farther) sufficiently proved, that what Dr. Smith asserts, as touching the scale of music is not right; [Footnote of footnote: But indeed, if a man be not able, or cannot be highly master in this concern, viz. so as to make, and prove his strings to be right, right truly in order, he cannot make this [most highly good] experiment; neither others, as belonging to the same purpose, and as also to be, in the first place, as the most highly necessary.] for, in his making [or supposing] the 5th to be wider, must as in consequence, spoil the sharp 6th, because as thence, it must become wider or sharper than what it will bear; now these are indeed very material matters, and that besides the other proofs or truths which the fretts will afford; but still as overlooking all this, [as indeed, heretofore unknown or unthought of, but that as on the contrary, being biassed and prejudiced through false or foolish conjectures, viz. as touching what was done, or might be done] these instruments, the violin and violincello [not withstanding deficiency] were, and still are said, and as without fretts, to be perfect; whenas it must be, that faults by their voices are cloked or concealed. But here it may be proper to notify, that a viol [viz. with six strings], to anyone who may have a capacity to put it in order, or can be instructed to know what must belong to that, and consequently to keep it so, or always to have, or make it so, will then afford [as in itself, and as so - the king of instruments] the greatest proof of all, of what is the real scale of musick! although an instrument now - of low esteem, nor was it worth anything at all, for during all the while - the thing it was in vogue; but I shall not here treat about its qualifications to the purpose, for that would be as here too long: But I may here notify, or certify, that an organist, who upon hearing me play some tunes upon my viol owned that it spoke to perfection itself; and whenas, without a monochord, a spinet or harpsichord can give no such proof to the matter, viz. of what is the true, or real scale of musick - as the viol in itself can do.] but even without any farther to say, it is certain that there must be greater faults embraced there, than could be put up with on the organ, harpsichord or spinet; a famous qualification indeed in them sort of instruments, as here above advanced! And as very surprizing on the other hand, what ought there to be said of the infamous, or monstrous division by the use of fretts, as now in common upon the guitars? For certainly the improvement of screw-work for the open-notes, cannot in the least do any thing towards mediating or bettering the badness of the scale, or rudeness of the division thereupon used! viz. the same which was foolishly, and for a long time, used upon the viols and lutes, [Footnote: viz. the octave into twelve equal parts; two of which to

the whole tone, and one to the half.] but that there must be, as now again, as well as were then for all the while, - infamous matters indeed, viz. for the greatly abusing of musick; for now, from the pretty voice of the guitar, viz. in its clokeing such stuff as can have nothing to do in the matter, no, far from it, and though in that point (Viz. clokeing) much better than the viol, &c. could do, yet still as with respect to musick (viz. in the condition intimated) there can but be as it were a fine sort of janglement turned off, for, was a psalm-tune or anthem to be played upon it [be such to be notified] the beauty of holiness [as according to the royal psalmist] must, in the praising of God that way, be very much defaced, true melody and harmony being - both as thence sacrificed, viz. to the absurdity from, or by which the fretts are placed; and yet to this ladies of quality must sing! But what must they sing? Why a shame on themselves and their masters! because it can play nothing else! But now to proceed, [the last piece as here above treated, viz. as about the guitar, being as it were almost a digression, and but hardly worth notice, but I say,] it ought certainly, as in a high degree, to be remarked, that Dr. Smith's endeavours, whereby to find the bearings of each chord, viz. by the number of beats respectively in any given time, and as thence to tune the organ exactly - could be nothing, but were pretty much a-kin to the finding the longitude by the moon; [Footnote: Now here it may be proper to notify, that no beatings are to be heard from my viol when truly fretted, or rightly in order, no, nor if you please from two viols, playing slowly a psalm-tune and its bass, viz. any more or no more, than as from human voices; but indeed, not so the case with an organ, neither with musical forks, but still not to be enumerated.] for, as nothing to the purpose could be had that way, so in his tuning an organ, harpsichord or spinet, and as not being on the other hand by an accurate monochord, founded upon, what he calls his own principle, neither as upon that of mine, how could he tell what was done, viz. as touching any strictness or truth in either of them? [Footnote: But a monochord to perfection, to have been produced from Cambridge education, would have been another thing [viz. something very extraordinary indeed].] But as notwithstanding, whatever university men write or do, it must be had in veneration, as was the case with Mr. Huygens's division as touching the scale of musick; [Footnote: As likewise in his cycloid, viz. as with respect to any application of such his demonstration to the pendulum of a clock, and where it (the said pendulum) must move in the medium of air, and where, consequently, the draught of the wheels of a clock must be concerned; and whenas, even without that [or else matters] it could not, for other reasons which I have given, be as there -- for any good applied.] viz. the octave into thirty-one equal parts, whereof five of which was to go to what they call the whole note, and three to what they call the half note major, where as if an organ, harpsichord, or spinet, was to be tuned exactly thereto, viz. by a monochord well executed, and truly divided or set off upon that principal, i.e. each division to be thereupon true to its place, at least to the 200th part of a 1/4th inch, as ought to be the case with a monochord, nay must to the purpose be so upon my principle [viz. to set off with great accuracy from logarithmical calculations, and as then together with such a string, as must still to the purpose be required; [Footnote: for here I must notify, or rather certify, that none of the common wire [viz. of the spinet wire &c.] will do for the

