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THE SEARCH FOR CONSISTENT INTONATION: AN EXPLORATION AND GUIDE FOR VIOLONCELLISTS

Daniel Hoppe

University of Kentucky, dhhopped@gmail.com

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Daniel Hoppe, Student

Benjamin Karp, Major Professor

Dr. Michael Baker, Director of Graduate Studies
THE SEARCH FOR CONSISTENT INTONATION:
AN EXPLORATION AND GUIDE FOR VIOLONCELLISTS

DMA Project

A DMA project submitted in partial fulfilment of the requirements for the Doctor of Musical Arts in the College of Fine Arts at the University of Kentucky

By
Daniel Lorand Hoppe
Lexington, Kentucky

Director: Mr. Benjamin Karp, Professor of Violoncello
2017

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ABSTRACT OF DMA PROJECT

THE SEARCH FOR CONSISTENT INTONATION: 
AN EXPLORATION AND GUIDE FOR VIOLONCELLISTS

This paper provides a system that helps diagnose and address the specific challenge to cellists of intonation in any passage. Learning to play consistently in tune is essential for every cellist. In the over three hundred years of cello history, teachers have tried approaching the topic from a variety of perspectives. While each technique is useful in its own right, there is scant attention to how they work together. Viewing intonation through its component sub-skills is the first step toward integrating existing exercises and paving the way for further advances in pedagogy. The following paper categorizes training techniques according to the sub-skills of playing consistently in tune. This approach makes the learning and teaching of intonation manageable and approachable to cellists at all levels. What we do before the note, How we play the note, What we do after the note, and Putting it all together are the four broad categories of sub-skills identified. Within each of these sections, relevant exercises are presented and their efficacy explained. Examples are drawn from a wide range of sources including music education, my own educational experiences, music psychology, the Alexander Technique, cello pedagogy, professional cello teachers’ responses to a questionnaire, physiology, and neuroscience. By integrating published research in these areas, this paper provides a more comprehensive understanding of intonation. Instead of a wealth of techniques each claiming to resolve the challenge of playing in tune, the introduction of sub-skills allows for a methodological approach to intonation pedagogy.

KEYWORDS: Intonation, String Pedagogy, Violoncello, Music Psychology, Violoncello Pedagogy

Daniel Hoppe

5/17/17
Date
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By

Daniel Lorand Hoppe

Benjamin Karp
Director of DMA Project

Dr. Michael Baker
Director of Graduate Studies

5/17/17
This document is dedicated to my father, David Hoppe. With many thanks for the years of helping improve my cello playing and diligent attention to developing my ability to play in tune.
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My own personal journey with intonation, though never ending, has traveled a
great distance and been fraught with difficulties. My primary teachers along the way have
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Introduction

Cellists at every level have to address the challenge of playing consistently in tune. All too often working on pitch is approached as a frustrating, arduous, inconvenient task. Many teachers admonish their students to treat intonation like personal hygiene. A person that doesn’t bathe is typically smelly and dirty; the same can be said about the playing of a musician who neglects his or her intonation. Both require the same level of constant, consistent attention and are a basic threshold for productive, meaningful interactions. Even as the standards of intonation and the tools for improving it have evolved, its importance as a fundamental aspect of craftsmanship has remained unchanged. And yet gaining consistency has remained an elusive objective for students and a pedagogical conundrum for teachers.

Intonation is not a new issue for cellists. It has been a primary concern from the very outset, when the violoncello was beginning to supplant the fretted viola da gamba. The earliest teaching manuals, from the mid-1700s, prescribe the precise placement of the fingers.¹ Others recognized the benefit of a non-fixed pitch instrument:

The fingers, by practice, and the guidance of a good ear, effected a more accurate intonation, than could ever have been accomplished by the direction of frets, fixed on the fingerboard with the utmost mathematical precision. These can never be so applied, that the intervals or stop can be exactly in tune, but in one key; in every other, they will be remarkably faulty; and if the error be divided and lessened by what is called temperament, the variation from exact tune will be easily distinguishable and offensive to a correct ear.²

Over two centuries later mastering intonation has never proved to be as easy as John Gunn claimed. At times of desperation, I have longed for a fretted neck to remove the burden of finding consistency of intonation. I am not alone in seeking a solution to this challenge. Last year *Strings Magazine* published no fewer than 20 articles that refer to intonation.\(^3\) The voluminous publications on the subject represent a wealth of techniques and ideas. “Instructional techniques which have been investigated include the use of chromatic stroboscope…electronic graphs…multiple discrimination training…key-to-note matching…and verbal inducements. All of these procedures have been effective to varying degrees and with specific conditions.”\(^4\) Despite these multitudes of approaches, teachers and students continue to struggle developing consistent intonation. Why after so many years and with so many resources is playing in tune so hard?!

Undoubtedly, consistent intonation is a lifelong endeavor that cannot be solved by a magic exercise or an insightful observation. But the struggle, headache, and frustration can be greatly eased by understanding when and how to address specific challenges. In my personal journey with the cello, intonation plagued me like an enemy lurking around every corner. My teachers presented me with numerous strategies and practicing tips. I focused at times on the shape and relaxation of my left hand, listening carefully to the overtones series, eliminating beats, and singing. These were all important to my development and are frequently used approaches. I improved but not to the extent

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\(^3\) Search in IIMP (http://search.proquest.com.ezproxy.uky.edu/iimp/advanced?accountid=11836) Inside of *Strings* publication using the search term “Intonation” limiting results to the year 2016.

that I wanted or needed. I had learned a collection of valuable techniques but still lacked an understanding of why they worked or when to use them. This issue can be viewed using music educator Edwin Gordon’s distinction between techniques and methods. “A technique is a teaching aid which is used to accomplish a specific objective. A method is the **sequential** manner in which (immediate) specific objectives are introduced in a course of study as they relate to the accomplishment of a (long-range) comprehensive objective.”\(^5\) Treating intonation as a series of interrelated tasks, or sub-skills, rather than a single entity is the first step needed to integrate existing training techniques and pave the way for further advances in pedagogy. This understanding makes clear the specific objectives of each exercise, with the ultimate aim of gaining consistent control of pitch. The observation that “when teachers or performers consider intonation, they may be addressing one or more of several skills that fall under this general heading”\(^6\) rings true. But it need not be. Organization is the first step of moving from an amalgam of techniques to a method.

The following paper categorizes the component sub-skills of playing consistently in tune for the purpose of making the learning and teaching of intonation manageable and approachable to cellists at all levels. Techniques gleaned from my own personal experiences, cello pedagogy, and responses to a questionnaire completed by professional cello teachers (included in Appendix A) are explained and supported with published research in music education, music psychology, and neuroscience. This examination of sub-skills provides a system that helps identify the specific challenge of intonation in any


passage. It has not only enabled me to diagnose and address my own needs, but given me the tools to help each of my students as they encountered the difficulties of playing consistently in tune. While the document is written with the professional cello teacher in mind, it is a useful resource for anyone seeking new insights into mastering her/his control of pitch.

“The Search for Intonation” is separated into five sections. Sub-skills are presented in four broad categories that correspond to chapter titles: *What We Do Before the Note, How We Play the Note, What We Do After the Note, and Putting it All Together*. In each of these sections current techniques are grouped together with explanations of why they are effective. The end of each chapter includes original and adapted exercises that target specific sub-skills.

Chapter 1 (*What We Do Before the Note*) explores the formation of mental representations of our desired sound. The chapter details the process of pitch internalization and auditory imagery. It focuses on research in music education and in psychology and presents exercises from the aural skills classroom and sports psychology.

Chapter 2 (*How We Play the Note*) details how the body learns to realize the desires of the mind. Research in motor control and motor learning are used to explain prevalent teaching techniques. The chapter also broadens the traditional perspective, which focuses on the left hand and arm, to include the entire body and mind.

In Chapter 3 (*What We Do After the Note*) the sub-skills of pitch differentiation and pitch matching are examined. Steven Morrison and Janina Fyk have made significant contributions in the exploration of these sub-skills through their chapter “Intonation” in
The Science and Psychology of Music Performance. Their research is summarized to be more accessible to performers and extended to include an examination of listening.

In actual performance, the various sub-skills of intonation must occur simultaneously and instantaneously. The last chapter, Putting it All Together, explores strategies for multi-tasking and developing fluid connection between the categories.

The sub-skills are presented within these broad categories to provide a clearer understanding of the aspect of intonation they emphasize. In the conclusion one possible method for ordering the skills pedagogically is presented. The establishment of a hierarchy provides a sequential path towards realizing consistent intonation.

There are many aspects of intonation which this paper cannot contain within its scope. One of the most pressing is a discussion of tuning and temperament. In researching the pedagogy of intonation, a significant number of sources were primarily concerned with establishing what “in tune” means, and not how it is taught. The majority of respondents to my questionnaire identified “Knowing what is in tune” as the primary issue among their students. Each artist and teacher chooses to use equal temperament, just intonation, Pythagorean, or some combination of those systems. While some intonation approaches, such as Barry Ross’s Exquisite Intonation for the Violin, dictate a certain system, I do not address the issue. This paper is focused on enabling a musician to consistently play his/her desired pitch, and not on dictating what that pitch should be. For those interested in learning about this important aspect of intonation, Appendix B contains references to excellent resources on the topic. I also do not discuss the intricacies of intonation in an ensemble. The paper focuses on the task of the individual

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See questionnaire response in Appendix A.
musician in gaining consistent control over pitch. In researching and writing this paper my understanding of intonation has grown tremendously and I hope that in reading it you are presented with new concepts and ways of thinking and practicing that make consistency of intonation approachable and attainable.
Chapter 1
WHAT WE DO BEFORE THE NOTE

Understanding what is happening in a student’s mind and guiding him or her to a new mental approach is one of the great challenges of teaching. Doing it successfully is a mark of an effective pedagogue. Ken Bain’s study of teachers in higher education observes that students learn best when they are encouraged to “build new mental models of reality.”

Teaching and learning intonation is no different. Gaining consistent control of intonation starts even before making a sound. Thoughts are just as important as hands. As cellists, we must look beyond the arm, hand, and fingers to include the entire body and mind in how we play. This chapter examines mental prerequisites for consistent intonation. It explains the importance of listening, aural skills, and imagination.

To play in tune we rely on mental representations. This term comes from the field of cognitive psychology and refers to the internal construct we form of reality. “Musicians at every level use these [aural representations] to guide their play, and better musicians have far more detailed representations, which include not just pitch and the length of the notes to be played, but their volume, rise and fall, intonation, vibrato, tremolo, and harmonic relationship with other notes, including notes played on other instruments by other musicians.”

Clearly, developing a detailed internal representation is an important part of playing any instrument. For intonation, this mental preparation establishes an expectation of our desired pitch.

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8 Ken Bain, What the Best College Teachers Do (Cambridge, MA: Harvard University Press, 2004), 27.
The formation of mental representations begins with external models. It is based on the human instinct to imitate the sounds and gestures of our environment, both through imagination and physical action. “We imitate gestures, facial expressions, postures, gaits, vocalizations, and other behaviors of those around us. This is part of how we learn to be human, and how we learn to be a member of a given culture and subculture.”

Similarly, the internal expectations for intonation are shaped by our musical environment. High standards and accurate demonstrations are tremendously important aspects of successful teaching studios. According to Arnie Cox’s *mimetic hypothesis*, imitation plays a powerful role in the conceptualization of sounds.

Listening to recordings and professional performers is an essential element of laying the groundwork for intonation. The Suzuki Method’s insistence on listening illustrates the effectiveness of this approach. “The children will be happy and proud because they are the students of the best in the world. Further, by listening to good music continuously, they will internalize it.”

The creation of mental representation is strongly supported by listening to the performances of professionals, teachers, colleagues, or even electric pitch generators. To successfully gain consistency of intonation, the expectation of the desired sound needs to be deeply ingrained.

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12 The Suzuki Method is a “mother tongue” pedagogical approach. It models the learning of music on the acquisition of language skills. The process of learning to talk is the same starting point for Cox’s *mimetic hypothesis*.
Aural skills teachers everywhere work diligently to help music students internalize the sound of intervals and scales. A common approach is to connect the terminology of music theory with students’ existing mental representations. An example of this method is the use of familiar tunes to remember the sound and size of intervals.\textsuperscript{14} Other techniques more actively shape the conception of intonation. The moveable-do solfege system and Curwen hand signs both reinforce the tendencies of tones within a scale. For example, in these systems the tendency of the leading tone to be tempered higher towards the tonic is emphasized by the ‘i’ vowel of the mi or ti/si (solfege) and pointing upwards (Curwen). These pedagogical tools establish discrete interval zones, categories that allow for the identification of and distinction between one interval and another.\textsuperscript{15} They also establish a fixed system for the identification and reproduction of accurate intonation. The structure of the solfege system helps solidify the mental representation of pitch relations. However traditional aural skills strategies “rely exclusively on external sound sources.”\textsuperscript{16} Pianos in particular are heavily relied upon, reinforcing the temperament constraints of a fixed pitch instrument.\textsuperscript{17}

There is no one way to play a note that will be in tune in every situation. Playing cello, like other non-fixed pitch instruments, offers the luxury and challenge of choosing

\begin{itemize}
\item Some examples include: Jaws theme for ascending minor seconds, \textit{Three Blind Mice} for descending major seconds, \textit{Greensleeves} for ascending minor thirds, Beethoven’s 5\textsuperscript{th} \textit{Symphony} for descending major thirds, \textit{Twinkle, Twinkle Little Star} for ascending perfect fifths. For an extensive list of modal songs consult https://www.earmaster.com/products/free-tools/interval-song-chart-generator.html.
\item Temperaments are “tunings of the scale in which some or all of the concords are made slightly impure in order that few or none will be left distastefully so.” See Mark Lindley, "Temperaments," in \textit{Grove Music Online} (Oxford Music Online: Oxford University Press).
\end{itemize}
the temperament. Unlike pianists, cellists can subtly alter the size of intervals to change the color of a chord, amplify the musical direction of a phrase, or highlight harmonic resolutions. This is a complicated topic that requires its own dissertation, but for the purposes of this paper it is important to know that a cellist must choose which tuning system to use. Many string teachers reduce the issue of intonation to this choice. They focus their teaching and research on establishing the conclusive definition of what it means to be in tune. They argue that if a student knows what the pitch should be, he/she will be able to produce it consistently. Many of the most widely used practice techniques for intonation focus on what an in tune note sounds like and presume a certain tuning system.

Listening for the ringing of open strings is a frequent approach to training consistent intonation. Emphasizing sympathetic vibrations creates a robust mental representation of how notes on the cello should sound. Though this approach has been fundamental in my own search for consistency, it is limited because it relies on the harmonic series of the open strings. Checking single notes for their ringing or playing double stops with a neighboring string are effective ways to begin building a mental expectation for intonation, but we must acknowledge their underlying assumptions about temperament. *The Violinist’s Guide to Exquisite Intonation* by Barry Ross is an excellent example of both the benefits and limitations of this approach. It provides exercises that explicitly demonstrate sympathetic resonances of open strings and the phenomena of

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18 References to resources that explore the issue of temperament can be found in Appendix B.
19 Evidence of this is reflected in the answers to the questionnaire provided in Appendix A.
combination tones when playing double stops. While Ross’s book is valuable for developing a mental representation of the sound, it does not address the many other sub-skills of intonation. Furthermore, though Ross presents both melodic and harmonic tuning considerations, his exercises are all based on sympathetic vibrations or playing pure intervals. His aim to “explore a variety of tuning possibilities in the process of determining the most perfect tuning for each note” is undermined by the continual use of open strings as reference points. Despite this limitation, Ross’s book is an important resource for learning consistent intonation. Even with the robust mental representation that the book helps facilitate, there is an additional sub-skill of intonation needed before we play the note. Simply knowing what an in tune note sounds like when someone else is playing is not enough. Cellists must be able to actively hear the pitch before they produce it on their instrument.

