

# How PURE is Your Orchestra's Intonation?

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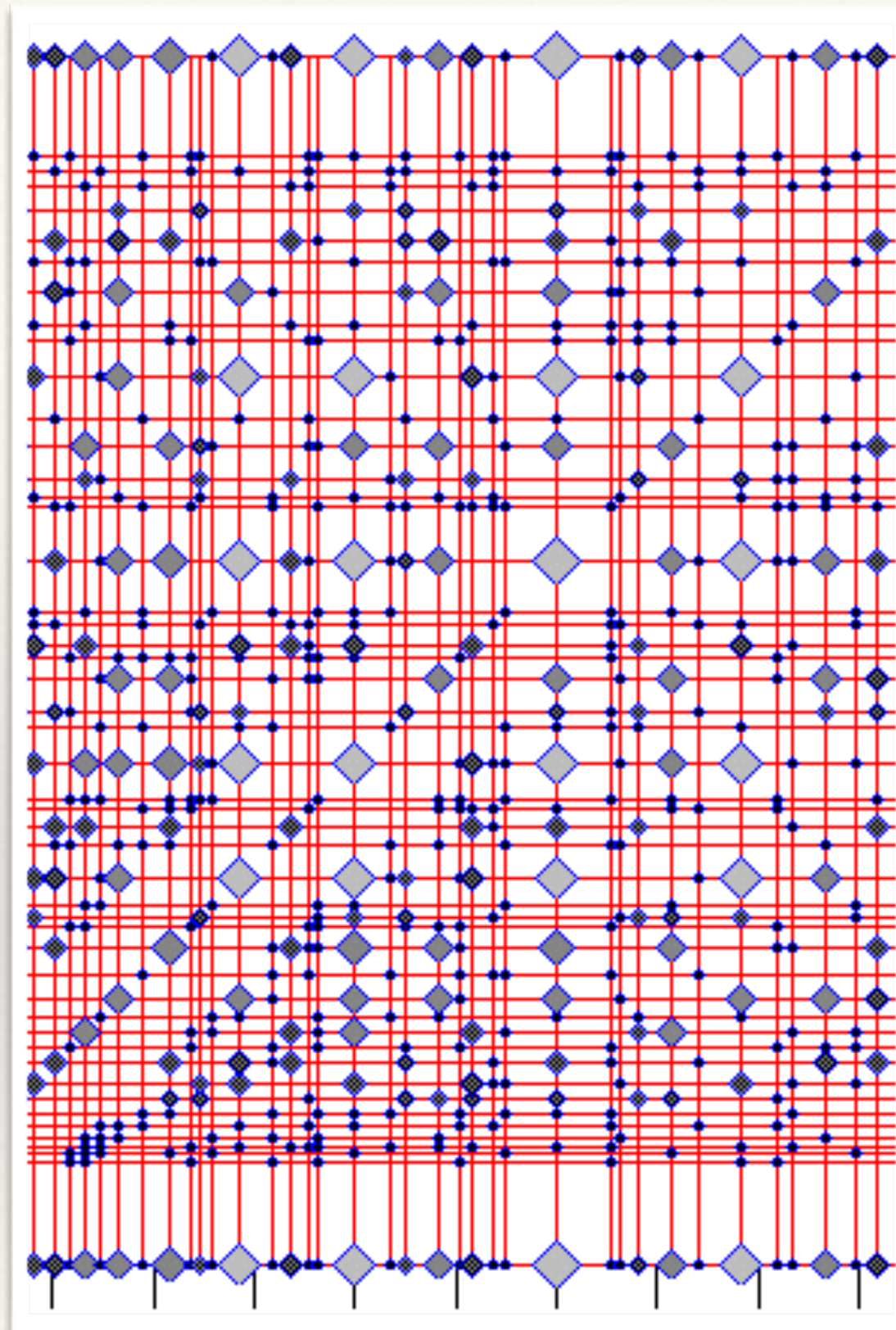
Alpharetta High School, Fulton County Schools

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# Why do ensembles play out of tune?

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- ❖ Students play out of tune because the teacher allows it!
- ❖ Students play out of tune because they don't have the aural skills to know what is correct
- ❖ Students often play out of tune because of technical deficiencies (posture, hand position)
- ❖ Students have poor tone. You can't tune a bad tone.
- ❖ **"IN-TONE-ATION"**

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# Why do we need to play in tune?

