

**Bach's solo violin sonatas in syntonic just intonation:
A historically inspired possibility**

by Sara Cubarsi-Fernandez

Dedicated to Isabel Soteras

*Special thanks to my friends and past mentors
Wolfgang von Schweinitz and Marc Sabat for their guidance*

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Bach's solo violin sonatas in syntonic just intonation – A historically inspired possibility

Abstract

Based on tuning ideals of the Renaissance and Baroque periods, this article shows that a performance in syntonic just intonation of Bach's solo violin sonatas is possible. The tuning has several unusual characteristics, namely comma modulations, a scordatura tuning with a narrowed fifth by a syntonic comma, some pythagorean sounds, and technical tricks that help realise the task of playing consistently and continuously in just intonation for the entire work, overcoming the typical issues encountered in music for fixed pitch instruments or solo choir. In order to visualise and realise this historically inspired experiment, the notation uses the Helmholtz-Ellis Just Intonation accidentals by Marc Sabat and Wolfgang von Schweinitz.

Article

Just intonation was held as the ideal way of tuning from the Renaissance until at least the middle of the 18th Century. However, in practice it presented several problems around which violinists could elegantly navigate by tempering the open strings, like keyboardists tempered their fifths. A great violinist in the 18th Century would have tempered his or her intonation when playing with other instruments and would have modified the temperament towards just intonation when possible.¹

Today, automatically tempering the open strings in early music is common practice for the historically informed violinist regardless of the repertoire. Nevertheless, music written for solo violin presents an excellent opportunity to thoroughly apply the beautiful and resonant sounds in just intonation without bumping into the typical tuning problems associated with music for fixed pitch instruments or 'a capella' choirs.² This possibility of playing a work in its entirety in just intonation not only differs from the current historically informed approach (tempering), but also from modern practice which tends towards expressive or pythagorean intonation. In this study I do not claim that there should be a historically legitimate performance practice of performing baroque solo violin repertoire in just intonation, but I introduce a new performance possibility for these sonatas that is at least legitimately 'historically inspired.'

Syntonic just intonation

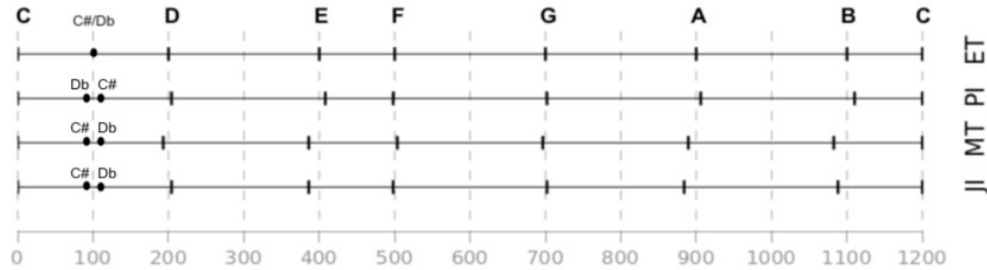
In the middle ages, the pitches of the scale were obtained through a cycle of pure fifths, a tuning system called pythagorean intonation. But later in the Renaissance with the increasing use of thirds in harmony, musicians looked for a way to fit both pure thirds and pure fifths in the same scale, a system called syntonic just intonation. In this system, some of the pitches are derived through a cycle of pure beatless fifths (with frequency ratio 3/2), as in pythagorean intonation, and others through pure major thirds (5/4).

1 B. Haynes, 'Beyond Temperament: Non-Keyboard Intonation in the 17th and 18th Centuries', *Early Music*, vol. 19, no. 3, 1991, pp. 357–81. P. Barbieri and S. Mangsen, 'Violin Intonation: A Historical Survey', *Early Music*, vol. 19, no. 1, 1991, pp. 69–88.

2 Celebrating the sounds of pure (just) intonation are, for example, Gioseffo Zarlino's *Istituzioni armoniche* (1558), Giuseppe Tartini's *Trattato di musica secondo la vera scienza dell'armonia* (1754), and Georg Philipp Telemann's *Neues musicalisches System* (1743/4).