Singing level, internal soundtrack, and listening ahead are all common ways cello teachers refer to the internal projection of the mental representation. “We must learn to use the ability of the ear not only to react to what the fingers have done, but to live the music (and the most refined intonation) almost as if it had heard it before it was played.” I have found the most effective techniques for learning this skill alternate

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20 “When a stringed instrument plays a double stop, additional tones are invariably produced which bear the name combination tones.” Barry Ross, The Violinist’s Guide to Exquisite Intonation (New York: Alfred Music, 2010), 34. The discovery of these sounds is widely attributed to the eighteenth-century violinist Giuseppe Tartini, who used them as a teaching aid for intonation in the violin treatises Trattato di musica secondo la vera scienza dell’armonia published in 1754. He referred to them as the “third sound” and they have since been called Tartini tones, which includes combination tones, difference tones, and resultant tones. See Gary Edwin Moody, "A Practical Method for the Teaching of Intonation" (Doctoral dissertation, University of Northern Colorado, 1995).
between external and internal productions of the sound. Hindemith provides one such exercise in *Elementary Training for Musicians*.\(^{23}\) He instructs students to sing a scale and with each successive repetition leave out certain notes. Just like practicing with a metronome beating only downbeats forces musicians to feel the inner subdivisions of the measure, this exercise demands that the missing notes be heard internally. Another approach alternates playing a note on the cello and actively imagining it (see Figure 1).\(^{24}\)

Our ability to imagine sound is a crucial aspect of playing in tune. But, even though its importance is widely acknowledged by performers, composers, and music educators, techniques and methods for improving the skill are still rare.

![Figure 1](image)

**Figure 1:** When playing this exercise be aware of the seamless transition between playing and imagining.

Researchers in music psychology and education use the terms musical imagery, audiation, auditory imagery, and inner hearing to describe imagined sound. Their work offers a new perspective on the development of this sub-skill of intonation. Researchers have found that imagining sound uses the same neural pathways as playing.\(^{25}\) It follows then that we can better train our inner ear by emphasizing its connection with the other senses used in playing cello – touch, sight, and hearing. The link between reading notation and auditory imagery is already widely discussed. It is evident in the ability to

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hear the sound of a piece simply by looking at the sheet music. Music educators teach “students to ‘hear’ with their eyes and ‘see’ with their ears.” Dictation and error detection exercises in the theory class or listening to a recording while reading the score are all ways to reinforce this skill.

Developing the skill of inner hearing, however, uses much more than just the eyes and ears. An intermodal approach, explored by Arnie Cox, uses “imitation of the heard sounds in a different performance medium.” Silently singing the desired sound of the cello, a device known as subvocalization, is the most widely used example of this technique. Physical movement is another cross-modal way of training intonation. The Dalcroze method emphasizes this approach by “seeking to transform the whole organism into what might be called an internal ear.” Even non-acoustic physical actions or gestures can help develop inner hearing. Curwen hand signs are useful not only for demonstrating the tendency of notes within a scale, but also for establishing a link between sound and body. The movement of the hand helps clarify and amplify the internal imagination of the sound. Both Dalcroze and Curwen techniques are effective ways of training the sub-skill of musical imagery away from the instrument. At the cello, it can be practiced by playing a piece with the left hand or right hand alone. This exercise strengthens the link between internal sound and physical motion and removes the crutch of external reinforcement. Moreover, simply imagining the fingerings can be enough to stimulate an internal sound. The strong link between auditory imagery and

26 Gordon, Learning Sequence and Patterns in Music, 14.
27 Cox, Music and Embodied Cognition: Listening, Moving, Feeling, and Thinking, 45.
physical motion will be explored more in the next chapter. Using the connections between sensory modalities is an effective way of developing auditory imagery.

Consistent intonation requires that the internal sound include the complete musical context. It is not enough to hear tones in isolation; the melodic and harmonic function of each note carries import for how to play it in tune. Music educator and psychologist Edwin Gordon stresses the importance of internalizing and understanding music. He uses the term *audiation* to refer to “the ability to hear music that is not physically present.”31 For Gordon this is a prerequisite for musical understanding. “Basic audiation provides the immediate readiness for intelligent listening to music.”32 In his educational philosophy, learning the meaning of sounds is highly emphasized. Thus it follows that in the pedagogy of intonation, developing the ability to hear the aural framework internally is especially significant.

Audiating a harmonic context is a prerequisite for playing in tune. With the exception of equal temperament, every tuning system is based on relations to the tonic pitch. Thus, teaching the inner ear to hear both melody and harmony is an important task. Similar to the process of developing mental representations, using external sources is a good place to begin. Playing with open string drones, pitch generators, accompaniment, or recordings are all effective tools. Some aural skills classrooms require students to sing melodies while they play chordal accompaniment.33 Cellists can practice this skill by singing the tonic while playing a passage or vice versa. Ultimately, we cannot rely solely on external sources to provide the harmonic context. It must come from the imagination.


Achieving consistent intonation begins even before we make a sound. Diligently shaping a detailed mental representation and proficiently audiating the desired sound are sub-skills that either support or detract from our ability to play in tune. For some students, it may not be enough to be merely lectured about the importance of internally hearing the desired sound. As guides on the search for consistent intonation, teachers can facilitate the refinement of mental representations and audiation. Providing specific exercises to practice the mental aspect of playing in tune is just as important as the physical.
**What We Do Before the Note Sub-Skill Exercises**

Forming a Mental Representation:

**Pitch Space** - Place thirteen markers an equal distance apart on the floor. These represent the twelve half steps of the octave. Once these are in place walk up and down the scale, taking note of whole steps and half steps. Next try leaping up an arpeggio. How do these skips feel compared to the stepwise motion of the scale? Experiment with moving in large and small intervals. Can you move in the intervals that correspond to your piece?

**Head, Shoulders, Knees** – Assign a discrete part of the body for each step of a scale. For major scales, I use my toes for $1^\text{st}$, knees for $2^\text{nd}$, hips $3^\text{rd}$, belly button $4^\text{th}$, sternum $5^\text{th}$, chin $6^\text{th}$, noes $7^\text{th}$, and top of the head for $8^\text{th}$. Sing the scale pointing to each part of the body. Now play the scale on the cello, feeling the sound move along the body as you play each step of the scale. Do ascending and descending feel different? After getting comfortable with the major scale, switch to minor. Does the lowered third connect with a different part of the body?

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34 Unless otherwise indicated, all exercises in this document were written by the author.
35 In my own teaching I place the markers 6-12” apart.
36 Bobby McFerrin played a similar game with the audience at a talk at the World Science Festival. He moves to certain spots on the stage outlining the pentatonic scale and the audience responds by singing the corresponding sounds. Video footage of this activity is available through TED talks at the following link: https://www.ted.com/talks/bobby_mcferrin_hacks_your_brain_with_music?utm_source=tedcomshare&utm_medium=referral&utm_campaign=tedspread.
Hearing Before You Play:

**Tuning the Mind** – After tuning the cello, imagine the sound of the A string. Then play that string. Ask yourself: “How accurate was the sound in my head?” Do this with all of the strings. Are you better at some than others? Try the same exercises with stopped notes. Take note of when your thoughts are in tune and when they need adjusting.

**Subvocalization** – Choose a piece or passage for which you already have a clear mental representation. Play it with a pause before each note so that you are able to sing or hum each sound before producing it on the cello (this may require playing under tempo). Play the same passage again, this time sing/hum at a volume that is barely audible. Notice how the singing is directed inward, while the cello sound fills the entire room. Finally, play the passage one more time letting the sound of each note fill your entire body before being externalized through your instrument. Can you find this same feeling without the pause before each note?

Auditing Both Melody and Harmony:

**Sing and Play** - Play a scale and sing a tonic drone the entire time. Are you able to hear the pitch of both your singing and your playing? Are certain notes harder to harmonize with than others? This activity develops the ability to audiate both melody and harmony simultaneously. This same exercise can be used to sing a bass line while playing an upper voice, or as part of playing in an ensemble.
Duet – Memorize the following brief melody.

Play the bass line below while you sing the melody. Can you do the inverse, play the melody and sing the bass?

How does your ability to audiate both the harmony and melody change with a different bass line?  

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37 This alternative bass line can also be used to illustrate how the harmonic function of notes changes how the sound and feel.
In the previous chapter we examined how to train the mind, now we will turn to teaching the body. After a particularly frustrating struggle with a passage I might exclaim disgustedly: “Why won’t my fingers play in tune?!” Of course, this comment reveals a significant problem. It localizes the issue, cutting off the significance of the rest of the body and the mind. Playing in tune is not just about the left hand and arm, but involves the entire person. As violinist Ivan Galamian writes in *Principles of Violin Playing and Teaching*, “The key to facility and accuracy, and ultimately to complete mastery of violin technique is to be found in the relationship of mind to muscles, that is, in the ability to make the sequence of mental command and physical response as quick and precise as possible.”38 This chapter explores how this connection is made and its implications for intonation.

The physical motions of cello playing are geared toward translating imagined sound into external reality. The human brain is already primed for this connection between sound and motion. Studies in neuroscience have demonstrated that hearing or even simply imagining music activates the motor centers of the brain.39 These findings echo Arnie Cox’s theory of *mimetic motor imagery*. He argues that “part of how we comprehend music is by way of a kind of physical empathy that involves imagining making the sounds we are listening to.”40 This somatic approach to music is also

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39 Bangert and Altenmüller, "Mapping Perception to Action in Piano Practice: A Longitudinal De-Eeg Study."
supported by the research of David Lidov and Robert Hatten. Their work focuses on how listening to music leads to a sensorimotor experience. The physical relationship with sound is not just a reaction; Cox asserts, “mimetic motor action and mimetic motor imagery occur in real time, recall, and planning.” In the search for consistent intonation there needs to be a fluid and supportive connection between hearing a sound internally, imagining a physical response, and executing the motion. Exploring our movements and how they are learned illuminates ways to establish a seamless connection between mind and body.

The neuroscientist David Marr proposed three components of motion through which movement can be analyzed. The *computational* covers the necessary equations of distance and angle. Although in performance these calculations are done implicitly, in the practice room examining them illuminates the precise distances between notes. The *procedural* addresses how an action will be carried out. It answers the questions: ‘what part of the arm needs to move? Which muscle groups do the moving?’ The final component is *implementation*, which is the execution of the procedural plan. These levels of analysis provide a system for examining motion that is insightful for learning and teaching a string instrument.

A computational approach to playing a note in tune prepares the mind for the physical motion. Just as we need to create a mental representation of our desired sound, we need to have an internal conception of the physical dimensions of the cello. “Students must learn how far away notes are from each other, and how big those measurements feel

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in the hand." Successful cellists have an accurate and detailed mental representation of the physical aspects of their instrument. For beginners, tapes are often used to develop this representation. The use of visual markers on the fingerboard is an approach that dates back to the early history of the instrument. In Michel Corrette’s 1741 violoncello method book he advises that “marking horizontal lines on the fingerboard will show immediately on which line to play each note.” The same approach can be seen today in the use of the Don’t Fret fingerboard marker, and similar devices (Figures 2a and 2b). Despite its consistent use across generations, marking the fingerboard is only a temporary fix for understanding the spatial dimensions of the instrument. Furthermore, a 1985 study illustrated that for college age beginners the effect of visual markers made no significant difference in their ability to play in tune. Ultimately, the use of tapes is a means for developing a mental representation of the instrument. Its purpose is to provide students with a detailed internal map of the cello and fingerboard.

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43 Cornelia Watkins, Rosindust: Teaching, Learning and Life from the Cellist’s Perspective (Houston, TX: Rosindust Publishing, 2008), 79.
Figure 2a: *Don’t Fret* finger position marker. This product comes as a long sticker that can be placed on the fingerboard and provides an approximate placement for the fingers. The first three colored tapes indicate the placement of 1\textsuperscript{st}, 3\textsuperscript{rd} and 4\textsuperscript{th} fingers in first position.

Figure 2b: Illustration of the placement of each tone from Michel Corrette’s treatise. It is interesting to observe that while both fingerboard charts dictate fixed locations for notes, Corrette does not use an equal distance for every half step. Instead, each note is based on perfect ratios with the length of the string.

When students struggle with understanding where to place their fingers, Suzuki pedagogues Tanya Carey and Carolyn Mead turn to visual aids. These tools are explicitly about developing a visual image of the layout of the fingerboard.\textsuperscript{47} By drawing a map of the strings and where the notes lie, important patterns of intervals and harmonics emerge. Another approach that relies less on visual learning is the use of handshapes. Diran Alexanian and Janos Starker emphasize the internalization of the intervals in each position as an effective means for developing fingerboard maps. Alexanian uses a chart to depict all the possible intervals within a given position.\textsuperscript{48} Starker breaks down the length


of the string into 24 positions and provides exercises to gain familiarity with each one.⁴⁹

Consistent intonation requires a solid mental representation of where the notes lie on the instrument. This can be developed using visual aids, or by thinking about the intervals between fingers and across strings, and by frequent repetition.

Once we know what note we want to play and where it is on the cello, we use the body to produce our desired sound. Marr’s *procedural* level of movement analysis addresses the necessary actions of the body to achieve a given objective. By teaching proper playing position, cello teachers regularly address this topic on a basic level.⁵⁰

Adjusting the position of the elbow, encouraging students to keep the thumb behind the second finger, or maintaining a rounded left hand all contribute positively to playing in tune. These types of challenges are typically easily observed by a teacher or a diligent student practicing in front of a mirror or with a video recorder. But the *procedural* level is not only concerned with proper playing position, it also extends to a cellist’s mental conception of her or his body.

The way we think about our bodies informs how we use them. Consistent intonation relies on an accurate mental representation of how the body works. Barbara and Bill Conable’s concept of body mapping provides a vital resource for the study of intonation. They use anatomy to inform “the internal, neuronal representation we have of ourselves in the brain that dictates how we move.”⁵¹

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⁵⁰ The book George Kennaway, *Playing the Cello, 1780-1930* (Burlington, VT: Ashgate, 2014) provides an excellent examination of how cellist’s left hand and arm position has evolved.

times, be a simple matter of awareness. Playing in thumb position provides a revealing example. If you ask most cellists to close their eyes and imagine their hand in thumb position, they typically do not include the fourth finger in the image.\textsuperscript{52} This finger often carries tension and undermines the consistency of intonation. Simple imagination exercises, like the one above, or drawing the image (regardless of artistic skill level) are effective ways to reveal body parts excluded from the mental representation. Continual reminders — such as asking “Do you know where your fourth finger is?” or practicing in front of a mirror, or watching videos of yourself playing — are also effective tools for including more of the body in the mental image. Some mental representations, however, take more than an expanded awareness to address.