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- ❖ We want to sound good!!
- ❖ Even a **non-musician** can still discriminate an out of tune performance!
- ❖ Establish a strong value for in tune playing
  - ❖ “*A moral premise*” - Michael Alexander

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# Teaching good intonation...

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- ❖ You CAN do this!!
- ❖ Takes planning, practice, and a lot of patience
- ❖ Set your standards high and don't accept anything but the very best from your students
- ❖ The reward from your hard work is BEAUTY!

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# Prerequisites for good intonation

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- ❖ Aural training
- ❖ Good technique
  - ❖ Posture, Hand position, Embouchure, etc.
  - ❖ Bad intonation is almost always a sign of poor technique.
- ❖ Good tone
- ❖ Good equipment



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# Developing Aural Skills

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- ❖ Students should be able to audiate / internalize a pitch before they can play it in tune
- ❖ Spend some time each day working on aural skills. 5-10 minutes tops. Consider it an investment of your time!
- ❖ Singing, playing echoes, pitch matching games,

# Strategies for developing aural skills

- ❖ Match 4 note pitch patterns. Start simple, work your way to more difficult

**3.**

The image shows two staves of musical notation on a yellow background. The first staff is in 4/4 time and contains four measures. The first measure is labeled 'Teacher plays' and contains a sequence of four quarter notes: G4, A4, B4, and C5. The second measure is labeled 'Students echo' and contains the same four notes in parentheses. The third measure is labeled 'Teacher plays' and contains the same four notes. The fourth measure is labeled 'Students echo' and contains the same four notes in parentheses. The second staff also contains four measures. The first measure is labeled 'Teacher plays' and contains a sequence of four quarter notes: G4, A4, B4, and C5. The second measure is labeled 'Students echo' and contains the same four notes in parentheses. The third measure is labeled 'Teacher plays' and contains a sequence of four quarter notes: G4, A4, B4, and C5, with a fermata over the final note. The fourth measure is labeled 'Students echo' and contains the same four notes in parentheses, also with a fermata over the final note.

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# Strategies for developing aural skills

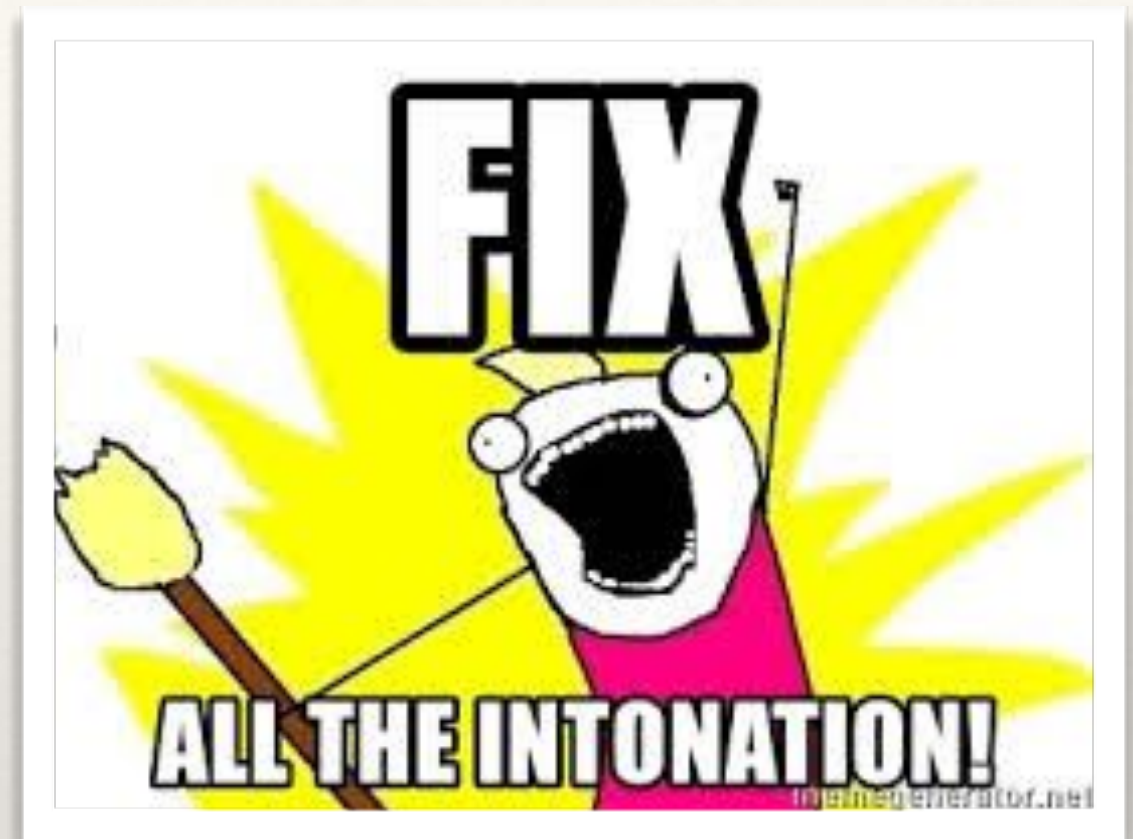
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- ❖ Match 4 note pitch patterns. Start simple, work your way to more difficult
- ❖ Play scales and other exercises with sustained drones
- ❖ Have students play major melodies from their literature by ear
- ❖ Break down pieces into chords, and have students repeat the chord progressions
- ❖ Practice with accompaniments, piano or otherwise