Figure 1

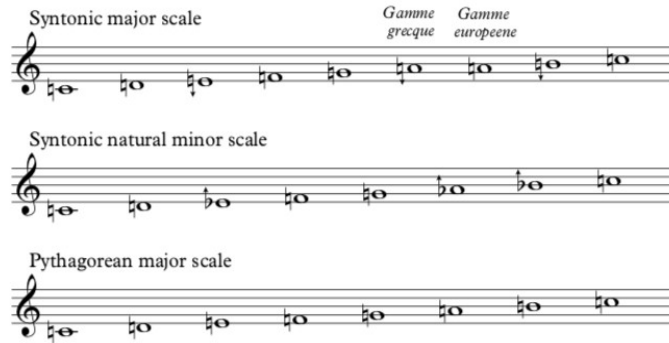
This illustration compares the finger placement of the tones and semitones in four different intonation systems: equal temperament (ET), pythagorean intonation (PI), quarter-comma meantone temperament (MT) and syntonic just intonation (JI).



The major scale in syntonic just intonation is unambiguously illustrated in Galeazzi's fingering charts in his *Elementi teorico-pratici della musica, con un saggio sopra l'arte di suonare il violino* (1791) and also documented and named the *Gamme grecque* by physicist Jacques-Alexandre Charles in *Course de physique* (1802). It contains in succession: a major whole tone (8:9), a minor whole-tone (9:10), a large semitone (15:16), a major whole-tone, a minor whole-tone, a major whole-tone and a large semitone (Figure 2). It also contains a fifth that is too narrow by a comma, here between D and A (more on this 'problematic' fifth later). Jacques-Alexandre Charles also documented the *Gamme europeene* to be in practice by violinists Giambattista Viotti and Pierre Baillot, with the sixth scale degree tuned one comma higher compared to the *Gamme grecque*. The comma-narrow fifth/fourth is in this case between the E and A. There were, therefore, two slightly different syntonic just scales in practice. The *Gamme europeene* was already a step closer to the upcoming trend towards expressive pythagorean intonation, as it has one more pitch derived through fifths than the *grecque*. Towards the end of the 18th Century this growing practice was confirmed by Anton Bemetzrieder in *Traité de musique* (1776) among others. In pythagorean intonation, the flats and sharps (derived through a cycle of pure fifths) are tuned the other way around from both syntonic intonation and meantone temperament: in pythagorean intonation a flat note is tuned lower than its enharmonically equivalent sharp. Furthermore, the whole steps in the diatonic scales are all large whole-tones (8:9). Figure 1 also highlights the compatibility and similarities between pythagorean intonation and equal temperament, and between syntonic just intonation and meantone temperament.

The notes derived through pure fifths are henceforth indicated with a 'zero' exponent in the text, or with the traditional accidentals in the musical examples. For instance, the violin strings tuned in pure fifths are written: G^0 - D^0 - A^0 - E^0 . The difference between the larger pythagorean major third (81/64) and the small pure major third (5/4) is the *syntonic* comma (81:80, or 21,5 cents). The pythagorean minor third (32/27) is one syntonic comma too small compared to the purest version of the minor third (6/5). For the open E^0 string to be a pure minor third (plus two octaves) from the open G^0 , it will need to be lowered by one syntonic comma, indicated as a 'minus one' exponent, to E^{-1} . In the musical examples, the raising or lowering by a syntonic comma will be indicated with an arrow up or down, as in the Helmholtz-Ellis Just Intonation Notation (Sabat & Schweinitz, 2000).