The shoulder region has particular importance for playing in tune and is a common source of difficulty for students and teachers. As a teacher, there have been countless times when I tell students to “relax your shoulder” or to “think about your shoulder.” But, as Jennifer Johnson points out, “there is no anatomical unit called a “shoulder,” which is why there is so much confusion and mis-mapping in this region of the body.”\textsuperscript{53} Consistent intonation requires an accurate representation of the left arm. A basic anatomical description can immediately confirm or contradict our mental conception.

The arm is relatively loosely attached to the trunk. Where two bones move against each other at a joint, they are said to articulate. The arm articulates with the shoulder blade (scapula), which in turn is braced against the breastbone (sternum) by a long lever formed by the collarbone (clavicle). The collarbone is relatively narrow and provides the only bony connection between the arm and the trunk… The shoulder blade is otherwise attached to the trunk only by muscles, which run

\textsuperscript{52} Playing in thumb position rarely calls for the use of the pinky finger and as a result it is left out of the mental representation for many cellists.

\textsuperscript{53} Johnson, \textit{What Every Violinist Needs to Know About the Body}, 53.
both to the vertebral column (the spine) of the back and the neck, and to the chest wall.\textsuperscript{54}

Verbal explanations, as well as images such as Figure 3, are helpful in correcting mis-mappings of the shoulder.\textsuperscript{55} However, experiential knowledge is typically the most effective method. As Jennifer Johnson observes, “the quickest way to regain a sense of how the whole arm includes the shoulder blade and collarbone is to go swimming.”\textsuperscript{56} Doing mind-body practices such as tai chi, yoga, the Alexander Technique, and the Feldenkrais method are all effective ways for improving the mental representation of the body. While the examples given above emphasize the left hand and arm, consistency of intonation is supported by knowledge of the role of every part of the body. Everything, from the top of the head and the neck to the toes, can have a constructive or destructive influence on intonation. Using the techniques of awareness, imagery, and teacher guidance are helpful for understanding the role of body, which is a necessary sub-skill for intonation.

\textsuperscript{56} Johnson, \textit{What Every Violinist Needs to Know About the Body}, 53.
Knowledge of how the body works must eventually be applied to the instrument. Marr’s *implementation* level of analysis examines how we execute our procedural plan.
The ability to reflect on our physical motions is a fundamental aspect of playing in tune. Consistent intonation requires a finely trained kinesthetic sense. When we play out of tune we have to ask: “Was there unintended tension in the hands? In the neck?”
Essentially, we are observing how well the procedural plan was executed. Answering this question demands a sense of proprioception, the awareness of our body’s position and use of force, and a kinesthetic memory. The human body is quite skilled at providing this information. The trick is for us to be receptive.
Nurturing kinesthetic awareness is an important and challenging aspect of intonation pedagogy. Cornelia Watkins approaches it by encouraging students to reflect on how their bodies feel.

When teaching students in first position, help set up the hand with good positioning and measurements and then ask the student how spread apart the fingers feel. Sometimes the response will be ‘As far as I can stretch them.’ Check to see if that’s true – that the fingers couldn’t open wider if the student tried. But whether the observation is a fact or not, it is the perception of what must be done with the hand that really counts. If on the next try the intonation isn’t as accurate, ask if the hand felt the way he had described them earlier, and if not, have him reset his hand accordingly. These perceptions will not stay the same, of course: muscles stretch, and students grow and move to larger instruments – but that’s okay. The goal is to increase awareness, even if the feeling changes from day to day.\footnote{Watkins, \textit{Rosindust: Teaching, Learning and Life from the Cellist’s Perspective}, 79-80.}

The same tool of heightened awareness can be applied beyond the spacing of the fingers. Whether we are playing in one position or shifting, in double stops or single notes, we should always be aware of the kinesthetic sensations of the body. Reflecting on how the body feels has been shown experimentally to improve intonation. A 1999 study of beginning violin and viola students compared the effectiveness of pitch accuracy feedback with kinesthetic feedback. It found that the students who were asked "How did your hand and fingers move differently when you played the note in tune and when you played it out of tune?" improved their ability to play in tune much more than those who were given multiple trials but not asked about kinesthetic sense.\footnote{Christopher Jacobson, "The Importance of Kinesthetic Perception in Playing in Tune," \textit{American String Teacher} 48, no. 3 (1998).}

Another avenue for using the kinesthetic sense is to develop an expectation, or mental representation, for how playing in tune feels. Many teachers emphasize listening for sympathetic vibrations caused by the overtone series. These vibrations give a discreet
feel to the string under both the left hand and the bow as well as the instrument as it rests against the player’s body. Developing an expectation for this feeling is a powerful tool for playing consistently in tune. The first step is a matter of exploration and discovery. In *Exquisite Intonation on the Violin* Barry Ross reminds the reader many times that finding the sound and feeling of sympathetic vibrations takes patience and regular practice.\(^{59}\) Once we have a tactile sense of how it feels to play in tune it becomes easier to return to the same feeling.

Our bodies store kinesthetic memories. Like the carbon copies in a receipt book, after we move there is an afterimage not as distinct as while movement was happening, but legible all the same. Repetitions can be used to deepen the impression of our carbon copy, making it easier to remember. Another way to boost these kinesthetic memories is by attaching a word or image to the kinesthetic sensations. Teachers and students can explore adjectives together and choose the best ones to describe a particular feeling. There are no right answers in choosing these descriptors, they are simply a tool to help us return to the same feeling even if the instrument isn’t present. We can use this technique to activate our kinesthetic imagination. Just like we train to hear music internally before we play, we can practice how a note or passage should feel when we play it in tune.

Accurate mental representations of the instrument, body, and motions of playing are all important parts of developing intonation. Learning consistency also involves training the body to execute a motion no matter the circumstances. Some teachers and students take the mindset that “drilling is the biggest key to playing in tune.”\(^{60}\) How we

\(^{59}\) Ross, *The Violinist’s Guide to Exquisite Intonation*.
approach these repetitions, however, greatly impacts the consistency with which we play. Using what Anders Ericsson calls “naive practice, which is essentially just doing something repeatedly, and expecting that the repetition alone will improve one’s performance,” is inefficient and ineffective in making lasting improvements in intonation. Research in motor learning has considerable resonance with the pedagogy of intonation. Closed-loop and open-loop learning are models for how humans learn and refine movement to precise locations. Schema theory addresses how to apply movement sequences to new or unfamiliar situations.

Closed-loop learning emphasizes the interrelationship between movement and perception. This theory was first articulated by Jack Adams in 1971. It can be summarized by the following example:

Consider the task of reaching for a glass. According to Adams, when one has little experience with this task, a crude first movement is made toward the glass, perceptual feedback indicates that the movement was not effective, then subsequent movements are performed to reduce the error between the perceived position of the hand and the perceived position of the glass. As practice continues, the perceptually defined reference condition for each hand position along the trajectory toward the glass becomes better suited to completion of glass grabbing. Replace the glass with a note and every cellist can relate to trying to teach their body to gain consistency in movement by using Adams’ closed-loop theory. As we move we perceive and react to the motion and sound. Just as was discussed in the implementation stage of movement analysis, aural and kinesthetic perception are essential aspects of this approach. The theory lends immediate credence to teachers’ pleas that their students slow down to receive information from their senses. But this paradigm is limited to slow,

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deliberate practice. While it may be a useful model for adjusting the intonation on long sustained notes or in the practice room, the closed-loop theory is incomplete.

A cellist’s motions need to be deeply internalized and activated automatically. These aspects are not accounted for in Adams’ closed-loop theory. “The sluggishness of closed-loop, feedback-based control has led scientists to propose that the production of most rapid movements depends on some form of advanced planning and programming.”63 This mental preparation is formed during Marr’s procedural level of analysis already examined. Motor learning experts refer to this plan as the motor program. It can be defined as “a set of pre-structured movement commands…which defines and shapes the action being produced.”64 These programs are stored in long-term memory and operate with very little conscious control. The sequence of choosing a motor program and using it to execute an action is governed by an open-loop control system. Open-loop systems are the ideal for playing consistently in tune. Music educator G. Joshua Sanders notes that “open-loop control is characterized by fluency and accuracy.”65

As we practice our intonation we want to use very deliberate movements with hyper-awareness (closed-loop) to form our motor program so that playing in tune becomes automatic (open-loop). Choosing effective ways of accomplishing this objective is an important aspect of finding consistency.

We have all experienced the frustrating phenomenon of working diligently on the intonation of a passage, only to return the next day and discover that it is still out of tune.

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64 *Motor Learning and Performance*, 124.
It is self-evident that our practice strategies determine how we learn the motor program. A typical cellist will approach an intonation problem by practicing it until he/she believes it is right, and then play it again and again so that it sticks. The field of motor learning refers to this as consistent or block practicing. Repeating a task many times can lead to fluency, but it is not the most efficient way of teaching our body. “When we drill practice we do show what scientists call ‘momentary strength,’ but we do not gain ‘underlying habit strength.’”\(^{66}\) An alternative approach is varied or random practicing. With this strategy “the order of rehearsal of a number of different tasks is intermingled, or mixed, during the practice period. Learners rotate continually among the tasks and, in the most extreme case, they never perform the same task twice in a row.”\(^{67}\) Varied practicing has been shown to be more effective in learning a skill. In part this is because by breaking up the practicing we rehearse retrieving the movement from our memory, and each act becomes more distinct. While the gains may not be as noticeable in the practice room, “the science is clear: random practice is unequivocally the best practice method for enhanced performance.”\(^{68}\) An additional advantage to randomized practice is that the skills learned in this way are more transferable to related tasks.

Consistency of intonation requires that our practice be untethered from a specific context. We need to develop generalizable skills that we can call upon no matter the circumstances. Varied practice facilitates this recall. By interspersing activities, our brain is given the opportunity to compare two actions. As we explored in the development of

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\(^{67}\) Schmidt and Wrisberg, *Motor Learning and Performance*, 233.

the kinesthetic sense, and as we will see again in the discussion of pitch discrimination, comparison is an essential part of learning. Studies in motor learning compared varied versus block practicing strategies on learning to throw a certain distance. The block practice group only rehearsed throwing the necessary distance, while the varied group practiced throwing both longer and shorter. The knowledge gained from the varied practice group enabled them to perform a new but related task (throwing the ball an unrehearsed distance) significantly better than the first group.\textsuperscript{69} Even though there are a limited number of notes on the cello, each time we sit down to play we don’t “produce something absolutely new, and [we] never merely repeat something old.”\textsuperscript{70}

Consistent intonation relies on the use of generalizable motor programs. Instead of learning movements in isolation, our brain groups similar actions into categories. Whenever cello teachers draw parallels between playing the instrument and a daily activity, such as drinking a glass of water, they are using this ability. Schema theory, as it is referred to in the field of motor learning, was first postulated by Richard Schmidt in 1975. It explains how we learn to connect the motor programs of similar motions.\textsuperscript{71} For example, shifting on the A string a fifth from D\textsuperscript{4} to A\textsuperscript{4} uses the same basic motion as moving the hand a whole octave higher (from D\textsuperscript{4} to D\textsuperscript{5}). Understanding this connection makes both shifts more reliable. Practice techniques, such as transposing a passage into a new key and rehearsing intervals wider and narrower than printed, train the generalizable motor program. These approaches are particularly effective when a motion feels new or

\textsuperscript{69} Schmidt and Wrisberg, \textit{Motor Learning and Performance}, 247.
\textsuperscript{71} Schmidt and Wrisberg, \textit{Motor Learning and Performance}, 245.
unfamiliar. Directly addressing the generalizable schema connects how we play each note and as a result supports the consistency of our motions and intonation.

How we approach playing the note is an important part of consistent intonation. Traditional teaching methods already emphasize body position, hand shape, and relaxation. To these techniques, the addition of an accurate mental representation of the fingerboard and body, as well as active cultivation of the kinesthetic sense supports the ability to play consistently in tune. Ingraining these sub-skills so they become second nature requires diligent practice. But simple repetition is not always enough. Using variable practice strategies to address an issue in a multitude of circumstances prepares a motion for consistent execution. In addition, connecting how we play a note to generalizable motor programs allows for actions to be learned more deeply and applied effortlessly to new situations. These aspects inform how we practice and prepare for reliably using the body to produce our desired sound.
How We Play the Note Sub-Skill Exercises

Body Mapping

**Let Your Toes Do the Shifting** – Choose a shift that is particularly challenging to play in tune. When you execute the shift notice which part of your body is at the center of your attention. What happens if you move the center to your bow? Or your head? Or even your toes? After exploring with your focus on individual body parts, do the shift with an awareness of the entire body. Was one version more successful than the others? How did each attempt feel different?

Fingerboard Mapping

**Fingerboard Geography**72 – Play the open A string. Match the same frequency on the D string. Can you alternate between the two notes controlling the timbre and pitch so the changes are imperceptible? Experiment with matching this sound with the same A played on the G or even the C string! Do the same exercise using octaves instead of unisons. How many different A’s can you find on the cello? As you explore other notes, notice what patterns emerge.

**Bingo the Dog** – Play a section of your piece where the intonation is frustrating. Choose one note to leave out - put your finger down and imagine what it would sound

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72 Adopted from Phyllis Young, *Playing the String Game: Strategies for Teaching Cello and Strings* (Austin, TX: University of Texas Press, 1978), 60.
like. Play it again and notice the intonation of the notes immediately preceding and following the empty space. Did the intonation suffer? Do the same thing this time skipping two notes. Leaving out certain notes tests your body’s sense of the distance between pitches without the benefit of acoustic reinforcement. This exercise can be especially revealing in chromatic passages.

Kinesthetic Sense

**Performing is Acting** – Get a partner or watch a video and observe someone else playing the cello. Can you imitate them on your own instrument? Try imagining what it would be like to play like this other person. Do you notice how this imagining makes your body feel? Now play just the way you envisioned. Was there anything different when it was happening in your mind compared with what your body did? Do this exercise imitating a leading soloist. How is it different from your normal playing?

**The Poet**\(^73\) – Select a short excerpt, two to four measures long, to use for this exercise. Explore what it feels like to play these few bars with as much tension as possible. Starting from the tips of your fingers, observe the interaction between your muscles. How does the tension move from your hands into your arms? To your neck and shoulders and down your back? Play the passage as many times as you need to observe the impact on your entire body. What is the sensation of tension like in your hips, your feet, your eyes, or your breath? As you notice these sensations make a note of single

words that might describe your feelings. For some people, tight, prickly, hard, cold, strong, or warm are words that describe the feeling of tension. There are no correct answers, just find a few that are right for you. Do the same activity, this time playing as relaxed as possible. Some associative words might be loose, tingly, or warm. Once you have a collection of words to describe each sensation, think about your adjectives and notice what happens to your body. Connecting language and feeling is a powerful tool for developing the kinesthetic sense. You can use the words you have discovered through this exercise as triggers for relaxation. Play the excerpt a final time, using your adjectives to release tension whenever it is needed.
Flawless intonation is an impossibility. The closest we can come as performers is to create an illusion of precision. Simon Fischer writes, “Part of the art of playing in tune is adjusting notes that are fractionally out of tune so quickly that nobody else notices.” After we play a note the search for consistent intonation continues. We must listen attentively to hear when a note is out of tune and adjust our position to correct it. Successfully convincing someone that a note was actually in tune from the outset requires these two skills to happen nearly simultaneously within milliseconds of the beginning of the sound. This chapter explains how we develop these fundamental sub-skills of pitch discrimination and pitch matching.