string of a monochord: No. A string for a monochord is indeed something very extraordinary, and of great moment, and that as to the world unknown before! But I shall not here treat of its properties or faculties; but however, it is very practicable to be produced, since as now, after my discovery of such secrets or faults as would pertain thereto, and as not only so, but also how to prevent the same, and render the matter perfect, it is no great difficulty to be had [but still, not that every one will do] as is verified from divers sorts of experiments by two monochords, truly perfect in other respects; the old notions of a monochord being even as nothing at all towards the matter.] or was a viol, &c. to be fretted accordingly as here signified, viz. to what Mr. Huygens thought must be the best, they would, viz. any or each of them respectively, be very confusingly out of tune, viz. more so by far than what Dr. Smith had imagined, and as farther upon his own conjectures had made, as he thought, very accurate experiments about; and, as with respect to his book, no doubt but that algebra was made a tool of, or rather (as in its having nothing to do in the matter) a fool of. viz. before he took occasion, through his conversing with me, to alter from what he thought he had ascertained, not meaning that he altered from the algebra, but only in the algebra, so as the better to suit with me; but still as to his experience or application thereof to an instrument (as already shewn) there could be no proof, either of his principle or mine, or rather, as in other words, no proof at all of what he had brought his principle to, as in comparison, or consequence of mine! And yet to publish this on such a silly, weak foundation, or insufficient, uncertain way of trying, as wherein (for ought he could prove or assure to the contrary) mine might be taken or aimed at, instead of what he calls his own! O fie! Infamous Cambridge craft indeed! Such experience as that, no being able to verify the truth of what he thought, or might think, he had brought the alteration of his book to!

[Footnote: But Dr. Smith says, that he directed Mr. Turner, an organist so as put his way of tuning in execution, and that he [viz. Mr. Turner] approved of it very much: But here, it must certainly be worthy remark, that it had never been the doctor's way, had it not been mine first.] for, from his conversing with me, be his book what it will. or whether it had been wrote at all or not, or whether he had so much as thought about it at all or not, he might, from that way to work, had done the very same! University's ingenuity! Nor can any the best player on the violin, &c. [viz. as without fretts, or any adjusting, or correction of the strings as whence to be verified] ever as whence know what is the real scale of musick; for supposing he could stop, or may stop exactly to, or in such places as to which his ear may best like it, or even, as exactly to what he ought to stop; yet I say, as thence, he can have no mathematical account of the proportions or intervals of the scale, or of what is the scale of musick he makes use of: as for instance, no one, even any the best player, could ever tell whether he played the sharp 3rd exactly to what is said would be perfect, or whether he played it, as with respect thereto, a little flat or sharp, in order that it really should be so; no, no more than what a good singer as by nature can, and that is at hence or thereby -- none at all; consequently, such a performance can have nothing to do with the application of the real scale of musick to the tuning the organ, the harpsichord, or spinet.