Figure 2. Scales with the HEJI accidentals



In syntonic intonation, the tonic, subdominant and dominant harmonies are tuned in their purest form (Figure 3). The *ii* chord on the second scale degree (D^0) can be tuned either in pythagorean intonation ($D^0-F^0-A^0$) with a comma-raised sixth scale degree (A^0) as in the *Gamme europeene*, or built on a lowered second scale degree (D^{-1}) and tuned as a pure minor triad ($D^{-1}-F^0-A^{-1}$). In the first case, the *ii* carries the function and tension of the *dominant* (the raised A^0 also pertinent to the key of the dominant), invoking the sound of a V^7 plus a major ninth ($G^0-B^{-1}-D^0-F^0-A^0$). In the second case, the *ii* performs a *subdominant* function on D^{-1} (pertinent to the key of F^0), invoking the sound of the subdominant sixth chord in third inversion $D^{-1}-F^0-A^{-1}-C^0$ (omitting the C^0).

Figure 3. Chords with the HEJI accidentals, with the two options for the *ii*.



Having said that, playing in syntonic just intonation is of course not as straight forward as applying these ‘formulas’ to any music. The three usual issues of playing in just intonation on the violin are: (1) the one-comma narrow fifth and comma modulations, (2) the difficulty of transposing the correct sizes of the intervals (e.g. major and minor whole tones) to other tonalities at performance speed, and (3) the difference between the ‘Greek’ and ‘European’ scales.

With regard to the first ‘problem,’ it is indeed unrealistic to expect a solo choir to sing precisely a comma-narrow fifth in a melody (Figure 4) and the pitch of the composition might be consequently altered substantially, as Zarlino already explained in his *Istitutioni* (Figure 5).³ A violinist does not run into this danger, as the open strings (tuned accordingly) and finger positions will help delineating the characteristic comma narrow fifth that belongs to the syntonic scales, and help maintaining the pitch of the composition unaltered. In *Violin Intonation* (1991), Patrizio Barbieri defends that the one-comma narrow fifth does not sound in a melodic line as outrageous as one might think, and as I will defend later, comma modulations (adjusting where this comma ‘error’ happens) is an expressive tool absolutely necessary for playing in syntonic just intonation. One must decide where a comma modulation best suits the musical interpretation and the tuning-specific accidentals will help preparing these decisions.

3 Gioseffo Zarlino, *Istitutioni*, Seconda parta, Cap. 45, p. 157

Figure 4. Chord progression with a narrow fifth.

$C^0-F^0-A^{-1}-D^0-G^0-C^0$

Figure 5. Undesired comma fall.

$C^0-F^0-A^{-1}-D^{-1}-G^{-1}-C^{-1}$

With reference to the second issue, I will refer again to Galeazzi (1791). He wrote that a great violinist would be able to transpose and play the correct whole tone sizes in the different tonalities when performing.⁴ Their ears were much more refined in this sense than ours, as is also proven by the insistence to perform a clear difference between the large and small semitones (for example $G^0-A^{\flat+1}$ or 15:16, and $G^0-G^{\sharp+1}$ or 128:135 respectively) as defended by Joachim Quanz (1697-1773).⁵ The solution to the key-transposition problem in just intonation is outside the limits of fixed pitch instruments, but for a trained violinist, it is a viable challenge. With the aid of tuning-specific accidentals, the goal is also in this respect more easily achieved. It must be said, however, that this refined practice was in the end only showed off by the first-class virtuoso, as there was much critique and complain about the ‘ordinary’ violinist failing to make these subtleties.⁶

Lastly, it is in fact helpful that the sixth scale degree in the major diatonic scale may be tuned flexibly between the *Gamme europeene* and the *Gamme grecque*, depending on its context and desired function. The *ii* is therefore able to function as a dominant or as a subdominant, depending on which scale degree is modified.

I have now summarised the basics for performing in syntonic just intonation which will be applied to the sonatas. Below I will explain some of the tuning choices in this version (some of them with room for interpretation depending on the performer) and how the challenges are overcome, as well as the playing techniques needed.