Steven Morrison and Janina Fyk bring these sub-skills to light in their chapter “Intonation” in The Science & Psychology of Music Performance. Their work assembles research that reflects what we do after we play the note. Morrison and Fyk define pitch discrimination as “the ability to distinguish between two successive pitches or two dissimilar examples of a single pitch” and pitch matching as “where one attempts to reproduce exactly a given pitch.” Both of these steps are equally important and intimately intertwined in performance. Our ability to execute these skills, however, develops separately. In a study of woodwind players’ pitch matching and pitch

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75 Morrison and Fyk, “Intonation.”
76 Morrison and Fyk’s use of sub-skills to examine the topic of intonation, helped articulate the framework for the current study. However, they only address pitch discrimination and pitch matching. This paper takes a broader view of the necessary components for playing consistently in tune. Still, Morrison and Fyk’s chapter expertly explains these two sub-skills.
77 Morrison and Fyk, "Intonation," 183.
discrimination skills, Mark Ely finds that there is “an extremely low correlation between woodwind performers’ abilities to play in tune and their abilities to detect intonational deviations.” To support their independent development, these fundamental sub-skills will be addressed separately.

Pitch discrimination is a matter of training our aural perception. There are certain biological limits to this ability. The typical human ear can detect frequencies ranging from 20Hz to 20,000Hz (20kHz). But we are not uniformly sensitive within that range. We can hear pitches between 3 and 5 kHz at significantly lower volumes than pitches at the extremes of the audible spectrum. Researchers have also explored the minimal threshold for discrimination between pitches. To measure small alternations in frequencies, musicologists divide an equal-tempered half step into 100 cents. Perceptual studies show that “given favorable experimental conditions, listeners have been found to identify differences smaller than 2 cents (0.02 semitone).” For certain ranges this minimal threshold for discrimination can be as small as .5 cents, (though it increases with lower and shorter pitches.) While the ear has the potential for such refined discrimination between frequencies, these studies were conducted on musically trained adults. As musicians, it is our task to teach our ears to distinguish between pitches.

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80 This unit of measurement was devised by the mathematician and philologist Alexander Ellis and quickly adopted in acoustics and ethnomusicology. See "Cent," in *The Oxford Companion to Music*. (Oxford Music Online: Oxford University Press). Also see Mark Lindley, "Interval," in *Grove Music Online* (Oxford Music Online: Oxford University Press).
81 Morrison and Fyk, "Intonation," 184.
Developing the skill of pitch discrimination begins by comparing the sound of two pitches. The same way our bodies learn by noticing the differences between movements, our ears become more sensitive when we attend to the differences between pitches. “Virtually anyone can learn to identify high and low pitches, starting with the extremes and moving towards the most subtle.” Honing this skill comes from repeatedly comparing two frequencies and gradually altering their distance. Dr. Tanya Carey empowers her students to tune their own instruments and refines their ability to discriminate between pitches by playing the game “Same or different.” This type of activity removes the stigma of being out of tune and simply asks students to observe differences. Encouraging the use of even basic discriminations skills, such as imitating performed intervals, is too often ignored or assumed. Reinforcing the importance of this skill through praise motivates students to refine their perception further.

Listening for certain aspects of a note can increase the ability to make minute pitch discriminations. In Chapter 1 we addressed the benefit of using sympathetic vibrations to help shape mental representations. Checking for the ringing of notes is also an effective means for amplifying the distinction between pitches. A very slight change in frequency can have a profound effect on the volume of the sympathetic vibrations. A similar technique can be used for comparing the sound of double stops. Along with listening for combination tones as mentioned in the first chapter, beat elimination is a

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83 Watkins, Rosindust: Teaching, Learning and Life from the Cellist’s Perspective, 78.
84 As the name of the game suggests, Dr. Carey begins by asking, in reference to either the comparison of A strings, or the middle harmonic on the A string (A4) with the third harmonic on the D string (also A4), “Is it the same or different?” If the answer is different she then asks, “Is it higher or lower?” Then, after adjusting the string she asks, “Did it get better or worse?” This question allows for the possibility that the answer to the higher or lower discrimination was not correct, or the student over adjusted. The whole routine encourages cellists to test their pitch discrimination ability in a nonjudgmental environment. Repeating it also helps students refine their sense of perception.
significant strategy for refining pitch discrimination. Beats are an acoustic phenomenon that occur when two sound waves interact. When the two frequencies are different the competing rates of compression and rarefaction cause audible pulses in the sound. As the tones get closer together, these pulses slow down and completely disappear when the notes are exactly the same.\textsuperscript{85} Like ringing tones, listening for beats provides a specific focus that aids the comparison of pitches. While both approaches assume particular temperaments, they are exceptional tools for training the ear to perceive fine differences between frequencies.

   Even cellists who excel at hearing the differences between two tones may struggle noticing their own intonation while they play. Ultimately, pitch discrimination occurs between a perceived pitch and the mental representation of our desired sound. However, this presents the additional challenge that “the presence of an image of one pitch might interfere or impede detection of a target of the other pitch.”\textsuperscript{86} In these situations external reflection is an important tool. Listening to recordings of yourself playing is a frequently recommended practicing tip. While this is certainly a useful approach, research in music psychology indicates that verbal feedback is the most effective device for external reflection. A study of college string players showed that “subjects who received verbal feedback performed significantly more in tune than those who heard tape-recorder playback or listened to model performances.”\textsuperscript{87} As in the formation of mental representations, the role of teachers and colleagues is extremely important. While

external reflection is important in every cellist’s development, consistency is only possible when the performer can discriminate between pitches in his/her own playing.

The teaching of violinist Dorothy DeLay provides an excellent model for empowering students to reflect on their intonation while they play. She prompts her students by saying: “Play it again. Really listen. What is wrong?” ‘Well,’ someone might say, ‘I think the B-flat is out of tune.’ ‘Are you sure that note is out of tune? Play it again. Play it again.’ ‘Yes, that note is out of tune.’ ‘Why is it out of tune?’”88 This type of dialogue helps encourage students to include intonation in their awareness while they play. In my own teaching, I use praise such as “good listening,” to build students’ self confidence in their ability to hear subtleties in their playing. The final question in DeLay’s teaching example connects the two sub-skills of pitch discrimination and pitch matching.

The adjustment of a note is just as important, if not more, than the initial attack. Research has shown that every cellist, regardless of performance experience, or perceptual ability, relies on pitch matching.89 Successful pitch matching is strongly connected with the physical approach to the instrument. On a very basic level, cellists must understand how the changes of hand position affect pitch. When teachers ask for a note to be higher it can be counterintuitive for beginning students to move their hand down toward the bridge. The process of sliding the finger up and down the fingerboard to find a note is an important step in training pitch matching. This activity pairs naturally with pitch discrimination. With each adjustment, the student needs to answer: “Did it get

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88 Nadja Solerno-Sonnenberg as quoted in Watkins, Rosindust: Teaching, Learning and Life from the Cellist’s Perspective, 92.
better or worse?” While it takes patience in its infancy, developing acuity in pitch matching goes a long way toward building confidence in the ability to play in tune.

Creating the impression of consistent intonation requires instantaneous pitch matching. It should be so instinctual a reaction that it is “unnoticed by both the listener and the performer.”\textsuperscript{90} This lofty aim is frequently stymied by tension. As the British violin pedagogue Simon Fischer says:

While good listening is always the first condition for playing in tune, the second condition is that the left hand is free, since any lightning-fast, microscopic adjustments that are needed will be blocked if the hand is tense. The muscles must be in a state of balance and freedom so that any part of the hand or finger is free to move in any direction without initial resistance. The lightning fast adjustments cannot happen if there is resistance to movement that lasts even a fraction of a second, let alone if the hand is so tight that it takes longer to make a single adjustment.\textsuperscript{91}

Acknowledging tension as an obstacle for adjusting a note is an important step in learning consistent intonation. While learning to play with balance and freedom may not be simple, diagnosing problems of intonation caused by unnecessary tension helps focus practicing methods. Resolving these issues requires a return to the strategies presented in the previous chapter. Refining the skill of pitch matching eventually leads to very subtle changes. Rather than repositioning the finger, subtle changes in hand balance, bow pressure, or the width of vibrato can all be used to better match a given tone.

Morrison and Fyk astutely identify pitch discrimination and pitch matching as fundamental aspects of intonation. Basic competency with these sub-skills informs the other aspects of developing consistency previously explored. Despite their significance, a cellist’s ability to execute these skills is often assumed or taken for granted. Instead of

\textsuperscript{90} Fyk, \textit{Melodic Intonation, Psychoacoustics, and the Violin}, 59.
\textsuperscript{91} Fischer, "Intonation," 76.
celebrating a student’s ability to hear minute changes of frequency to successfully match a given sound, teachers scold them for not listening hard enough or adjusting fast enough. As this chapter demonstrates, these skills are not just for beginners but can be refined throughout a cellist’s career. There is always potential to hear ever smaller changes in frequency and adjust more quickly and effortlessly.
What We Do After the Note Sub-Skill Exercises

Discrimination between tones

**Exploration** – Play the note G on your D string. Listen to the sympathetic vibrations of the open G string. Can you see both strings moving? Can you feel the ringing of the string under your finger? Can you feel the quality of resistance under the bow? Now move your finger ever so slightly higher. How did the sound change? How did the feeling of the finger and the bow change? Is there a different feeling when it is too sharp versus flat?

**Five Ways to Play** – Explore how slight changes in intonation affect the resulting sound. Take a simple passage or scale and play it in five different ways. Take the scale written below as an example, try playing the G natural a little low and the C# very high. How does it sound when you narrow these half steps? Next try matching each note with a chromatic tuner. Are you successful in playing within 2 cents of equal temperament? Which steps of the scale are easier and which more challenging? Play the passage with a bright sound. Notice what happens to the intonation. Is it different when you create a dark, melancholy sound? What other variations in intonation can you discover? Observe how these impact the character, color, and direction of the passage.
Pitch Manipulation

**The Long Glissando** – Player 1 holds a note somewhere in the middle of the instrument, this serves as the target pitch for the exercise. As Player 2 start at the very top of the fingerboard (closest to the scroll) and slide towards the bridge making the pitch higher. Move past the target pitch, going all the way to the other end of the fingerboard. Now change directions, sliding the hand so that the pitch descends. Again, move past the target, but stop before reaching the original starting location. On each successive trip, change directions closer and closer to player 1’s note, until the two tones match exactly. Notice how when the two notes are very close moving higher or lower only requires a slight rolling of the finger. Experiment with how many and how few changes of direction it requires to find the target pitch exactly.

**The Race** – In a group setting choose one leader to establish a tone. On the count of “Ready, Set, Go!” race to see who can be the first to match the given pitch. Once it is found sustain the note until the whole class is playing one beautifully matched sound.
Chapter 4
PUTTING IT ALL TOGETHER

In many ways musicians are like jugglers, attending to a large number of challenges in alternation and in combination. Like jugglers, musicians need dexterity, alertness, and sangfroid. And, also like jugglers, musicians need to become so comfortable with their skills that making music doesn’t feel like a desperate attempt not to break anything.92

Separating intonation into its component sub-skills runs the risk of making the already challenging task of playing in tune seem Herculean. Like handing a juggler five more balls simultaneously, the wide-eyed response of a cellist could be “What?!? I have to do all that!” Thinking about all of the component sub-skills while we play would be debilitating. While the categorization of sub-skills is very useful in the practice room, on the concert stage they all need to happen instantaneously and effortlessly. This chapter explores the inextricable links between the sub-skills and strategies for integrating them into a cohesive whole.

The aim of practicing intonation is to make the execution of each sub-skill a habitual response. “An individual can perform a complex task only as fast and as accurately as he or she can perform the component skills. Thus, fluency of superordinate skills is not possible unless the prerequisite skills can be performed fluently.”93 Each step, projection, execution, and reflection is mutually reinforcing in an endless cycle. Playing in tune requires a constant and seamless progression through this sequence, as shown in Figure 4.94 Each stage in Malva Freymuth’s illustration – Ideal Projection, Action, and

Mental Recall – reflects one group of sub-skills presented in the previous chapters. In performance, this cycle needs to happen so quickly the steps occur nearly simultaneously and without interruption. Ideally, this way of thinking about intonation becomes habitual. Music psychologist John Sloboda observes that “the principal feature of a habit is that it is automatic, and that it uses up little or no mental capacity to execute. The precursors of habits are conscious, deliberate, and effortful behaviors which commonly involve verbal control.”

Making the sequence in Figure 4 a habit begins with conscious attention to each step, even using verbal commands to guide the progression.

Figure 4: The three step practicing loop.

Awareness is a significant aspect of constructively creating habits. The Alexander Technique is one effective training method for improving this skill. According to Alexander practitioners, the first step of habit forming is to “do nothing.” It does no good to simply paste a new approach over preexisting tendencies. A better place to begin is with non-judgmental observation. Just noticing what we do before the note, how we play a note, and what we do after we play goes a long way toward developing consistent intonation. In The Inner Game of Music, Barry Green provides an example of how the

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96 Judith Leibowitz, Dare to Be Wrong: The Teaching of Judith Leibowitz (New York: American Center for the Alexander Technique, 2007), 27.
skill of awareness can be applied in the practice room. After playing a piece or passage he asks the following questions:

1. How was your pitch?
2. If you were out of tune, play the piece again, this time paying attention to exactly which notes are out of tune.
3. Now list them. Were you sharp or flat? If you didn’t notice, play the tune again until you can list which notes you are playing sharp and which ones flat.
4. Now sing or play the piece again, this time focusing your awareness on the notes that were out of tune. Have they changed? For the better? For the worse? Were you able to correct your problems with pitch and intonation with simple awareness (#1 of the four ways that awareness can bring about positive change)? By simply noticing which notes were out of tune (#2)? Once you noticed which notes were sharp or flat (#3), could you immediately correct them? Or did your awareness when you played the tune again give you subtle feedback that allowed you to make adjustments so that you sang or played in tune (#4)?

While Green’s writing makes attaining this level of awareness sound simple, it is not always easy.

Intonation is one of a multitude of competing demands on a cellist’s attention. Even if a student is able to execute every sub-skill, doing them all in the midst of every other consideration can still be elusive. “For less experienced performers, the number of competing demands may be so great that attention is not available to monitor fine pitch adjustments.”98 This challenge is typically met with the scolding exclamation: “Intonation!” Students are asked to play the passage again and to “really concentrate this time.” I know from my personal experience that this is counterproductive. As Barry Green observes, “‘try’ instructions tend to cause anxiety, and then we are liable to tense up and ‘try too hard,’ making us fail at tasks we might otherwise accomplish without any


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problems.” Fixing intonation by exerting more effort easily leads to tension and results in worse pitch.

“The remedy for concentration is focus.” When cellists struggle with their awareness of pitch while they play, inclusive attention can be an effective solution. By accepting and embracing the competing demands on our minds, we can become more receptive to the present moment. “By accepting distractions and then consciously choosing to focus our attention elsewhere, we can increase our awareness of the music – and lessen the amount of frustration we feel at the distractions.” Thinking about the elements of our playing as a picture clarifies the value of inclusive awareness. “When a camera focuses, trees and grass are not excluded from the photograph just because they are not the main subject of the photo.” Similarly, intonation, with all of its components, should always be included in a cellist’s playing even if it is not on the forefront of the performer’s mind.