# Degrees of intonation

- ❖ In tune
- ❖ Very close (1-2 cents off)
- ❖ Out of tune
- ❖ Way out of tune
- ❖ Remember:
  - ❖ A little out of tune is **still** out of tune!
  - ❖ It only takes one person playing out of tune to make the entire section/ensemble sound bad!



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# “Cross Tuning” the Orchestra

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- ❖ Use after tuning individual strings
- ❖ Helps students understand P5 tuning
- ❖ Allows more time for students to tune
- ❖ Allows for *harmonic* tuning - can be more helpful for a lot of students!
- ❖ Locks in tuning across the orchestra

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# Tuning Systems

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- ❖ **Equal Temperament**

- ❖ All intervals within an octave divided equally

- ❖ **Just Tuning (or Pure tuning)**

- ❖ Based on the overtone series, uses whole number intervallic ratios (3:5, 2:1, etc.)

- ❖ **Pythagorean tuning**

- ❖ Everything based on 3:2 ratio, raised 3rds and 7ths

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# Thinking “Vertically”

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- ❖ Must instill a “vertical” mindset in students.
  - ❖ Rhythmic alignment
  - ❖ Harmonic alignment
- ❖ “Horizontal” intonation comes more naturally to students

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# Tuning Systems - When to use?

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- ❖ **Equal Temperament**
  - ❖ When playing sustained notes / melodies with a piano / keyboard
- ❖ **Just Tuning (or Pure tuning)**
  - ❖ When tuning chords
- ❖ **Pythagorean tuning**
  - ❖ When playing single line melodies, scales, and arpeggios. Used most of the time.



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# Equal Temperament

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- ❖ Equal Temperament (ET) *approximates* just intervals by dividing an octave (or other interval) into equal steps.
- ❖ ET is a sacrifice to allow keyboard instruments to be more versatile
- ❖ Our ears have become desensitized due to training with ET
- ❖ ET dominates and is heard in almost all popular music

# Just Tuning vs. Equal Temperament

Just tuning uses whole number interval ratios that are relative to the overtone series, as nature intended.

ET does not!

Interval	Ratio to Fundamental Just Scale	Ratio to Fundamental Equal Temperament
P1	1.0	1.0
m2	$25/24 = 1.0417$	1.05946
M2	$9/8 = 1.1250$	1.12246
m3	$6/5 = 1.2000$	1.18921
M3	$5/4 = 1.2500$	1.25992
P4	$4/3 = 1.3333$	1.33483
d5	$45/32 = 1.4063$	1.41421
P5	$3/2 = 1.5000$	1.49831
m6	$8/5 = 1.6000$	1.58740
M6	$5/3 = 1.6667$	1.68179
m7	$9/5 = 1.8000$	1.78180
M7	$15/8 = 1.8750$	1.88775
P8	2.0	2.0

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# Adjustments from ET to Pure Intonation

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## MAJOR KEYS:

Scale Degree	1	2	3	4	5	6	7	8
Adjustment	0	+3.9	-13.7	-2.0	+2.0	-15.6	-11.7	0

## MINOR KEYS:

Scale Degree	1	2	3	4	5	6	7	8
Adjustment	0	+3.9	+15.6	-2.0	+2.0	+13.7	+17.6	0



Was that supposed to be Ab or G#?  
Geez, make up your mind, Dad.