Now Mr. Graham never so much as offered to beset, bespatter, or besiege my proceedings, after any such rate or manner; but, as notwithstanding, Mr. Ludlam could: But now, upon my first telling Mr. Graham that the doctor and I could not chime in right about the scale of musick, and that I believed that I had lost a good friend as with respect to the longitude affair, he [viz. Mr. Graham] was very much displeas'd, and thought that, instead of the doctor using me ill [viz. as my his taking or setting the accuracy of my labour as nothing] he ought, as in an upright, ingenious man, so have been pleas'd that musick had so good a foundation, and so as to put an end to all disputes and conjectures about the matter, and Lord Macclesfield also expressed the same; however, I kept to my integrity, not minding the loss of a friend, and who I had so great an esteem for, and would very gladly have had him to have taken the matter [as in its true light] quite off my hands [viz. before he published his book, or as even from the first time we conversed about it] as thinking he had both more time and art than I, viz. so as whereby the more handsomely to communicate both it and its use to the world: but that he would not do, as pretending [viz. after he had altered his book] that demonstration would not let him, the which, as I have shewn, could be nothing; but as I was certainly in the right, and standing in my integrity I lost his friendship, and instead it was tears; [Footnote: Not that he had any skill in the matter [viz. of machinery] but did me good, nay a great deal of good, from what Mr. Graham said of it.] but this is the way of the university-men, they want to suck the virtue out of everybody's works, and then to call all their own; for through me, he [the doctor] brought his scale of musick very near to mine, or nearly to the truth, but as in the main to be taken, left a little difference, that it might be called his, and not mine -- besides this, and that a secret as this; and the which had never been discovered at all, had it not been through some transactions I had with my third machine; consequently as so, and as to be very weighty, or so highly useful a matter of discovery as it was, and as never to have been known or discovered without it, it was therefore longitude enough of it, and worth all the money and time it cost (nay, it was even withal, as some requital towards the loss or expence of the other two) viz. my curious third machine; and the which; with the other two machines, was the most scandalously sacrific'd, viz. by a novice, as at, or to his pleasure employ'd -- by the board of longitude.

Now Mr. Graham allow'd that his methods for a nice mensuration of time, were insufficient as with respect to mine; but that was far from being the case with Dr. Smith; he was a parson, and they are strange things!

And now I think, that the drawing up of this book, and as together with the drawing and other writings I shall leave [and especially them of late] as illustrating why time-keeping can indeed be so truly had, must, if their virtue can be so kindly receiv'd--- be better to the public than if I had finish'd or complet'd ten longitude time-keepers; no (Lord Morton's) chance to take place in my proceedings: For, towards a proof of which, Let it be remember'd, that I have said in this book, that if it pleas'd God to continue my life and health a little longer, that then, from my last improvement, I would bring my watch or time-keeper so as to perform to a second in

a fortnight; and now, since the drawing up of that part of the book, I have indeed put the major part, but still not the most nice part thereof, viz. of my last improvement, in execution, not venturing, upon serious thought, to attempt the whole, lest I not live to see it perfected, and I now find the watch to perform as aboveexpressed, nay even to nearer than so! but still no astonishing matter, save only to them [or such philosophers] who cannot be able to weigh its construction, or the main points of its contrivance, and as wherein hardly to be influenced, whether any oil or not: But indeed, had I continued under the hands of the rude commissioners, this completion, or great accomplishment, neither would, nor could, ever have been obtained; but however, providence otherwise ordered the matter, and I can now boldly say, that if the provision for the heat and cold could properly be in the balance itself, as it is in the pendulum, the watch [or my longitude time-keeper] would then perform to a few seconds in a year, yea, to such perfection now are imaginary impossibilities conquered; so the priests at Cambridge and Oxford, &c. may cease their pursuit in the longitude affair, and as otherwise then to occupy their time.

I will now give some account how the real scale of Musick is indeed generated from the proportion which the diameter and radius of a circle bear respectively to the circumference; but as towards which, this great, or secret discovery, it is as in the first place, to be understood, that it was after I had made several strict experiments of divers, or diverse divisions of the octave, and they as from or by such necessary, or proper preparations, or aparatusses to the purpose, as from my other business I was enabled to make: yea, I may boldly say as thence, from far more correct, or natural qualifications to the purpose, than any before me were able to make or have, (nay, and still are --- as yet the same), and that as so at last, I found to my great surprize, or admiration (viz. as from the same strictness of trial of the result of the properties of a circle, as here above specified, and as with such, the same apparatusses to the purpose) the real foundation of the matter to exist, or be, as thence, by the hand of providence established: and the which (as in brief) I shall explain as followeth.

Let the ratio of the octave, or, as even here, as well as below to the purpose, the octave itself, be represented by the logarithm of 2 (viz. .30103): and let that same number be also taken or supposed as the circumference of a circle -----  
And then, (as in the margin) ( $.30103 \times 2 = .60206 + .09582 = .69788$ ) let the space of two octaves and a sharp 3rd be taken, or be as chiefly, or rather as primarily to the purpose notified, viz. when (as according to my discovery) the said sharp 3rd is in its most strictly musical proportion, and that is as when, with respect to the octave the same is taken as the diameter of the circle (viz. here, as .09582): For the proportion which the circumference of the circle bears to the diameter (and as true enough to this purpose, as well as to others) is about as 3.1416 to 1: So, as 3.1416 is to 1, so is .30103 to .09582.