Viewing intonation through its sub-skills is only useful if it can be put back together. Additional strategies are needed to convert the gains of the practice room into a performance setting. Eliminating obstacles in the continuous loop of imagine, play, reflect is a preliminary step for recombining sub-skills. Additionally, practicing inclusive awareness is an effective way of addressing the demands on attention. Consistent intonation can only be found when it becomes seamlessly integrated into the act of making music.

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100 Johnson, *What Every Violinist Needs to Know About the Body*, 13.  
Putting It All Together Sub-Skill Exercises

Expanding Awareness

**What Did You Have for Breakfast?** – While playing force yourself to think about something other than the challenge of intonation. Can you play and describe what you had for breakfast? Can you say the note names while you play? Multitasking activities reveal how comfortable we are with a passage. Including a conversation in your awareness while playing is a fun and challenging way to practice listening to multiple things simultaneously.

**How Much Can You See?** – Practice expanding your awareness using all of your senses. While you are playing your piece can you see what is immediately next to your music? While you continue to play, experiment with how much of your peripheral vision you can include. If someone were to hold up a number to the side of your body, could you see it? What about the ceiling? Are you aware of the size of the room as you play? All of these questions help use vision to expand awareness.¹⁰³

**Feel the Space** – Where do you hear the sound of the cello coming from? Do you hunch over and tilt your head to hear it emanating from the f-holes, or are you aware of it filling the entire room? Practice expanding your attention to include your entire room.

¹⁰³ Adapted from Barry Green and W. Timothy Gallwey, *The Inner Game of Music*. 
When you play can you feel the sound resonating all the way to the ceiling? How about behind, in front, and even through the floor boards? Try feeling the space beyond the room. Are there other floors beneath or above you? How does your awareness of pitch change if you imagine yourself in your teacher’s studio, or on the concert stage?
Conclusion

The preceding chapters present a system for the categorization of approaches to learning consistent intonation. For the benefit of cello students and teachers, the component sub-skills of the complex task of playing in tune are explained and discussed. The formation of mental representations and the ability to form auditory images are important considerations before playing the note. While we play the note, the faulty understanding of the distance between notes, or mechanics of the body, or unnecessary tension can all impede the ability to play consistently in tune. After the note, the cellist needs to listen to the sound they produced and adjust as needed. Finally, all of these skills need to be combined into a single action that is trained to be a habit.

The order of tasks presented in this paper at first glance appears to be chronological. The sequence is also reflected in the loop of imagine, play, reflect examined in Chapter 4. But in performance the separation between the sub-skills disintegrates and they happen virtually simultaneously. In motor learning this phenomena is referred to as co-articulation. “With practice, such movement sequences become fluent and almost automatic and individual elements in the sequence may overlap temporally.”

An alternative approach is examining when various skills might be introduced pedagogically. This takes the sub-skills presented in the paper and puts them into a method. “One of the principal variables that distinguishes the teaching of truly expert artistic teachers is not so much experts’ knowledge of how to teach, but their ability to

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reliably identify what to teach right now, at each moment in the learning process.”

Understanding how sub-skills scaffold on one another facilitates the quick identification of areas for improvement. Morrison and Fyk’s hierarchy of intonation skills is depicted in Figure 5.

This approach is valuable because it connects the ability of the student with what aspect of intonation to focus on, and how to address it. But it is limited because it doesn’t effectively illustrate how to progress from one stage to the next. Furthermore, it diminishes the importance of refining skills such as pitch discrimination at every level of musical development.

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In the chart below the sub-skills presented in this paper are grouped in a pedagogical hierarchy. This order may not be the same for every individual, but it provides an illustration of how the various aspects of intonation build on each other. The skills of awareness rely on the control of the pitch, which in turn rests on fundamental aspects of intonation. This hierarchical structure suggests an order for the presentation of skills. It also provides a system for quickly pinpointing obstacles to playing consistently in tune.

<table>
<thead>
<tr>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic Familiarity</strong></td>
<td><strong>External</strong></td>
</tr>
<tr>
<td>• Begin pitch discrimination between notes</td>
<td>• Discover proper body position at the instrument</td>
</tr>
<tr>
<td>• Form mental representation based on external sources</td>
<td>• Practice pitch manipulation ability (pitch matching)</td>
</tr>
<tr>
<td><strong>Gaining Control</strong></td>
<td><strong>Expanding Awareness</strong></td>
</tr>
<tr>
<td>• Refine discrimination between tones</td>
<td>• Be aware of pitch while playing</td>
</tr>
<tr>
<td>• Hear before you play (audiation)</td>
<td>• Audiate both melody and harmony</td>
</tr>
<tr>
<td>• Become physically relaxed (body mapping)</td>
<td>• Tap into kinesthetic sense</td>
</tr>
<tr>
<td>• Shape mental representation of the size of intervals on the cello (fingerboard mapping)</td>
<td></td>
</tr>
</tbody>
</table>

Intonation has long been a challenge for cello teachers and students. Despite an ever-increasing repertoire of etudes and exercises to address the issue, it remains a sensitive subject for many performers. Even in professional ensembles “Dealing with bad intonation is a bit like coping with people with bad breath – you tend not to mention it too obviously!”\(^\text{107}\) The stigma around the topic can make it even harder to develop. By breaking it down into component sub-skills, tackling intonation issues is much more...

manageable. This approach facilitates identifying obstacles and choosing practicing strategies. It provides an organization for understanding the effectiveness of rehearsal techniques, many of which could not be included in the paper. Finding consistency of intonation through its component sub-skills has enabled me to make significant improvement in my own cello playing. Mastering and employing the ideas presented in this paper can take a lifetime (or more), but my hope is that this approach to intonation provides specific guidance that leads to concrete progress.
References for Part I


Part II

Five recitals in partial fulfilment of Doctor of Musical Arts Degree at the University of Kentucky

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Cello Masquerade Recital with Jerram John, Piano
April 18, 2015, Niles Gallery, 3:30 P.M.

Program:

“Masks” from *Romeo and Juliet*  
Sergei Prokofiev (1891-1953)  
Arr. Daniel Hoppe

*Vocalise*  
Francis Poulenc (1899-1963)  
Arr. Daniel Hoppe

*Divertimento*  
Joseph Haydn (1732-1809)  
Arr. Gregor Piatigorsky

-INTERMISSION-

*Three Preludes*  
George Gershwin (1898-1937)  
Arr. Jascha Heifetz

-INTERMISSION-

*Fantasiestüke*  
Robert Schumann (1810 – 1856)  
Arr. Unknown

*Arpeggione Sonata*  
Franz Schubert (1797 – 1829)  
Arr. Anonymous
“Masks” from *Romeo and Juliet* by Sergei Prokofiev (1891 – 1953)

arranged by Daniel Hoppe

Prokofiev established himself as a “controversial innovator”\(^\text{108}\) while still a student at the St. Petersburg Conservatory. His early compositions took up the tradition of Russian romanticism and pushed it to a point of exaggerated caricature. Although conservative critics decried his music, Prokofiev made a name for himself as a leading composer of his generation. The premiers of his *Piano Concerto No. 2*, in 1913, and *Scythian Suite*, in 1914, were sensations. When the Soviet government rose to power in 1918, Prokofiev applied to Anatoly Lunacharsky, the cultural commissioner, for permission to go abroad. He was granted a passport and was told “You are a revolutionary in music, we are revolutionaries in life.”\(^\text{109}\) Even while living in the West for nearly two decades, Prokofiev felt his music was giving shape to a break with tradition. His compositions at times reflect the trend towards the neo-classical, but always retain a modern edginess. Regarding the *Classical Symphony* written in 1917, Prokofiev wrote: “I thought that if Haydn were alive today he would compose just as he did before, but at the same time would include something new in his manner of composition. I wanted to compose such a symphony: a symphony in the classical style.”\(^\text{110}\)

Prokofiev wrote the ballet *Romeo and Juliet* in the summer of 1935, immediately following his return to the Soviet Union from living abroad. The original ballet was non-


\(^{110}\)Dorothea Redepenning, “Prokofiev, Sergey.”
traditional, and included an alternative ending in which the lovers survive. But this did not sit well with Soviet traditionalists and Prokofiev was forced to revise both the plot and the music to fit into a more classical conception of ballet. It was eventually premiered in 1940. “Masks” depicts Romeo, Benvolio, and Mercutio donning masks to crash the masquerade ball at the house of the Capulets. The music is full of playful energy depicting the high spirits of the revelers. It is accompanied throughout by an insistent boom-chick rhythmic ostinato alluding to the power of fate. In the orchestral version, the melody is passed around between strings and winds (and the brass in the trio section).
Vocalise by Francis Poulenc (1899 – 1963)
arranged by Daniel Hoppe

Francis Poulenc was an avant-garde composer and pianist in Paris in the first half of the twentieth century. He is most famous for his association with ‘Les Six,’ a group of composers that also included Darius Milhaud, Arthur Honegger, Georges Auric, and Louis Durey. These composers all took inspiration from Erik Satie and wrote music influenced by neoclassicism with an edge of satire. Their compositions are typically tuneful and have an “entertaining simplicity.”\(^{111}\) Although music history often groups them together, each composer had a distinctive compositional voice. Poulenc’s music is informed by the French chanson tradition and is powerful in its simplicity and directness. Despite his personal struggles with depression and internal conflicts over his homosexual identity, his compositions have a refreshing clarity of form and harmonic material that pairs well with the naturalness of his melodic phrases. In a letter written in 1942 he commented about his traditional use of harmony, saying: “I know perfectly well that I'm not one of those composers who have made harmonic innovations like Igor [Stravinsky], Ravel or Debussy, but I think there's room for new music which doesn't mind using other people's chords. Wasn't that the case with Mozart–Schubert?”\(^{112}\)

Vocalise was first published in 1927 as the eighty-ninth piece of the ninth volume of the series Répertoire Moderne de Vocalises-Études. These volumes (ten in all published by Alphonse Leduc) drew contributions from leading composers of the time.

\(^{111}\) Craig Wright and Bryan Simms, Music in Western Civilization (Schirmer Cengage Learning: 2010), 660.
Faure, Ravel, Villa-Lobos and Nielsen all wrote songs without text for the publication. Poulenc's contribution is originally scored for high voice and dedicated to the memory of the singer Evelyne Brélia. It has a range extending an octave and a fifth, reaching from F above middle C to a high B. Beyond its extremely high tessitura, the piece is marked by large, expressive intervals and soaring phrases. It was premiered in Paris in 1928 by Jane Bathori. In this arrangement, I have left most of the piece at pitch, only playing a few passages an octave lower to provide greater contrast.
Divertimento by Joseph Haydn (1732 – 1809)
arranged by Gregor Piatigorsky (1903 – 1976)

Gregor Piatigorsky attributed the composition of this piece to Joseph Haydn, but it is only loosely based on two of Haydn's baryton trios. The original music was written in the early 1770s while Haydn was working in Austria-Hungary at the Esterhazy estate. The baryton is closely related to the viola da gamba, but is distinctive in its six or seven bowed strings as well as ten sympathetic strings behind the neck that can be plucked by the thumb of the left hand. This multitude of strings provides the baryton with a very resonant sound and with a somewhat brighter tone than other instruments such as the violin or viola de gamba. Because Prince Esterhazy played the baryton, Haydn wrote prolifically for the instrument, completing over a hundred and fifty trios featuring the baryton.

Piatigorsky made the arrangement in the nineteen thirties in an effort to balance his revulsion for "ungrateful" works and his need for encore pieces. In turning to Haydn's compositions he drew on music of exquisite craftsmanship. His alterations keep the spirit of the original but dramatically increase the level of technical virtuosity required. The “Adagio” and “Allegro di molto” are based on Hob. XI 113. But, while the former is only altered with a few melodic embellishments, the latter takes after its source only in its use of a sequential pattern. The middle movement, “Menuetto,” stems from Hob XI 95. The cello part in the trio section of this movement is entirely the work of Piatigorsky. The re-composition of Haydn's original pieces goes so far that it is almost

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unrecognizable. Exactly how Piatigorsky choose what material to use is a mystery. Jeffery Solow, a former student of Piatigorsky during his tenure at the University of Southern California, claims it came directly from Haydn’s original. However, it is also possible it stems from an arrangement for string trio by Richard Heuberger.\textsuperscript{114} Regardless, Piatgorsky’s arrangement retains the charm of a composition by Haydn and incorporates the romantic flair of a twentieth century virtuoso. The music was first published in 1944 and eventually recorded in 1963, accompanied by Heifetz as concertmaster of the orchestra.

\textsuperscript{114} Henk Lambooij and Michele Feves, \textit{A Cellist’s Companion: A Comprehensive Catalogue of Cello Literature} (Lulu.com, 2007), 429.
“Preludes No. 1 & 2” from Three Preludes by George Gershwin (1898 – 1937)
arranged by Jascha Heifetz (1901 – 1987)

The compositions of George Gershwin are situated in between the world of classical western art music and American popular music of the 1920s. His career progressed from playing Tin Pan Alley tunes to being accepted as a composer for the concert stage. Gershwin forged a place for his compositions in music history and in audiences’ hearts by combining elements of jazz with those of classical music. His first success on this front was Rhapsody in Blue, premiered in 1924. After this breakthrough, he focused less on show tunes and more on composing for the concert stage. He wrote the Concerto in F for piano and orchestra in 1925 and the Preludes in 1926, followed two years later by a triumphant tour of Europe and the composition of An American in Paris.

Though reportedly a mere sampling of his preludes for solo piano, Gershwin only submitted these three for publication. Perhaps it was because he preferred these the most. Kay Swift, a composer and friend of Gershwin’s, recalls that "he loved to play the three preludes and included them, whenever he could, on programs that were just a little bit too short! They're easy to ruin, you know. Most people play the fast ones too fast and the slow one too slow."\(^{115}\) They first appeared in 1926 on a recital featuring Peruvian contralto Marguerite d'Alvarez singing Gershwin's songs.

Like Gershwin, other musicians regarded these works as an exciting way to round off a program. The preludes have been arranged for many other instruments. One of the

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most famous is that done for violin by Jascha Heifetz. The two musicians were close friends, and Heifetz tried to get Gershwin to compose something for the violin. However, the composer’s untimely death in 1937 made this impossible. Heifetz arranged these preludes five years later.

This version for cello originates from Heifetz’s edition. Like the arrangement for violin there are considerable additions to Gershwin’s original in order to better showcase the technical mastery of the instrument. Fortunately, it retains the jovial spirit (Prelude No. 1) and singing melodicism (Prelude No. 2) that made the pieces popular.

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1849, the year he wrote the *Fantasiestücke*, Op. 73, was a tumultuous time for Robert Schumann. Living in Dresden with his wife Clara, he was in close contact with the volatile Richard Wagner, who was then working at the court theater. In the spring of that year political upheaval caused Wagner to flee into exile, but it spurred Schumann’s creativity. In 1849 Schumann composed over 40 works including the *Manfred Overture*, *Drei Romanzen*, *Fünf Stücke im Volkston*, as well as *Adagio and Allegro*. He observed in a letter that “it seemed as if the outer storms compelled people to turn inward.”