Pythagorean sonorities

*Good musicians know how to use the different effects of the intervals, and prove their value by the expression and variety they are able to draw from them. Jean-Philippe Rameau*⁷

As already introduced, a pythagorean sonority that recurs in these tuning representations is that of the *ii* chord (Figure 3). Diminished triads in syntonic just intonation also contain a pythagorean interval. For example, in F^0 major, the dim. *vii* will be $E^{-1}-G^0-B^{\flat 0}$, which is just an isolation of the upper three notes of the V^7 and contains a pythagorean minor third between the G^0 and $B^{\flat 0}$. Pythagorean thirds are present in my tuning representations creating a chiaroscuro contrast with the pure thirds. This level of relative dissonance becomes a harmonic force that disrupts the equilibrium of consonance and furnishes an impetus that drives any harmonic progression. Therefore, certain pythagorean sonorities are welcome in this tuning of the sonatas and will reinforce the independence of the voices, not always maximally tonally fused.

The function of a chord can be ambiguous, and one needs to make a personal decision of whether it is to be tuned as a *ii* reflecting the dominant function (Figure 6, bar 13, first beat) or the subdominant function (Figure 6, bar 11, third beat).

4 Francesco Galeazzi, *Elementi teorico-pratici della musica, con un saggio sopra l'arte di suonare il violino*, i (Rome, 1791), pp. 100-22

5 Johann Joachim Quanz, *Essai d'une méthode pour apprendre à jouer de la Flûte Traversière* (Berlin; Eng. Trans. 1966; 2/1987)

6 See Roger North on music: *Being a selection from his essays written during the years c. 1695-1728*, ed. J. Wilson (London, 1959), p. 234

7 Jean-Philippe Rameau, *Nouveau système de musique théorique* (Paris, 1726), p. 110

Figure 6. C-major Fugue excerpt.



Comma modulations

Part of the challenge and art of playing in just intonation here is finding the smoothest and most expressive modulation between passage-keys that have different tunings of a same note-name, without disturbing the melodic flow and highlighting the particular character of the new tonality reached. For example, in G^0 minor the melodic scale with a raised sixth and seventh degree contains an E^{-1} and $F\#^{-1}$, but when modulating to its dominant D^0 the E^{-1} is raised by one comma to E^0 .

At their most challenging, these comma modulations of a pitch happen sequentially in a small span of time, as momentary passing-by expressive inflections under the influence of a related key-region, as in bar 9 of the A-minor Fugue (Figure 7). Here, I have tuned the first G^{+1} in the key of E minor. However the next G is the third of an E minor triad that belongs to the *ii* of D (in its pythagorean form): a foreshadowing of the modulation to D, which is only momentary. With this in mind, comma modulations are also a means for articulating the harmonic function of a chord within a key and expressively indicating modulations.

Figure 7. A-minor Fugue excerpt.



A recurring question when working out a tuning version of these works is *when exactly* to make the comma shift. The interpreter needs to use these “microtonal modulations” as expressive material that enables the articulation of a key-character – in this case the tuner-interpreter annotates where they find these shifts most effective within the interpretative limits of modulations. Comma modulations not only change the frequency of the pitch, but also the timbre and resonance of the violin. As a performer, it can seem overwhelming to make decisions to the extent of comma deviations, but it’s only a matter of knowing in which key one is, the function of the chords, and considering these microtonal modulations an colourful tool for the performance.

The comma-scordatura

[On a harpsichord] one cannot correct [the tuning] during a concert, while on instruments with tuning pegs, the tuning is adjusted for each key in which one plays, and not in a 'one size fits all' manner. Hubert LeBlanc⁸

In the comma-scordatura the narrow fifth that occurs in the syntonic diatonic major and natural minor scales is directly placed between two strings. Its placement will change depending on the main key-regions of the music. According to Patrizio Barbieri, 'Giuseppe Tartini unequivocally states that he strictly employed the syntonic intonation, leaving the comma in the 5th D-A, "where nature had placed it [the key of C major], without thinking of dividing it".'⁹ For each sonata I have chosen a tuning of the open strings that suits the key. Without the comma-scordatura tunings, the second and third sonatas are not possible to perform strictly in syntonic just intonation. For example, all the four-note C⁰ major triads in the C-major sonata with the open E-string would not be possible without either modulating the tonic of the piece one comma up to C⁺¹ (altering the pitch of the composition) or forcing the tonic into a pythagorean triad (not at all in the syntonic fashion).