## Semitone practice in the Mozart household



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# Cautions on using visual tuners...

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- ❖ Students become visually tethered to a tuner and don't learn how to use their ears
- ❖ Tuners don't adjust to different tuning systems and only tune using Equal Temperament
- ❖ Tuners can be a fabulous teaching tool to develop an aural image
- ❖ Tuners also help student to physically manipulate pitch with fine tuners and / or pegs



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# Introducing the Yamaha Harmony Director

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- ❖ **Yamaha HD-200 Harmony Director**
- ❖ Will play in Equal Temperament and Just Intonation
- ❖ Manual or Auto modes when in Just Intonation
- ❖ A unique tool and very practical
- ❖ Extremely customizable!
- ❖ Helps train the ears, not the eyes!



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# About the Harmony Director

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- ❖ Harmony training, rhythm training and ensemble timing together in one device.
- ❖ Enables clear demonstration of pure temperaments
- ❖ Emulates real instruments (with necessary overtones)
- ❖ Students hear individual notes within chords, so that entire chords may be tuned.
- ❖ Allows manipulation of pitch and volume parameters of each note



# Demonstration of the Yamaha HD-200 Harmony Director



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# Voice Section

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- ❖ 10 Sounds: Flute, oboe, clarinet, sax, organ, trumpet, horn brass, strings
- ❖ Sounds can be “shaped” with setting for attack, release, and brilliance.
- ❖ Sounds can be sustained with a pedal or the “hold” button
- ❖ Octaves can be adjusted to increase or decrease the range

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# Harmony Section

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- ❖ Voices can be transposed with a click of a button.
- ❖ WONDERFUL when working with full orchestra (unless you a master of transposing on the fly)
- ❖ Hit a button and you are playing in transposed B-flat, E-flat, or F!



# Transposition & Pitch/Volume Adjustments



If you change the transpose setting, you can play the music of transposing instruments just by changing the key of the device.

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# Effect of Timbre on Tuning

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- ❖ Does timbre (tone color) impact the ability to tune accurately?
- ❖ Experiment with different timbres in your classroom
- ❖ Greer (1969) found that brass players tuned more accurately with like-timbre instruments. He found that timbres that lacked overtones (like an oscillator) posed problems with accurate tuning

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# A Balanced Major Chord

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(opinions may vary)

- ❖ In addition to tuning, **balance** is important!
- ❖ 50% - tonic
  - ❖ (35% - lower tonic, 15% - higher tonic)
- ❖ 15% - 3rd (color chord)
- ❖ 35% - 5th

# Intonation concepts to be taught:

Diatonic Intervals

Chromatic Intervals

Open Fifths

Basic Harmony



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# Teaching Intervals

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- ❖ Teach by ear, and if time, on the page
- ❖ “Interval of the week” idea
- ❖ Ask students to identify intervals within their music
  - ❖ Especially helpful with notes in higher positions
- ❖ When students begin thinking of their parts as intervals, it helps with intonation, fingering choices, etc.



# Demonstrating Harmony Basics

The image shows a handwritten musical staff with five lines. On the right side, a treble clef is written, with a '7th' written next to it. The notes on the staff are: C (first line), A (second line), F# (third space), D (fourth space), and G (fifth line). A bracket on the left side of the staff groups the notes D, B, and G. Below the staff, the Roman numerals I, IV, and V are written, with a '7' superscripted to the V. Below these numerals are the labels 'Tonic', 'Sub-Dominant', and 'Dominant'.

GM:	D	5 <sup>th</sup>	G	A
	B	3 <sup>rd</sup>	F#	F#
	G	Root	C	D
	I		IV	V <sup>7</sup>
	Tonic		Sub-Dominant	Dominant

# Completing a chord

Elgar: *Serenade for Strings*,  
I. *Moderato*

Have cello/bass  
students play E to  
aid tuning the 3rd  
and 5th.