These three short character pieces originally appeared under the title: *Soireestücke*, or pieces for an evening of music. Each one feels just as intimate as that title suggests. Along with the sudden contrasts of character which characterize all of Schumann’s music, there is a dynamic interplay between the two instruments. The parts are exquisitely intricate. The piano and cello move fluidly between playing in dialogue and as one voice. The rhythm, too, is one moment contrasting and the next complementary. Schumann’s fictitious characters Florestan and Eusebius are also evident. The opening of the last piece, “Rasch und mit Feuer,” provides one example. The two instruments begin with a flurry of notes leading up an arpeggio (Florestan) and immediately follow this with a lilting quiet melody (Eusebius). All three pieces exhibit this rise and fall of emotion. Schumann effectively conveys the sense that something

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deeply personal is just below the surface of the music trying to get out, but never quite succeeding to appear. This feeling is supported by the intimate exchange between the instruments, the ebb and flow of tempo and dynamics, and the sudden appearance of new themes.

The piece was originally scored for clarinet and piano, but Schumann included a note that it could be played on cello or violin as well. Many of the other short character pieces he wrote that year include optional orchestration. It is possible that this was for financial reasons, to interest more musicians in purchasing the music. It could also be a byproduct of the music’s function. Intended as a piece to be played amongst friends at a social gathering, it makes sense to allow for flexible instrumentation so that whoever is available that evening can participate. Schumann recounts in his diaries fond memories of hearing the violinist Ferdinand David and Clara Schumann play these pieces. The passion and energy of the music are evident no matter on what instruments it is performed.
Arpeggione Sonata by Franz Schubert (1797 – 1829)

The Arpeggione is a six-stringed fretted instrument invented in 1823 by Georg Staufer in Vienna, although Peter Teufelsdorfer, of Pest, also claimed credit. Combining the tuning of a guitar with the bow technique of a cello, the instrument was first known as ‘the bowed guitar.’ It got its current name because of the widespread popularity of Schubert’s Arpeggione Sonata, which he wrote in 1824 for his friend Vincez Schuster, the best known major performer for the instrument. Its construction is well suited for playing fast runs and arpeggios, and these are featured prominently in the piece. By the time the piece was finally published, in 1871, the fad of the arpeggione had already passed and the publisher included versions for violin and cello in their printing.

Schubert spent his short life living in Vienna where his family was well connected in the artistic and aristocratic circles. His family provided a rich musical environment for the young composer. Around 1811 they started playing string quartets together. This intimate music making would mark all of Schubert’s compositions. This quality is also reflected in the genre he is most famous for, the German lied. In 1815 he wrote 145 songs for a wide range of vocal types and with text from many different poets. Throughout his career, Schubert would compose short beautiful pieces for his friends. Like the Arpeggione Sonata, many of these would only be published posthumously. These pieces were intended for his friends, to be performed at reading parties. These social events were formally started in 1822 by Franz von Schober, who gathered Schubert’s many friends and acquaintances to make music together. Although Schober’s reading circle was short lived due to its inclusion of an unmanageable number of people, others groups sprung up
in its place. Schubert was very happy amidst all of this socializing. But he struggled with his health, beginning with an illness in 1822, and the loss of good friends such as Schober, who moved away from Vienna. The *Arpeggione Sonata* reflects Schubert’s vocal approach to music. Every movement features long songful melodies. The transition between the “Adagio” and the “Allegretto” contrasts the feeling of nostalgia with one of joyful contentment.
Three Hundred Years of Cello Music with Zixi Ren and Hye Jin Yeom, Piano
November 23, 2015, Auditorium at Chandler Hospital, 7:30 P.M.

Program

Suite No. 3 in C major
Prelude
Allemande
Courante
Bourrée 1 & 2
Gigue

Johann Sebastian Bach
(1685 – 1750)

-INTERMISSION-

Sonata, Op. 102 no.2
Allegro con brio
Adagio con motto sentiment d’affetto (attacca)
Allegro fugato

Ludwig van Beethoven
(1770 – 1827)

Sonata pour Violoncelle et Piano
Prologue
Sérénade et Finale (attacca)
Finale

Claude Debussy
(1862 – 1918)


Suite No. 3 in C major by Johann Sebastian Bach (1685 – 1750)

When exactly Bach wrote this suite is an historical mystery. Bach’s manuscripts of the six suites were originally bound together with the Violin Sonatas and Partitas, but through the vagaries of time, the two were separated and the cello suites subsequently lost. It is generally assumed Bach wrote the pieces around 1720 when he finished the pieces for violin. Musicologists point to Bach's compositional duties in Cöthen to date these pieces. Bach worked for the Cöthen court from 1717 until 1723 where the Calvinist Prince Leopold didn’t require any music for the church service. As a result, most of Bach’s compositions from this time are for secular occasions. The Brandenburg Concertos as well as The Notebook for Anna Magdelina Bach are two of the most famous pieces written during this time of his life.

Even though they were written before the wide-spread adoption of the cello in Germany, they remain a fixture of the unaccompanied repertoire. Each suite is comprised of a collection of stylized court dances introduced by a prelude. Although removed from their role as dance music, the movements retain the form and rhythmic energy of their origins. They also demonstrate Bach’s compositional mastery. In the suites, he wrote in such a way that both melodic lines and harmonic structure can be heard on the solo instrument. He creates moments of call and response (the Bourrees of the third suite provide an example) and even a fugue in the prelude to Suite No. 5. Discovering these compositional details is an important aspect of preparing these works. Because there is no manuscript, it is the responsibility of each performer to determine what bowings to use to best reflect the exquisite structure that Bach gave the pieces.
Suite No. 3 for Cello is marked by its resonant key of C major and jubilant character. The Allemande is of particular interest because, in contrast to the movement’s role in the other suites, in this piece it is upbeat and joyous.
Beethoven’s compositional output is typically divided into three stylistic periods. His compositions from the last twelve years of his life are characterized by a considerable increase in the sense of musical drama and innovative uses of form. The two cello sonatas of Op. 102 were some of the first works to exhibit this new style. An 1818 review of the sonatas captures both the reverence with which Beethoven had come to be viewed in Vienna and the simultaneous inaccessibility of many of the compositions from his late period. “The two sonatas elicit the most unexpected and unusual reactions, not only by their form but by the use of the piano as well….We have never been able to warm up to the two sonatas; but these compositions are perhaps a necessary link in the chain of Beethoven's works in order to lead us there, where the steady hand of the maestro wanted to lead us.” By 1815, Beethoven had become a famous composer. This in part was due to the wide success of his *Battle Symphony*, the most financially successful of his pieces, written in 1813, as well as his seventh and eighth symphonies (1812). These major works allowed him some measure of financial security and the freedom to turn towards his artistic vision. The cello sonatas of Op. 102 and the *Hammerklavier* sonata two years later are marked by an increase in compositional complexity.

In his fifth cello sonata, Beethoven plays with how the cello and piano fit together. Listeners of the time would have expected clear sections of call and response contrasted with unison playing. However, in the fifth sonata the two instruments feel as though they are continually moving in and out of phase with one another. Call and

response is still contrasted with unison; but, instead of allowing each instrument to present complete phrases, Beethoven overlaps motives, significantly heightening the tension. This is present throughout the first two movements, and takes its full form in the last movement, a fugue that challenges both performer and audience by its strange metric placement and harmonies. The reviewer in the Allgemeine Musikalische Zeitung even made special note of the difficulty of the piano part and the extreme need for the cellist to retain a strong sense of pitch and pulse.
Sonata pour Violoncelle et Piano by Claude Debussy (1862 – 1918)

Depressed by the Great War and the death of both mother and mother-in-law, uncomfortable and troubled by health issues, and concerned about financial pressures, the last years of Debussy's life were not happy ones. His internal conflicts come out in his music, particularly in the Cello Sonata. A proposed subheading for the piece was "Pierrot argues with the moon." Pierrot, the naive fool of the Baroque commedia dell'arte, is closely connected with the moon, which is often presented as his only friend. Their argument reflects a man in conflict with himself. In the music, this can be heard in the sudden juxtaposition of characters and the frequently ironic melodic fragments in the final two movements. These elements jump out through the wide variety of sounds that Debussy asks for. The “Sérénade” begins with short pizzicatos that are to be played lightly and with fantasy. From that opening Debussy switches rapidly from arco to pizzicato, from normal bowing position to playing over the fingerboard or next to the bridge. These extended techniques greatly expand the color of the piece, and make each character leap off the page. As a prelude, Debussy presents a beautifully mournful monothematic sonata movement. While the last two movements are highly dramatic and move quickly between melodies and sounds, the first movement is more traditional in approach. The clarity of the musical form in this movement is connected to the neo-Baroque trend that swept through European music as a response to the atrocities of war. It also serves to transport the audience back in time, and sets the stage for the drama of Pierrot arguing with his friend the moon that enfolds in the final movements.

There are very few works from the last years of Debussy’s life. He wrote only one piece during 1914. But during the summer of 1915 he felt inspired. In July, he informed
his publisher of his intention to write six sonatas. The cello sonata was the first of this series of “Six sonates pour divers instruments.” He finished the second, a sonata for flute, viola and harp, that same year. At this time he also began Etudes for solo piano.

However, shortly after this summer spent on the English Channel at Pourville, Debussy’s cancer worsened and his health went into a rapid decline. He only completed one more sonata from the set of six, scored for violin and piano, before his death in 1918.
**Why Kodály?**

*Exploring Kodály’s Sonata, Op. 8 in the Literature for Solo Cello*

Lecture Recital Handout
The Niles Gallery, May 1st, 2016

**Program:** Excerpts from:

Bourée I from *Suite No. 3*  
J. S. Bach (1658-1750)

Caprice #6 from *6 Caprices pour Violoncelle*  
Adrien – Francois Servais (1807-1866)

Präludim from *Suite No. 1*  
Max Reger (1873-1916)

Prelude from *Suite No. 1*  
J. S. Bach (1658-1750)

“Hej, a mohi hegy boranak” from *Capriccio*  
Zoltán Kodály (1882-1967)

Etude #1 from *21 Etudes pour Violoncello*  
Jean – Louis Duport (1749-1819)

Courante from *Suite No. 3*  
J. S. Bach (1658-1750)

Sonata Op. 8, for Violoncello solo  
Zoltán Kodály (1882-1967)

Kodály’s sonata for solo violoncello enriches and expands the tradition of solo cello music by combining, within the framework of traditional classical forms, the influence of Hungarian folk music, a vast array of cello techniques, and creative and varied solutions to the challenge of writing for a single instrument.

**Form of Kodály’s Sonata:**

<table>
<thead>
<tr>
<th>Mvt. 1: Sonata-Allegro Form</th>
<th>1st Theme</th>
<th>2nd theme</th>
<th>Development</th>
<th>Recapitulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B – Aeolian</td>
<td>Eb is tonal center</td>
<td>False return of main theme in C#</td>
<td>Second theme inly now B is tonal center</td>
</tr>
<tr>
<td>m.1</td>
<td>31</td>
<td>79</td>
<td></td>
<td>153</td>
</tr>
</tbody>
</table>

**Mvt 2: Arc Form:**

<table>
<thead>
<tr>
<th>Mvt 3: Expanded Sonata Form:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section A</td>
</tr>
<tr>
<td>Alternates between bass and soprano theme</td>
</tr>
<tr>
<td>53</td>
</tr>
</tbody>
</table>

**Exposition – First Theme stated in opening, second theme marked by D drone**

**Development – Extensive Cadenza like passages, also includes reference to second movement**

**Recapitulation – First theme returns with chords, second theme now uses B drone**

**Coda – Elongated and serves as a second development**

174 420 567
After the Bach suites were written in c.1720 nearly two hundred years passed before the next major concert piece for solo cello; Kodály’s *Sonata* Op. 8 (written in 1915, premiered by Jenő Kerpely in 1918, published in 1921).

**What happened during those two hundred years?**

Noteworthy compositions for solo cello written after Bach’s Suites:

- **J.L. Duport:** *21 Etudes pour Violoncello* published as part of in 1770. Duport (1749-1819) was one of the first to provide a systematic approach to fingering and bowing.

- **Dotzauer:** *Six Amusements* Op. 90 (published after 1823); *Le dessert musical, piece brilliant*, Op. 112 (published in 1830s); *Variationen on Nel cor piú-Mich fliehen alle Freuden*, Op. 183 (published 1853). Friedrich Dotzauer (1783-1860) published hundreds of etudes and studies, in particular he emphasized a wide variety of articulations.

- **A.F. Servais:** *6 Caprices pour Violoncelle* composed in 1851. Servais (1807-1866) helped popularize the use of an endpin around 1845.

- **C. Schuberth:** *6 Caprices de Concert* (1841). Schuberth (1811-1863) was a student of Dotzauer, Director of Music at the University of St. Petersburg and teacher of Karl Davidov.

- **F. Battanchon:** *Quatre pièces caractéristiques* (1895). Battanchon (1814-1893) French cellist-composer and teacher at the Paris Conservatory.

- **D. Popper:** *Präludim* (date unknown); *Hohe Schule des Violoncellspiels* (1901-1905). Popper (1843-1913) was a great Hungarian pedagogue. He was cello professor at the Liszt Academy in Budapest while Kodaly was a student. Jenő Kerpely and Adolf Shiffer (his replacement as cello professor in 1913) both studied with him and were undoubtedly familiar with his etudes.

- **J. Klengel:** *Kaprizi in Form einer Chaconne unter freier Benutzung eines Themas von Robert Schumann* (1905). Klengel (1859-1933) was a leading cellist of his generation. Helped popularize the Bach suites as concert pieces.

Pablo Casals (1876-1973) began public performances of the Bach suites in 1899, and along with Julius Klengel and Hugo Becker helped popularize them as concert pieces. This inspired:

- **E. Moór:** *Suite*, Op. 122, 1913. Emánuel Moór (1863-1931) dedicated the suite to Pablo Casals.


- **Tovey:** *Sonata, Op. 30*, 1913. Sir Donald Tovey (1875-1940) was a close friend of Casals. He dedicated the Sonata to Percy Such, another champion of the Bach suites.
Why Kodály?: Exploring Kodály’s Sonata, Op.8 in the literature for solo cello
Lecture recital May 1, 2016

Lecture Monograph

Playing Demonstration: Bourée No. I from Suite No. 3 by J.S. Bach

My talk today explores the role of Zoltan Kodaly’s Sonata Op.8 in the repertoire for unaccompanied violoncello. The most important compositions for solo cello are Bach’s six cello suites. These suites were written between 1718 and 1723 while Bach was living in Cöthen, Germany. After their composition, nearly two hundred years passed without any other significant contributions for an unaccompanied cellist. Then, in 1915, Kodaly wrote his Sonata. According to Gordon Kinney, the Kodaly sonata is second only to the six Bach suites in terms of frequency of performance. After Kodaly wrote the piece he predicted its success. He told the cello professor at Liszt Academy, Adolf Schiffer, that “in twenty-five years no cellist will be accepted into the world of cellists who does not play my piece.” That is quite an extraordinary claim, considering that the technique demanded of the performer was, and still is, a significant challenge. Even the person who premiered the work in 1918, Jeno Kerpely, struggled playing it. Though he was an internationally established cellist who had performed other works by Kodaly and Bartok, eyewitnesses at the premiere said that Kerpely “lacked the technique necessary for an accurate performance.” Kodaly’s claim in this light seems farfetched. And it did take a long time for the piece to become established. Due to the political climate in Hungary, Sonata, Op.8 wasn’t published until 1921. After that it was still slow to enter

the cello repertoire until it was championed by Janos Starker. He began performing the piece in 1939 and first recorded it in 1947. After Starker, other cellists began to perform the piece regularly and it has since become a standard part of the literature for solo cello. Although not quite reaching the heights that Kodaly predicted, it is certainly expected that all advanced cello students become familiar with the work.