In the first sonata, there is no practical need for a one-comma scordatura tuning. Although it is in G⁰ minor, the key of D⁰ has a very strong influence throughout, and the E is therefore mostly tuned as the second scale degree of D⁰ (E⁰), or the sixth of the minor natural scale of G⁰ minor (Eb⁺¹). The comma narrow fifth often happens between notes which are not open strings. The strings are therefore tuned regularly: G⁰-D⁰-A⁰-E⁰.

In the second sonata, it is most practical to place the syntonic comma between the G and D-string in the first and second movements, and between the D and A-string in the third and fourth movements: G⁺¹-D⁰-A⁰-E⁰ and G⁺¹-D⁺¹-A⁰-E⁰. In the A-minor natural scale (A⁰-B⁰-C⁺¹-D⁰-E⁰-F⁺¹-G⁺¹) there is a narrow fifth between the subdominant D⁰ and the seventh scale degree G⁺¹, which is 'exported' into the scordatura tuning and already played out in the opening measures of the Grave with the open G⁺¹ in the bass line. This scordatura tuning best facilitates the just intonation sonorities of the first two movements. In the Andante and Allegro it is best to tune the D⁰ up to D⁺¹, a pure fifth to the G⁺¹ string. The Andante is in C⁺¹ major, the mediant of A⁰ minor, placing the narrow fifth where it falls in the syntonic diatonic major scale of C⁺¹ (as in the *Gamme grecque*). The Allegro is heavily charged by E-minor, the natural minor scale of which has a D⁺¹, so the scordatura tuning from the Andante should remain untouched there. The few instances with the fourth scale degree of A-minor in the Allegro (D⁰) need to be therefore fingered. In the third sonata the syntonic comma narrow fifth should be placed between the A and the E strings in the first, second and third movements, and between the D and A strings in the third movement: G⁰-D⁰-A⁰-E⁺¹ and G⁰-D⁰-A⁻¹-E⁻¹. Although this scordatura places the narrow fifth as in the *Gamme europeene*, the fingered bass line can still delineate the narrow fifth pertinent to the *Gamme grecque*. With both A⁰ and E⁺¹ strings available in the movements in C-major, one has both options as reference tuning points, both necessary in these movements due to the heavy presence of the keys of G⁰ and D⁰. This way, one is able to intone the E⁻¹ as in the scale of C⁰ major and use it as a double stop in the tonic chords, and tune the A⁻¹ just minor triad to the E⁻¹ string (*vi* of C⁰, and *ii* of G⁰ in its subdominant form). At the same time, one can also use the open A⁰ string as reference tuning when modulating to D⁰ and G⁰ major. In the Largo in F⁰ major, the performer should bring down the A⁰ to A⁻¹. This will allow the movement to articulate the key of the subdominant F⁰ (given the opening double-stop, presumably in first position with an open A-string), creating an overarching form across movements of C⁰-F⁰-C⁰ in the sonata. Again, when the D⁻¹ appears in F⁰ major, it should be fingered, but when it modulates to C⁰ minor or G⁰ minor it can be

8 Hubert LeBlanc, *Defense de la basse de viole* (Amsterdam, 1740), p. 55

9 Barbieri, *Violin Intonation*, pp. 70-72

sounded with the open D⁰ string. For the Allegro in C-major one should re-tune the A⁻¹ string back to A⁰. This should only take up to 5 seconds if the pegs are in good condition.