And then as five larger notes (but not with tones major and minor, as hath been imagined, and that from of old) and as together with two of the lesser notes (as all along foolishly styled half notes major) are, or must be, exactly contained in the octave: so therefore, as in

taking half the diameter for the larger note, viz. .04791, as I from strict, or proper experience, found it to be -- as an interval of melody, right truly pleasant (although, as barely in itself, as well as the lesser note, nothing to do with harmony), and that four 5ths, thence as below to be generated (viz. of each containing .17447), (margin note  $.17447 \times 4 = .69788$ ) and as when, as I am proof sure, to be then in their most strictly musical proportion, will, as according to nature, be equal to the two octaves and sharp 3rd, and at the same time, as already intimated, each one of the four 5ths will also be as without any infringement in any case (viz. as with respect to the product of nature) so generated by subtracting five times the radius from the circumference, where will be left such a quantity or space, as the two lesser notes must, with equal shares, take up; and that will be .06148, so the half of which, viz. .03074 must be the lesser note; and the lesser subtracted from greater will leave .01717, properly to be called a flat or a sharp (or the difference of the notes), and not non-sensically the half-note minor; the lesser note having withal the same authority to be called a whole note as what the other has; but they may respectively or properly be styled tone major and tone minor, viz. without meaning the fictitious nonsense as of old: and (as well understood) a 5th must contain three of the larger notes and one of the lesser (viz. as in the case or cases here .17447).

But as not withstanding, that from what is here above, are indeed the real steps or intervals of tune, or of natural melody, exactly pointed out, or are to be thence truly generated (viz. accordingly as they out, or are to be as thence truly generated (viz. accordingly as they are taken by the voice or by voices); be also the real consequence thereof, be also the real consonances, or chords of natural harmony, truly limited or described; nay as so, in both respects (viz. as touching both melody and harmony) I found to my great surprize, to be confirmed upon strict instrumental musick, as I have shewn above. But still (and as has just been intimated) that though from what is shewn above, the true steps of melody, as also the true consonances of natural harmony, are as touching them all, or each of them, exactly to be defined, yet as from thence, no ratios at all can be said to be (that of the octave to be excepted), so the said chords etc. must be denominated as they have all along been: and in the logarithm way, as here to the purpose the best way, as the ratio of any chord is to be had by subtracting the logarithm of the lesser number from that of the greater, so therefore, and as only proper, viz. as in what is here, as first above -- may differ from such ratios, so each chord, or interval, must to its properness or sweetness of relish, in tunes or lessons of musick, be said to have respectively such and such flatness or sharpness of latitude: as the 5ths to have, .00162 flat latitude, the 4th (its complement to the octave) as much sharp; the flat 3rd to have .00109 flat latitude, the flat 6th as much sharp; and here I may notify, that the thirds will bear their flat latitudes better than the 6th will bear their sharp; nay the 5th will bear its flat latitude of .00162 as well or better than the sharp 6th its sharp latitude of .00053: But to bear have I said, as touching them all! whenas, as when in that, their exactly right degrees, they are only as so rendered perfect! I speak from strictly due experience (viz. from such as no man before me could ever make, nay and are as still the same): and therefore, as each interval respectively so results from the properties of a circle, as

I have shewn, they cannot each one, or any one, as by proof from hence, be said to have a defect of any part or parts of a foolishly feigned nonsensical comma; no for this, as here otherwise shewn, is certainly the true essence of all that can be said of the matter, whatever nonsense any book, as heretofore in the world may consist of. Now whether my style of writing in this affair, be right proper to the purpose or not, I thought it must be better than that the contents of this book should be in danger of sleeping in oblivion; yea, notwithstanding what I had -- as verbally communicated to the world.

**FINIS**

Appendix to John Harrison's Later edition of *Concerning Such Mechanism....*

Reproduced here with thanks to Damian Emanuel of Kirby Muxloe for photocopying one of the rare copies in England and mailing it to me here in Hawaii ..... April 1992.

The references are listed using the original page numbers and (in bold) for the page and line numbers in section CSM transcription in this edition of *Pitch, Pi, .....*)

**APPENDIX**

Let what is here following be joined to the secondary Note on Page 82.