However, this piece wasn’t the only composition for solo cello written around that time or during the two hundred years since Bach wrote his suites. It’s led me to wonder: “What about this piece has made it such an important part of the repertoire? And, why does it stand out so brilliantly compared to everything else written at that time and since the Bach suites?” In my research and process of learning this sonata, I have found that the piece truly enriches and extends the repertoire by taking existing techniques to new levels and by approaching the instrument from a fresh perspective. The piece does this by combining, within the framework of traditional classical music forms, elements and influences of Hungarian folk music, a vast array of cello techniques, and creative and varied solutions to the challenge of writing for a single instrument.

Before we get to Kodaly’s Sonata, it’s important to explore what was happening in this two-hundred-year period. When Bach wrote his suites, the cello was just beginning to replace the viola da gamba in Germany and performers needed to figure out what this new instrument was capable of. The avenue they chose to do this was by writing studies and etudes, both to improve their own technique and to teach their students. The first such work was compiled by Antonio Caldara prior to his death in 1736 in the volume “Letioni per il violoncello con il suo Basso.” Since then numerous examples have appeared under a wide range of titles. Jean Louis Duport’s 21 Etudes pour
Violoncello and David Popper’s *Hohe Schule des Violoncellspiels* are still widely in use. Others, such as Felix Battanchon’s *Quatre pièces caractéristiques*, don’t call themselves etudes at all. In the two hundred years before the Kodaly *Sonata*, Op. 8, compositions for solo cello were published as etudes, caprices, concert etudes, variations and preludes, and, especially in the 1800s, with programmatic titles such as “The Storm” or “The Chase.” Regardless of their titles, all of these works share similar traits that allow us to group them together and fit them into a larger trend of etude studies.

The first is that they were written primarily for pedagogical purposes, intended for the teaching studio rather than the concert stage. The second is that they focus on a limited number of cello techniques. Etudes explore a certain aspect of cello playing. In the case of variations, it is common for each variation to emphasize a particular technique. Lastly, compositions of this type use simple structural forms and compositional techniques. The majority of them are in binary form, and they primarily rely on the device of sequence to shape the composition. Servais’ *Caprice No. 6* provides one example. In this piece he requires the cellist to practice crossing strings. After establishing a pattern, he uses sequences to draw out the composition to two pages.

**Playing Demonstration: Francios Servais’ *Caprice*, No. 6**

The emergence of concert pieces for solo cello is tied to the resurgence of Bach’s six suites. In the eighteenth and nineteenth century, the Bach suites were grouped together with study etudes and were not performed in public. Instead, they were treated as pedagogical pieces. It wasn’t until 1899 that Casals began public performances of the Bach suites. And, along with the German cellists Julius Klengel and Hugo Becker, popularized them as concert pieces. This sparked composers’ interest in writing concert
pieces for solo cello. Emánuel Moór’s *Suite* Op. 122 (1913) Max Reger’s *Drei Suiten*, Op. 131c (1915) and Sir Donald Tovey’s *Sonata, Op. 30* (1913) are all examples. These compositions are indebted to Bach’s cello suites. Most of them reflect this through their dedications, but the Reger suites also show Bach’s influence compositionally. The two pieces share a similarity in their use of perpetual sixteenth notes and the pedal point on G. These commonalities directly connect Reger’s *Suite No. 1* to Bach’s compositions.

**Playing Demonstration: Max Reger’s “Prelude” to Suite No. 1**

**Playing Demonstration: Johan Sebastian Bach’s “Prelude” to Suite No. 1**

Kodaly, however, approaches solo cello music from a different perspective. In 1921, after Kodaly’s *Sonata* was published, Bela Bartok said,

> No other composer has written music that is at all similar to this type of work – least of all Reger, with his pale imitations of Bach. Here Kodály is expressing, with the simplest possible technical means, ideas that are entirely original. It is precisely the complexity of the problem that offered him the opportunity of creating an original and unusual style, with its surprising effects of vocal type, though quite apart from these effects the musical value of the work is brilliantly apparent.¹²³

The possibly hyperbolic insult to Reger’s compositions aside, this quote gives us a lot to unpack. What is so remarkably new and different about Kodaly’s writing in this sonata?

One of the aspects is Kodaly’s use of scordatura. Scordatura is when the composer asks the performer to tune the instrument differently, outside of the normal A₃, D₃, G₂, C₂ tuning. Many scholars have pointed this out as a link between Kodaly’s *Sonata* and Bach’s *Suite No. 5*. However, this is a superficial claim because Bach’s suite tunes down the ‘a’ string to a ‘g’, and in Kodaly’s he asks the performer to tune the ‘g’ and ‘c’ strings to ‘f#’ and ‘b’. Instead of connecting it directly with Bach’s suites, I think

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that the use of scordatura reflects Kodaly’s connection with the larger trend of the Baroque period to experiment with the instrument. This was made particularly famous by Heinrich Bieber in his *Rosary Sonatas*, also known as the *Mystery Sonatas*. It demonstrates that Kodaly was approaching the instrument in a very new way. The reason a composer might ask for scordatura is that it changes the timbre and the resonance of the instrument. And so it becomes a remarkably new thing. The use of scordatura also connects Kodaly’s composition with the traditional music of Hungary.

Another aspect that is new and remarkable, as Bartok claimed, is Kodaly’s use of the Hungarian folk idiom. Beginning in 1905, Kodaly and Bartok went on field trips to the Hungarian countryside in order to collect folk music. They would record songs on wax cylinders. By the time he wrote this sonata, they had collected over three thousand such folk tunes. Both Bartok and Kodaly looked to incorporate these folk elements into their classical compositions.

The appropriate use of this folk song material is not limited to the sporadic introduction or the imitation of these melodies, or to the arbitrary thematic use of them in works or foreign of international tendencies. It is rather a question of absorbing the means of musical expression hidden in this treasure of folk-tunes, just as the most subtle possibilities of any language may be assimilated. It is necessary for the composer to command this musical language so completely that it becomes the natural expression of his own musical ideas.\(^{124}\)

In Kodaly’s *Sonata*, Op. 8 the influence of Hungarian music is evident in the use of modes and the emphasis placed on the interval of an augmented second.

Playing Demonstration: Zoltán Kodály’s Sonata, Op. 8

Another way that Kodaly incorporates the folk idiom is through an accentuation of strong beats, which reflects the Hungarian language. We can hear this by comparing Kodaly’s setting of the song “Hej, a mohi hegy borának” in Capriccio with the melodies found in his sonata.

Playing Demonstration: Zoltán Kodály’s Capriccio

The existence of the Capriccio is interesting for another reason. It was written the same year as Kodaly’s Sonata, and provides a means for assessing why one is a study etude and the other a significant part of the performance repertoire. When it was first discovered it was thought to be an earlier version of the sonata, but it has since come to be accepted as a piece in its own right. But, it is not difficult to imagine Kodaly using this piece as a way to explore what might be possible on a solo instrument. In Capriccio, Kodaly also uses scordatura. He asks for the ‘c’ string to be tuned down to ‘b’. He also employs strong contrasts between lyrical passages and technical ideas. Capriccio exhibits the focus on a single technical device and reliance on sequences characteristic of study pieces. Kodaly’s connection with study etudes also connects to his history.

Growing up in rural Hungary at the end of the nineteenth century, Kodaly taught himself how to play the cello through the use of a manual when he was about ten years

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125This can be translated as “Hey, that wine of Mohi vintage”
old. We don’t know exactly what tutor this was, but it’s undoubtable that it incorporated etudes for the student, or reader, to learn. The tradition of etudes is present in his writing of the Capriccio and in how he learned to play the cello. It is also present in Sonata, Op.8. There are long sections such as that shown in Figure 6. Extending a few measures over another page would easily transform this section into an etude. It uses a single technical idea and sequences it into different positions on the cello. But Kodaly breaks with the tradition of etudes by stitching together different ideas in rapid succession. Instead of continuing with the same idea, Kodaly jumps to a completely new part of the music. What in an etude might be the entire piece, Kodaly uses as just one part of this remarkable sonata. This is one of the most interesting ways in which Kodaly’s Sonata is separated from other pieces written at the time. While other composers were looking at the Bach suites as a model for writing for concert pieces for the solo cello, Kodaly was drawing on the tradition of study etudes. This was a fresh way of approaching writing concert music for solo cello. Even though etudes had been written for over two hundred years, Kodaly took the same elements, extended them further and elevated the piece to the concert stage.

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What elevates this sonata beyond being an etude? What makes it a full and evocative work for the concert stage? One of the most basic reasons is the formal structure. Study pieces rely on simple compositional forms while Kodaly uses sonata form. This gives the piece a more evocative and effective large scale compositional structure than an etude. Sonata form is also typical of composers writing longer, more complex music. Another element is his use of a variety of extended techniques. While etudes focus on one or two single ideas, Kodaly doesn’t limit himself. Some of the techniques Sonata, Op.8 calls for include left hand pizzicato, multi-stop chords, harmonics, sul tastò, sequences of double stops and chords, sul ponticello, tremolo, saltato, trills, and simultaneous arco and pizzicato playing. This variety creates a dynamic and interesting piece with many different sections, sounds, and characters. This same
element of variety, Kodaly applies to his compositional devices. Instead of using sequence as the primary means of development like a study etude, Kodaly uses motifs. In the opening of the third movement, for example, Kodaly introduces a theme, and then develops it in different contexts. This allows him to create a longer and more varied composition.

**Playing Demonstration: Zoltán Kodály’s *Sonata, Op. 8***

Kodaly takes the same sensitivity to contrast and variety in his approach to polyphony. Polyphony is “music in more than one part,” the writing of multiple lines of music simultaneously. This is the unique challenge for any composer writing for a solo instrument. A piece can easily become boring if the music is limited to a single voice throughout. Composers have grappled with the challenge of writing unaccompanied pieces since before Bach’s time. Different composers have used different strategies, but for the cello there are three primary approaches. One device is the use of bariolage, or the quick changing of strings. It can be heard in the Servais’s *Caprice No. 6*. One string becomes a drone and the melody is heard on the other. Another approach is the use of double stops. That is what Jean-Louis Duport uses in his *Etude No. 1*

**Playing Demonstration: Jean-Louis Duport *Etude No.1***

Lastly, there is the approach most often used in the Bach suites, that of using changes of register to separate the voices. This can be heard in the “Courante” from Bach’s *Suite No. 3*.

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Playing Demonstration: Johan Sebastian Bach “Courante” from *Suite No. 3*

These few bars demonstrate how the changes of register create polyphony, or the sense of multiple voices on a single instrument.

Relying on only these three approaches limits compositions for solo cello. Comparing the fugue from Bach’s *Suite No. 5* for cello with a fugue from one of his violin sonatas, it becomes apparent just looking at the page that the polyphonic approach in the violin sonata is much more varied and complex. It relies on more chords, as well as the quick alternation between playing a single string and two simultaneously. In the cello suite, in contrast, the primary means of polyphony is through changes in register.

In Kodaly’s *Sonata*, Op.8 he takes the three polyphonic approaches used in other solo cello music to new extremes. In the last movement of the sonata the range is five octaves. He uses multiple stop chords in quick succession, often writing an entire phrase with four note chords. He also uses contrasting timbres in order to create multiple voices. These differences can be heard in the pairing of arco and pizzicato, and in normal bowing versus sul ponticello. These are just a few examples of how Kodaly elevates this challenge of polyphony in this sonata. All of these elements together create a really remarkable piece that is not just a collection of technical studies, but a moving artistic composition. As Bartok said “the musical value of the work is brilliantly apparent.”

Kodaly takes the existing practices to a new extreme, and approaches the instrument in a new way. The piece’s prominent place in the literature for solo cello is a testament to Kodaly’s creative approach to the composition of his *Sonata*.

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The Florid and Fiery Jarrem John, Piano and Loren Tice, Harpsicord  
October 23, 2016, Singletary Center Recital Hall, 7:00 P.M. 

Program

<table>
<thead>
<tr>
<th>Piece</th>
<th>Composer</th>
<th>Composer Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegro ma non troppo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adagio – Presto Adagio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allegro appassionate</td>
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</tbody>
</table>

| Suite for Solo Violoncello                | Gaspar Cassado            | (1897 – 1966)    |
| Prelude – Fantasia                        |                           |                  |
| Sardana (Danza)                            |                           |                  |
| Intermezzo e Danza Finale                 |                           |                  |

-INTERMISSION-

| Sonata for Viola da Gamba in G minor, BWV 1029 | Johann Sebastian Bach  | (1685 – 1750) |
| Vivace                                       |                          |                |
| Adagio                                       |                          |                |
| Allegro                                      |                          |                |

| Introduction and Variations on ‘Dal tuo stellato soglio’ from Moses in Egypt by Rossini | Niccolo Paganini | (1782 – 1840) |

In 1924 the esteemed Curtis Institute of Music opened its doors and enrolled 357 students, among them the fourteen-year-old Samuel Barber. Barber thrived in this rich musical environment and stayed for a decade. He entered as a piano student, having started on the instrument at the age of six, and he quickly added two more majors, composition and voice. His teachers noted his sensitive musicianship. On his first report card his piano teacher, George Boyle, wrote “Astonishingly musical insight and a very extraordinary gift for composition.” Guiding him with his “extraordinary gift” was Rosario Scalero. It is to him that Barber’s Cello Sonata, Op. 6 is dedicated, and the years of training in harmony and counterpoint that Scalero demanded of his student are evident.

The sonata was written in the summer and fall of 1932. It was premiered shortly thereafter in New York by the cellist Orlando Cole with Barber at the piano. Cole had started at Curtis the same year as Barber and the two quickly become friends, in part because their names were next to each other alphabetically. As Barber was working on his sonata, the two would sit down and play through a few pages at a time, penning in changes as they were made. This intimacy of composition is strongly reflected in the piece. From the opening of the first movement the exchange of musical motives is evident. The cello and piano echo back and forth emphasizing the interval of a sixth, together creating a long phrase. This intimate ensemble continues in the second movement, when during the “Presto” the two instruments interlock rhythms, demanding

pinpoint accuracy. Encompassing the entire piece is Barber’s beautiful gift for lyricism and a profound structural coherence. Though written by a young man, this sonata is a masterful contribution to the genre.
Compositions for solo cello were seldom composed or performed until the popularization of the Bach suites by Pablo Casals in the early twentieth century. Since then there has been a proliferation of excellent pieces for the instrument, among them this suite. Gaspar Cassado, the son of a composer, was a phenomenal cellist from Barcelona. In 1910 he moved to Paris to study with Casals, who he thought of as his “spiritual father.” During his studies he worked closely with Maurice Ravel and Manuel de Falla. Their influence can be heard in many of the pieces Cassado wrote and arranged for the violoncello. His compositions also reflect his proficiency as a performer. He regularly appeared in concerts with the generation’s leading soloists such as Arthur Rubinstein, Joseph Szigeti, and Yehudi Menuhin. His pieces reflect both his sensitive musicality and consideration for entertaining the audience.