Fingering with the pinkie and at the ‘nut position’

“Of the first sort [of rules for studying the violin] the chief is the sounding all the notes under the touch, and none with the strings open; for those are an harder sound than when stopt, and not always in tune, which the stop (assisted by the ear) affects with utmost niceness; so that upon instruments so handled, all the semitones, whatever the keys are or however they change, are in tune to the most scrupulous of the ear. And besides all this, the power of the finger in giving temper and commixture to the notes, hath a superlative effect of sweetness [...] To perform this [finger-stopping] well is a sovaine skill, but seems more abstruse than really it is; for among us the old way of using the open strings hath a prepossession, and it is not easy to leave it off. But in time, beginners will take into it, and then common practise will make it familiar.” Roger North¹⁰

Two other techniques are necessary: using the fourth finger more often than is generally done and the nut-position fingering. In melodic passages an open string will often need to be avoided and fingered with the pinkie, which may seem an annoyance to the modern player (Figure 8). Interestingly, the modern practice of using open strings has been influenced by the growing historically informed performance scene. However, evidence shows that open strings were often mis-used and criticised by authors such as Roger North. Whether one can use open strings or not should depend on the key and the instrumentation of the work (especially the tuning of any fixed pitch instruments), which will at the same time influence how one chooses to tune the strings. As previously mentioned, the difference of the two whole tone sizes was expected from the great violinists of the time. In *Elementi teorico-pratici della musica, con un saggio sopra l'arte di suonare il violino*, Galeazzi shows fingering charts illustrating the placement of the narrowed fifth and the different sized whole tones in different keys, which he says might seem ridiculous to the ordinary player.¹¹ So regular fingering of open string pitches is also indispensable when attempting a performance of a piece in just syntonic intonation in order to allow the different comma shadings of an open string note.

Figure 8. Passage with 4th finger on the Es. Excerpt from the C-major Fugue.



Another characteristic and technique is the use of the nut position fingering, strongly advocated by composer Marc Sabat in his septimal tuning of the Bach solo sonatas arranged for two violins, titled *Sei Bach-Intonazioni per Violino Solo* (2010/19). That means: to finger-stop a string one-comma higher, very tightly close to the nut, a technique which I use a few times where it is necessary (Figure 9).

10 Roger North on music: Being a selection from his essays written during the years c. 1695-1728, ed. J. Wilson (London, 1959), p. 234

11 Barbieri, *Violin Intonation*, p.71. Francesco Galeazzi, *Elementi teorico-pratici della musica, con un saggio sopra l'arte di suonare il violino*, i (Rome, 1791), pp. 100-22

Figure 9. Nut position at the end of bar 55. Excerpt from the G-minor Fugue.



A last secret to the performer – a giveaway

With all this theory and technical strategies applied, the challenge of playing these sonatas in just intonation is practically achieved. In the same way that performing in mean-tone temperament also has its tricks, there are also two tricks that can be considered in order to maximize the just sonorities that would belong to a passage-key. There are instances, such as in m. 192 of the A minor Fugue (Figure 10), where a four note chord is played, in this case the desired chord is a V^7 on G^+ , but the open D^0 stays on the way. An option is to play it out as it comes, with the rattling narrow fifth, which in this case would not belong to the V^7 of C^+ . Another option would be to very lightly skip over the D-string, brushing it so lightly that it is not really clearly heard. And lastly, one could also opt by replacing the D^0 by a G^+ on the D-string. In the tuning annotations, these “problematic” notes are indicated by a bracket, and above the staff-line appears the accidental that would be desired. The performer can then make up their own mind, if they leave it, lightly skip over it, or replace it. The ‘solution’ style of playing these chords with a narrow fifth highlights the bass line and fits with the pointillist style observable in the current historical performance scene. Similarly, in (modified) meantone performance practice one avoids a sustained sound that shows the rattle between the tempered strings.

Figure 10. Excerpt from the A-minor fugue. In bar 192 one could avoid playing the D string clearly or replace it by a G^+ .



Figure 12. Skipping over a middle note (bars 45 and 49), or replacing it by another chord-note (ossia option). Excerpt from the C-major Fugue.



However rarely necessary these tricks are, and although they are indeed very elegant and can be well covered in performance, their disclosure here gives away that Bach had most likely not envisioned my

scordatura tunings for his sonatas. I can certainly not go as far as claiming so, at least. It is therefore a new performance practice for these sonatas and I can only go as far as calling it historically inspired and imagining that someone like Guiseppe Tartini could have considered it.