(CSM page 6 of 16. line 27), viz. the words with good Strength of Voices - in four Parts rightly adapted -----

And here it may be worthy Notice that (in any Psalm) as a Grace to the Matter, the Trebles and Basses, at the End, or last Note of each Line, do continue to sound a little after the Tenors and Counter-Tenors have done, but the Basses, of the two, rather the longest; and thus with the chief Matter, the Subject is, or must be as thereby, very much set off or enhanc'd, and as whence withal the Singers have Respites for their Voices; and certainly, as so in the Whole, the Matter is or becomes very taking and good, or as according to St. Paul, very rich; but the Parsons take little Care about this Sort of Richness, but for the most Part to render it Poorness; consequently as so, or as whereby to become no small Contributors towards the upholding of the Play-House; and at which Rate the Devil's-Gloss that is upon the Play-House, must excel or outweigh the Divine Stamp, that is upon the Psalms.

And let this following be joined to the Note on Page 85 (CSM page 8 of 16. line 6), viz. after the Words, if less Care was to be taken about a Sermon:-----

for even in this Point it is withal, from their Carelessness, to be observed, viz. the wrong Transmutation in some Places of the Psalms [as in some Books or Impressions without Authority] since Tate and

Brady left 'em. But here it is as farther to be notify'd that an Organist who plays in the Church, may or can also any Girl, who as they think sings fine in the Church [though even there as nothing in Comparison to what Church Singing ought to be] may also sing in the Play-House; but then ought it not be asked. Why does not the Clerk. &c. at the Church, or of the Psalmody there, go also to the Play-House? - see Bedford's Abuse of Musick: and whenas his Sentiments about the Matter are not according to what they ought to be.

Since the publication of this book, a Monthly Review (for October 1775) was presented to me, wherein I found a great deal of Rancour, yea, even to a high Degree, against me: but my Answer to the Matter shall be but short.

As first, Let the Professors, Commissioners, for the Longitude, come and shew me whatever Use there has as yet been made, or can ever be made, for any good Purpose at Sea, in the numerous Columns, the which I spoke of in their Nautical Almanac.

And secondly, as touching the Scale of Musick, As they have (in the same Review) said that it is confessed [meaning by all] that was there but only one Key to be used, all its 8 Notes, should then be tuned perfect Consonances, according to the Diatonick Scale, and as only wherein, a Tune to be play'd perfect; whenas, in what they therein think, --- that could not be: a foolish Imagination as of old, even that there was such a Scale at all, for no such Thing is in Nature to be found, but what will have Clashes in it, and they very great ones too! Whereas certainly, the real Scale of Musick, when so far exhibited, as in proper Divisions necessary, must afford a Tune, most truly sweet in itself, in any Key, in which as so they may be pleased to play it, as is the Case in my Discovery: but they have said (in the said Review) that my Scale only did, as it were accidentally fall in with Dr. Smith's was vastly wide from mine, before he had conversed with me, and altered his! Now these Expressions are vastly different \*; nor can it yet be proved, nor ever will, that Dr. Smith, as without a proper apparatus, or rather as without proper Apparatuses, could, as at his Pleasure, in tuning the Spinet or Harpsichord [I say as so exactly tune either to arbitrary Scale, or as what is build upon assuredly true Foundation: And now, if I have written wrong, as in there not being what they would call a Diatonick Scale, let them come and prove that +, and I will not only bear their Expences, but will also pay them for their Labour. Therefore, to conclude, shall write no further about such Nonsense, Spite and Poison [scandalously scurvy, dirty Work indeed] as runs throughout the Whole of their maliciously groundless Objections, as objected against Things which are really true and done! Famous Fellows indeed! The like not being elsewhere to be found; the Longitude not being to be right truly proved or completed, as long as such -- the said Fellows do reign.

\* But still they agree, as well as what is in Dr. Smith's Preface does, to the Words which passed betwixt the Doctor and me. Desperate Priestcraft sure!

+ Neither were there ever such nonsensical Things, as Chromatick and Enharmonic Scales, as being (all three) but only such imaginary Stuff as was through Ignorance blaz'd, or buzz'd about in the World, and that no good Purpose at all, but mere Confusion! There being but one true Scale of Musick, and that a very stupendously natural one indeed! Stupendous, I say, considering upon what the same is grounded, or as from whence the same to exist!