**Moderato**

The image shows a musical score for the first movement of Elgar's Serenade for Strings. The score is in 3/4 time and the key signature has three sharps (F#, C#, G#). The tempo is marked 'Moderato'. The score is written for a string quartet, with the first two staves being the Violin I and Violin II parts, and the last two staves being the Viola and Cello/Bass parts. The Cello/Bass part is marked 'pp' (pianissimo) and 'div.' (divisi). The score shows a double bar line and a fermata over the first measure of the Cello/Bass part, indicating a moment where the instrument should play a sustained note to aid in tuning the other instruments.



# Completing a chord

Daniels: *Bold Venture*

Have cello/viola/  
bass students play  
open D string to aid  
tuning F#.

The image shows a musical score for a string ensemble, likely for cello, viola, and bass. The score is for measures 49 and 50. The tempo is marked 'a tempo'. The dynamics are marked 'mp' (mezzo-piano), 'p' (piano), and 'mf' (mezzo-forte). The score includes a 'rit.' (ritardando) marking. The notes are in a 2/4 time signature. The notes in measure 49 are: C4 (cello), C4 (viola), and C4 (bass). The notes in measure 50 are: F#4 (cello), F#4 (viola), and F#4 (bass). Red arrows point from the text box to the F# notes in the lower staves.

# Rhythm impacting intonation

Newbold: *Warrior Legacy*

Have upper strings sustain notes instead of play the written rhythms.

The image displays a musical score for the piece 'Warrior Legacy' by Newbold. The score is arranged in a system of seven staves. The top two staves are for the Violins (Violini), and the bottom two are for the Violas (Violini II). The middle three staves are for the Violas (Violini I), the Cellos (Violoncelli), and the Double Basses (Violoncelli II). The score is marked 'tutti div.' at the beginning. The dynamics are marked 'f' (forte) for the upper strings and 'ff' (fortissimo) for the lower strings. The rhythm is complex, featuring many triplets and sixteenth notes. Red arrows point from the text box to the upper string staves, highlighting the specific notes and rhythms that are being discussed.







# Adjusting the 3rd in a Chord

Sibelius: *Finlandia*, Op. 26

The image displays a musical score for Sibelius' *Finlandia*, Op. 26. The score is in 3/4 time and features a key signature of three flats (B-flat, E-flat, A-flat). The first measure of the chord is highlighted in yellow. The score includes five staves: two treble clefs and three bass clefs. The first measure shows a G-flat major chord in first inversion (B-flat, D-flat, G-flat) with a forte (f) dynamic marking. The subsequent measures show the chord's resolution and the entry of various instruments.

G-flat major chord, first inversion. This entrance comes after a very long period of rest!

# Adjustment of fingers according to harmony

Rutter: *Suite for Strings*,  
I. *A-Roving*

1st and 2nd fingers  
(3rd cello) must be  
manipulated in  
order to justly tune  
chords.  
(Roots/5ths don't  
move.)

Vivace ♩ = 120

Violin 1

Violin 2

Viola

Violoncello

Double bass

*f*

*f*

*f*

*f*

*f*

D *f* Em<sup>6</sup>

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# Tuning Apps

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- ❖ Tonal Energy Tuner (iOS / Android)
  - ❖ Allows playing in Just Intonation
  - ❖ Attach compatible MIDI keyboard to iPad and play in Just Intonation
- ❖ ClearTune
- ❖ Peterson strobe tuner



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# References

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- ❖ Duffin, R. W. (2008). How equal temperament ruined harmony (and why you should care). W. W. Norton.
- ❖ Greer, R. D. (1969). The effect of timbre on brass-wind intonation. University of Michigan).
- ❖ Laux, C. (2015). The effect of a tonic drone accompaniment on the pitch accuracy of scales played by beginner violin and viola students. (Electronic Dissertation). Retrieved from <https://etd.ohiolink.edu/>



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# Resources

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- ❖ Garofalo - “Improving Intonation in Band and Orchestra Performance”
- ❖ Jagow - “Tuning for Wind Instruments”
- ❖ Fabrizio - “A Guide to the Understanding and Correction of Intonation Problems “
- ❖ <https://pages.mtu.edu/~suits/scales.html>
- ❖ <http://violinmasterclass.com/en/masterclasses/intonation>

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# Resources

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- ❖ <https://www.kylegann.com/histune.html>
- ❖ <https://www.kylegann.com/tuning.html>

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# Special Thanks

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for use of the HD-200 Harmony Director keyboard



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# Contact Me!

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Slides and more resources available at:

**[www.orchestrateacher.net](http://www.orchestrateacher.net)**