A harmonic trip through the Adagio from the third sonata

The third sonata opens up from the tonic C^0 to its dominant in first inversion in m.3. The Bb^0 in the bass surprises us articulating the Pythagorean seventh of the tonic, in m. 4 – the D^0 is its major ninth. The following chord makes a chromatic turn with the expressive Pythagorean Limma in the bass line Bb^0 to A^0 , the V^7 of ii , which is articulated in its Pythagorean form in m.6. Had the Bb^0 been tuned a comma higher, it would have created the very narrow tritone of $50/36$ (or $100/36$). This would also appear if the D minor triad was tuned as a just minor chord instead of Pythagorean in m. 6 between the F^{+1} and B^{-1} , therefore I chose its Pythagorean tuning for the F^0 . The D^0 in the bass becomes the root of a V^7 with a minor ninth chord and the $F\#^{-1}$ against the Eb^{+1} produce a $75/64$ which is 6 cents away from the $7/6$ septimal minor third only. The bass D^0 moves to $D\#^{-1}$, articulating the expressive syntonic chromatic semitone of 92 cents ($128:135$), which we heard in the 90 cents step as a Pythagorean Limma in m. 4-5. This measure is suggesting the key of E^0 minor, and in m. 9 it moves to its diminished triad, with the A^0 tuned as its subdominant to the A^0 string. In beat 2 of m. 10 the bass articulates the previously suggested E^0 minor, but unexpectedly a chord is built suggesting the dominant of D^0 and acting as a pivot chord to the chromatic modulation too G^0 minor, which is (almost) established in m. 11, and well established in m. 15. However, the B^{-1} quickly destabilizes the G^0 minor key, bringing the B^{-1} and A^{-1} of the past C^0 major. M. 17 is a D^0 minor Pythagorean triad with a minor seventh and major ninth (last E^0 , which becomes the ii of D^0). We have a short fifth cycle from D^0 - G^0 - C^0 - F^0 . However, where the F^0 appears and is expected in m. 22, it becomes part of the D^0 minor with a minor seventh as fully arpeggiated by Bach in beat 3. It moves down a fifth to G^0 minor with a minor seventh in its Pythagorean version again. In the last beat of m. 23 we get the same progression as in m. 4-5, to V^7 of D^0 minor (ii of C^0 in its Pythagorean form), with the open E string already taking us to C^0 major in m. 27. In the last beat of m. 27 the Bb^0 is tuned as a $9:8$ from C^0 as before, resolving to F^0 . However, this chord contains the narrowed fifth. It can be fingered in third position in this slow tempo, or it can also be sounded with the ‘skipping trick,’ placing the emphasis on the F^0 in the bass and its beautiful major seventh on the E^{-1} string. M. 30 takes us again to a D^0 major triad via the dominant, and then back to a dominant G^0 pedal from m. 31-33. Last beat of m. 33 contains the ii chord of G^0 with the A^0 tuned as the second scale degree of G^0 and the E^{-1} as its sixth scale degree, both correct in G^0 . The A^{-1} would make a $20/9$ over the G^0 string, so after testing, the $18/8$ is a better option here. The music flows in C^0 major (with an $F\#^{-1}$ infection from the dominant) until m. 40 the Ab^{+1} and D^0 diminished fourth ($45/32$) is tuned to fore-show the key of C^0 minor as its diminished ii (and implying B^{-1} , D^0 , F^0 , Ab^{+1} , the dim. vii^7 of C^0 minor), with a momentary chromatic twist to the diminished vii of G^0 , and to the diminished vii of A^0 , and establishing a temporary C^0 minor, which in m. 44 moves to the dominant function of G^0 , and the G^0 with its cadential six-four progression becomes the dominant function of C^0 major, taking us back to home key C^0 major – which moves to G^0 at the end.