Sat. 8th July 1995

Searching for something else through a battered metal trunk from Nigeria this afternoon, I discover the following notes which I had transcribed from Dr. Robert Smith's "Harmonics" in the British Library I am posting it here for those interested in the history of tuning in eighteenth century England. (Harrison's era) (You may remember John Harrison wrote of how he felt that Smith had exploited his ideas. The mention of geometry and senses by Smith is interesting, although of course he is advocating JI logic.)

C.E.H.L.

excerpt from: Dr. Robert Smith "*Harmonics*" MDCCXLIX (1749)  
Preface pages xi - xv

He told me he took a thin ruler equal in length to the smallest string of his base viol. and divided it as a monochord, by taking the interval of the major IIIId, to that of the VIIITH, as the diameter of a circle, to its circumference.

The by the divisions on the ruler applied to that string, he adjusted the frets upon the neck of the viol. and found the harmony of the consonances so extremely fine that after a very small and gradual lengthening of the other strings at the nut, by reason of their greater stiffness he acquiesced in that manner the placing of the frets.

It follows from Mr Harrison's assumption that his IIIId major is tempered flat by a full comma. My IIIId determined by theory upon the principle of making all the concords within the extent of every three octaves as equally harmonious as possible, is tempered flat by one ninth of a comma; or almost one eighth, when no more concords are taken into the calculation that what are contained within one octave.

That theory is therefore supported on one hand by Harrison's experiment, and on the other by the common practice of musicians, who make the major IIIId either perfect, or generally sharper than perfect, with a design I suppose, to improve the false concords, though to the manifest detriment of all the rest.  
We may gather from the construction of the base viol, that Mr Harrison

attended chiefly, if not solely to the harmony of the consonances contained within the octave; in which case the difference between his and my temperaments of the Major IID, VIth and Vth and their several dependents, are respectively no greater than 4, 3 and 1 fiftieth parts of a comma. And considering that any assigned differences in temperaments of a system, will have the least affect in altering the harmony of the whole when at the best, I think a nearer agreement of that experiment with the theory could not be reasonably expected.

Upon asking him why he took the interval of the major IIIId to that of the VIIIth as the diameter to the circumference of a circle, he answered that a gentleman lately deceased had told him it would bring out the best division of a monochord whoever was the author of that hypothesis for so it must be called, he took the hint, no doubt, from observing that as the octave, consisting of five meantones and two limmas is a little bigger than six such tones, or three perfect major IIIIds, so the circumference of a circle is a little bigger than three of its diameters.

When the monochord was divided upon the principle of making the major IIIId perfect, or but very little sharper, as in Mr Huygen's system resulting from the octave divided into 31 equal intervals, Mr. Harrison told me that the major VIths were very bad and much worse than the Vths and VIths major when equally tempered should differ so in their harmony, after various attempts I satisfied my curiosity; and this gave me the first insight into the theory of imperfect consonances.

With a view to some other inquiries I will conclude with the following observation. That, as almost all sorts of substances are perpetually subject to very minute vibrating motions, and all our senses and faculties, seem chiefly to depend upon such motions excited in the proper organs, either by outward objects or the power of the will, there is reason to expect that the theory of vibrations here given will not prove useless in promoting the philosophy of other things besides musical sounds.

Such readers as can only dip into this treatise must remember, that by the word vibration so often repeated I mean the time of a single vibration, which I notified once for all in sect I art. 8 31/12/1748.

#### Section I art 8.8 Harmonics

7. If two musical strings have the same thickness, density and tension and differ in length only, (which for the future I shall always suppose) mathematicians have demonstrated that the times of their vibrations are proportional to their lengths (f).

8. Hence if a string of a musical instrument is stopt in the middle, and the sound of the half be compared to the sound of the whole, we may acquire the idea of the interval of two sounds, whole single vibrations (always meaning the times) are in the ratio of 1 to 2; and by comparing the sounds of  $2/3$ ,  $3/4$ ,  $3/5$ ,  $4/5$ ,  $5/6$ ,  $8/9$ ,  $9/10$ , etc of the string with the sound of the whole, we may acquire the

ideas of the intervals of the two sounds, whole single vibrations are in the ratio of 2 to 3, 3 to 4, 3 to 5, 4 to 5, 5 to 6, 8 to 9, 9 to 10, etc.

**Footnote:**

(f) As a clear and exact demonstration of this curious theorem depends upon one or two more of no small use in harmonics, and requires a little of the finer sort of geometry, which cannot well be applied in few words, I have therefore reserved it to the last section of this treatise.

*"Harmonics or the philosophy of musical sounds"*

by Robert Smith DD FRS  
Cambridge MDCCXLIV (1744)

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