After this chromatic trip, the theme of the Fugue is presented with the subject starting on the fifth scale degree, but tuned in C^0 major. In m. 4, the A^0 articulates the vi scale degree of C^0 major, and moves to E^{-1} major, with my imaginary bass-line going: A^{-1} - E^{-1} - E^{-1} - D^0 (half-notes). We have smoothly moved from A^{-1} to D^0 , a comma narrow fifth, but smoothly through E^{-1} , a $10:9$ above D^0 . The D^0 major triad is suggested in its syntonic tuning, but when the F^0 natural comes in the second half-note it becomes the Pythagorean form of ii in C^0 major. The D^0 major harmonies are tuned as a V of V . In m. 10 we get the narrow fifth that belongs to the key of G^0 major, from E^{-1} to A^0 , and right after, the E^{-1} string brings down the A^0 to A^{-1} for its minor tuning in C^0 major, and also tuned to the subdominant of G^0 .

Sonata n.3 for solo violin

Adagio-Fugue: G-D-A-E \flat

Largo: G-D-A \flat -E \flat

Allegro Assai: G-D-A-E \flat

J. S. BACH

Tuning by Sara Cubarsi

Adagio (*EGDA*)

The image displays the musical score for the Adagio section of the third sonata for solo violin by J.S. Bach. The score is written in treble clef with a 3/4 time signature. It begins with a key signature of one flat (B-flat major or D minor). The notation consists of a single melodic line with a bass line of chords. The piece is marked 'Adagio' and features a 'Fugue' structure. The score is divided into measures, with measure numbers 4, 7, 10, 13, and 16 indicated at the start of their respective lines. The music includes various rhythmic values such as eighth and sixteenth notes, as well as rests and slurs. The overall mood is slow and contemplative.

19

Musical staff 19: Treble clef, complex polyphonic texture with multiple voices and accidentals.

22

Musical staff 22: Treble clef, complex polyphonic texture with multiple voices and accidentals.

25

Musical staff 25: Treble clef, complex polyphonic texture with multiple voices and accidentals.

Musical staff fragment: Treble clef, partial staff with notes and accidentals.

28

Musical staff 28: Treble clef, complex polyphonic texture with multiple voices and accidentals.

31

Musical staff 31: Treble clef, complex polyphonic texture with multiple voices and accidentals.

34

Musical staff 34: Treble clef, complex polyphonic texture with multiple voices and accidentals.

37

Musical staff 37: Treble clef, complex polyphonic texture with multiple voices and accidentals.

40

Musical staff 40: Treble clef, complex polyphonic texture with multiple voices and accidentals.

Conclusions

This article explained the theoretical and practical basis on which a violinist can perform Bach's three solo sonatas in syntonic just intonation. The tuning is based on the syntonic major and minor scales in just intonation, and includes pythagorean sonorities (operating under the function of the dominant) that, despite the pythagorean thirds being more 'impure', are also part of the just intonation language, bringing contrast, motion, tension, and more independence of the voices. Momentary comma modulations are welcomed as an expressive tool to highlight tonal modulations, to bring out a new color and affect of a new key-region. Some of the tuning choices could slightly vary depending on the performer, leaving intonation still a relatively personal affair, namely: where exactly a comma shift might happen, which tuning to use for the *ii* chord and the sixth scale degree in major keys, and how to deal practically with chords that contain the comma narrow fifth between two open strings in one of the comma-scordaturas. In this tuning of the sonatas, I have presented my preferences.

Furthermore, the article proposes a scordatura tuning for the second and third sonatas, without which these sonatas would not be possible to perform in syntonic just intonation. This scordatura tuning places a comma-narrow fifth between two open strings, such as G^0 - D^0 - A^0 - E^{-1} in the C-major Fugue. Sometimes having to avoid open strings, with the aid of the fourth finger and the nut-position fingering the violinist is able to articulate the various different tunings of the same notes in different keys. Lastly, although the challenge of playing in just intonation seems majorly overcome, there are a few chords that show that Bach probably did not think of playing the sonatas with this scordatura tuning, and therefore strictly in syntonic just intonation. However, applying a stylistic trick, this last slope is elegantly overcome with various practical solutions, in the same way that playing in mean-tone temperament also has its tricks, making the attempt worthwhile and hopefully interesting to the historically inspired performer.

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