The Suite for Solo Violoncello was written in 1926. The legacy of the Bach suites is apparent in the formal structure of the piece. It begins with a Prelude which is followed by two dance movements. To this structure Cassado added a sense of Spanish flair. There are numerous points that imitate the sound of a guitar and the second movement is a two part Sardana, a Catalanian circle dance. It opens with a slow section that depicts a flabiol, a flute-like instrument, calling the dancers to gather round and join hands before the dance begins. Cassado also refers to Kodaly’s Sonata for Solo Cello (1915). The first movement quotes the sonata almost directly, and the use of folk material and extended techniques further connect the two pieces. The last movement also invokes a Catalanian

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131 Michael Parloff, “Gaspar Cassado,” Program notes for Cassado Suite for Solo Cello, Rafael Figueroa, Parlance Chamber Concerts, October 18, 2009.
dance, the jota. This dance was typically performed in bright costumes and accompanied by castanets. The stereotypical short-short-long rhythm of the castanets gives the final movement a flamenco-like flare that ends the piece with brilliant energy.
Sonata for Viola da Gamba in G minor, BWV 1029 by Johann Sebastian Bach (1685 – 1750)

Johann Sebastian Bach’s Sonata Viola da Gamba in G minor combines many different musical influences. It was written in approximately 1740 while Bach was working in Leipzig. The piece, along with two other sonatas for the viola da gamba, was most likely intended for Carl Friedrich Abel, the son of Christian Ferdinand Abel, Bach's close acquaintance from his time in Cothen. Carl Friedrich was passing through Leipzig in 1740, on his way to London. There, while the viola da gamba was fading in popularity on the continent, he enjoyed a successful career as a gambist. Unlike BWV 1027 and 1028 which are written in the style of a Sonata de Camera, the G minor Sonata looks forward to the emerging style of Italian sonatas. These had three movements, something fast, then one that is slow, and a fast finale. They became the norm for the next generation, replacing the older four movement trend. Within this movement schema, Bach relies on the compositional tools of the Baroque. The two instruments weave intricate lines around each other in expertly written counterpoint.

The first movement of the sonata begins with a strong rhythmic motive and builds through complex contrapuntal writing to a peak of rhythmic unison between the gamba and harpsichord. The second movement is a flowing aria that allows the viola da gamba to soar over the chords of the harpsichord. In the final movement, Bach incorporates a plethora of melodies within intricate polyphony between the voices. With the exception of the expansive feeling second movement, the piece rushes forward in a nearly perpetual
stream of sixteenth notes. This energy draws the listener into a complex musical texture that evokes the feeling of a larger ensemble.

Today these pieces are frequently performed on both cello and viola as well as on the viola da gamba. As the Bach scholar Peter Williams notes “good three-part invertible counterpoint remains good three-part invertible counterpoint no matter how it is scored.”\textsuperscript{132}

Introduction and Variations on ‘Dal tuo stellato soglio’ from Moses in Egypt by Rossini

composed by Niccolo Paganini (1782 – 1840)

Niccolo Paganini was renowned for his technical virtuosity and his magnetic charisma, and he remains among the most famous violinists that ever lived. In his concert performances, Paganini would often show off by purposely breaking his strings until he had only one left. The audience of course thought it was an accident and would leave astounded at the violinist’s facility. Paganini composed many pieces specifically to achieve that effect. His Introduction and Variations on ‘Dal tuo stellato soglio’ from Rossini’s Mosè in Egitto is one such example.

It was written in 1819 along with two other sets of variations on themes by Rossini. At the time Paganini was traveling through Italy on a concert tour. While in Bologna he met Rossini, who was by far the most successful musician of their generation. The two musicians became friends, but Paganini’s choice to use Rossini’s themes was also about marketing. Opera was the most popular genre in the early 19th century and virtuosic players would often use popular arias as a way to display their technical mastery. In the variations on ‘Dal tuo stellato soglio’ the use of only one string, a wide array of bowing techniques, and false harmonics add considerable flare to the composition.

This version was arranged for cello by Pierre Fournier. It transposes the piece to be played on the A string instead of the G string, but even on the larger instrument it doesn’t lose any of its delightful charm and impressive virtuosity. In performance, it combines the soaring melody of Rossini with the showmanship of Paganini. It creates
musical jokes between the cellist and pianist and for the audience in the freedom of timing virtuosic string effects.
Chamber Music Recital
March 8, 2017, Niles Gallery, 7:30 P.M.

Program

Sunrise of a Planetary Dream Collector  Terry Riley
(1935 – )

String Quartet No. 1 “From the Salvation Army”  Charles Ives
Chorale: Andante con moto  (1874 – 1854)
Prelude: Allegro
Offertory: Adagio cantabile
Postlude: Allegro marziale

Verdi String Quartet
Yichi Chiang, violin  Andrzej Kunecki, violin
Austin Han, viola  Daniel Hoppe, Cello

INTERMISSION

Suite for Cello and Jazz Piano Trio  Claude Bolling
I. Baroque in Rhythm  (1930 – )
II. Concertante
III. Galop
IV. Ballade
V. Romantique
VI. Cello Fan

Byron McChord, Piano  Nick Bolchoz, Drums
Joel Murtaugh, Bass  Daniel Hoppe, Cello

Rock Piece  Pauline Oliveros
(1932 – 2016)
Sunrise of a Planetary Dream Collector by Terry Riley (1935 – )

It was written for the Kronos Quartet in 1981, but the material originated from Riley’s 1970’s improvisation and his immersion in Indian music. The piece is made up of 25 modules, all of which are some multiple of 7 beats long. Riley imbues the piece with rhythmic energy. At times, it is perpetuated by repetitive sixteenth notes, at other moments it imitates the tabla, a drum in North Indian Music, or is mixed with “eddies of syncopations and cross-rhythms.”

The overall form of the piece is left to the performers. Originally, Riley had hoped quartets would improvise the composition, from start to finish, but soon realized the challenge this presented for classically trained ensembles. He notated a possible realization of his modules, but still invited ensembles to repeat them as many times as desired and play them in any order, as well as make alterations in octave, bowing, dynamic, and effects. All of this freedom facilitates an intimate collaboration amongst the members of the string quartet as well as between the performers and composer. Preparing for this performance required considerable exploration and improvisation to discover how we wanted the piece to progress. Like all good chamber music, it required listening and reacting not only in our playing, but in the rehearsal process itself.
String Quartet No. 1 “From the Salvation Army” by Charles Ives (1874 – 1854)

The music of Charles Ives is the product of four primary musical influences. Protestant hymns, American Band music, popular tunes, and the European Classical tradition were all significant parts of his life in New England at the end of the 19th century. He grew up next to a congregational church and became one of the youngest church organists in history. The music of Stephen Foster was very popular and frequently played in parlor's around the neighborhood. His father directed the local band, so he regularly heard John Philip Sousa marches. And he studied classical music, eventually matriculating at Yale and working with the traditionalist Horatio Parker.

In String Quartet No. 1, Ives placed tunes from his upbringing into classical forms. Originally the quartet was given the subheading “From the Salvation Army” and drew its primary musical material from hymns, including Beulah Land, Nettleton, Shining Shore, and Stand up, stand up for Jesus. While the first movement, a fugue based on the hymn Missionary Chant, was originally written for organ and later reused in the fourth symphony, the last three movements are tightly connected and depict a revival service. The compositional material rankled Ives’ teacher, Horatio Parker, who advocated for ‘pure music’ and thought “in music they [hymns] should have no place. Imagine, in a symphony, hearing suggestions of street tunes like ‘Marching through Georgia’ or a Moody and Sankey hymn!” Ives wasn’t completely impervious to his teacher’s sensibilities. String Quartet No. 1 falls firmly within the forms of classical music. The last three movements exhibit strong connection of melodic material, including the superimposition of themes in different meters at the end of the fourth movement.
Suite for Cello and Jazz Piano Trio by Claude Bolling (1930 – )

Born in Cannes, France in 1930, Claude Bolling’s first passion was for jazz piano. He developed quickly as a performer and won an amateur competition while only fourteen. It wasn’t long before he was playing with the leading jazz musicians. He had already performed and recorded with the likes of Chippie Hill, Lionel Hampton, Chad Jones, and Buck Clayton all while still in his twenties. His interest in mixing genres is put on display in his compositions for movies such as Jacques Deray’s Borsalino and performances of Duke Ellington’s Black, Brown and Beige and A Drum is a Woman. Still regarded as the premier French ragtime pianist and renowned for his Claude Bolling Big Band, he has also made a significant contribution in the combining of jazz and classical idioms. His 11 cross-over compositions include works for trumpet, guitar, flute, violin, and chamber orchestra. In writing these pieces he collaborated with premier musicians from the classical music world. The flutist Jean-Pierre Rampal, Maurice André for the trumpet suite, and the violinists Pinchas Zukerman and Patrice Fontanarosa were all involved in his cross-over projects.

Suite for Cello and Jazz Piano Trio juxtaposes forms and rhythms of jazz and classical music. The two styles sit side by side in harmony. For the most part the cello plays figures that would be at home in a piece from the Baroque or classical era. Repetitive sixteenth notes and sequenced gestures are interspersed between flowing lyrical lines. The trio provides a counterpoint that strongly reflects Bolling’s jazz roots. It incorporates 12 bar blues, improvisation, and swing all within the frame of standard classical forms. The interaction of these two idioms is at times groovy, at times charming,
and overall a joy to play and listen to. It was written in 1982 and recorded, with Yo-Yo Ma playing cello and Claude Bolling playing piano, in 1984.
Pauline Oliveros was on the forefront of the American avant-garde composers at the end of the twentieth century. She was good friends with Terry Riley while they were both in California. They played in a free improvisation trio together and shared the stage many other times, including for the premier of In C. Oliveros’ music explores new ground for sound creation. Her first compositions were conventionally notated, but she felt limited by the medium. She soon turned to tape music, becoming co-director of the San Francisco Tape Music Center in 1961. Her work with tape facilitated the realization that the recording preserved more than she could hear in real time. As a result, Oliveros started exploring the art of listening, allowing the doctrine “Listen to everything all the time and remind yourself when you are not listening” to guide her artistically. Her explorations coalesced in what she calls “deep-listening,” an approach to music that is grounded in meditation, improvisation, exploration, and connection.

*Rock Piece* (1979) is part of a volume of Deep Listening Pieces published in 1990. These pieces “are dedicated to the understanding that sound is a powerful agent and tool for personal growth, awareness, emotional and intellectual development.” As a performer, I find these pieces are not only a way to explore myself, but invite me to expand my awareness of fellow performers and audience members. In performance, participants of *Rock Piece* are instructed to tap rocks together and purposefully avoid beating in simple subdivisions of those around them. The resulting piece is a kaleidoscope of sounds and shifting patterns as the players move around the room.

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Although every performance sounds different, each time *Rock Piece* is played it facilitates a powerful sense of awareness and attention.
References for Part II


Appendix A

Professional cello teachers with personal connections to the author were recruited to complete a brief questionnaire in order to reflect on current approaches to teaching intonation. The five questions along with a cover page explaining the project were emailed to each participant. The introduction and responses are reproduced below.

Dear Cellist,

Thank you for your valuable time. The following questionnaire is part of a dissertation titled “The Search for Consistent Intonation: an exploration and guide for the violoncellists.” This project aims to collect effective teaching and practicing strategies for gaining precise and consistent control over playing in tune. The document will draw on research in music theory pedagogy, perceptual psychology, music education studies, cello treatises, my own teaching and playing experience, and, with your help, the expertise of cellists around the country. The completed dissertation is expected in the spring of 2017 please let me know if you would like to receive a copy.

The following questionnaire will take less than 30 minutes to complete. It consists of five questions focused on teaching and learning the art of playing in tune. Your response is extremely valuable for better understanding the topic, but you are free to skip questions or not participate. By completing the survey you are agreeing to allow your responses to be included as part of an appendix to the dissertation. These responses will remain anonymous unless you choose to include your name as part of the questionnaire.

Answers may be typed or handwritten. Completed surveys can be returned to me using the contact information listed below. If you choose to return the questionnaire through the mail, postage will be at the participants’ expense.

If you have any questions regarding the survey please feel free to ask; my contact information is given below. If you have complaints, suggestions, or questions about your rights as a research volunteer, contact the staff in the University of Kentucky Office of Research Integrity at 859-257-9428 or toll-free at 1-866-400-9428.

The aim of this questionnaire is to compile the vast knowledge and experience of cello teachers from across the country. It is open to any participants who currently or previously taught cello professionally. If you know anyone else who may be interested in participating in this study please have them contact me.

Thank you again for your time and your contribution to this project.
Sincerely,
Daniel Hoppe
DMA University of Kentucky expected 2017
Response 1: Dr. Minna Rose Chung

What level student do you primarily teach:
(Circle all that Apply)
Advanced Intermediate Beginner Other:___________

What are some challenges you have encountered teaching intonation?

My challenges are vast. Sometimes students simply do not hear western tonality as their “mother- tongue” and why should they? I hadn’t realized this until I realized that my Chinese student, technically well established, seemingly did not “hear” what we perceive as semi-tones and whole steps. Teaching anyone to hear certain pitches stems from their environment and the musical culture in which they have been exposed.

Double stops and chords. Until one understanding the just intonation system and the harmonic sequences including cent deviation from major/minor thirds, sixth, sevenths and semi-tones it’s all just relative. Some musicians hear it innately, others claim to have “perfect” pitch but still can’t play double stops or chords in tune.

How have you overcome them?

Sometimes it is a matter of patience and using Equal Temperament tuning as a guide. I do not find that tuners are helpful, unless a drone is used. (Even in this case, loud drones can be damaging to the ear and desensitize the musician) To understand that pitches are constantly moving around depending on the dominating key, note, or chord tone is vital.

What exercises that specifically address developing consistency of intonation do you use?

I have been working on an Intonation book and Left-hand Technique book, CelloMind with co-author Hans J. Jensen. (Publication to be early this year through Ovation Press). Within this book, we explain what harmonic partials, overtones are and how they line up on the cello. With the cent deviation, one begins to understand the subtle differences between slightly flat, slightly sharp, bang-on pitch. One of the lessons we emphasize in the exercises are hearing vibrations. To begin, we use open strings to guide our ears to hear the beating of vibrations (or in this case, the lack thereof) in unisons and octaves.
We ask the cellist to find the exact placement of a fingered A, D, G, C and listen for “zero” beats.

How have you personally developed your ability to play in tune?

Using this new method of tuning using different intonation systems (most simply, the Equal temperament with keyboard, Pythagorean for melodic tuning, and Just for harmonic tuning) and understanding why certain notes sound in tune, and then suddenly not-so-in tune has given me greater confidence manipulating the pitches to maximize a line or grounding the key.

What do you view as the component skills required for playing in tune?

Not being stubborn with my fingers, trusting my ear and not my tactile finger, conforming to the keyboard when necessary, quick mindedness to adjust. Listen before you play the note.

I greatly appreciate your time and participation. If you would like to include your name as part of your response please print it here:

Minna Rose Chung, DMA
Response 2: Rhonda Rider

What level student do you primarily teach:
(Circle all that Apply)
Advanced  X  Intermediate  Beginner
Other:___________

What are some challenges you have encountered teaching intonation?

The ability to hear oneself and ones intonation while playing.

How have you overcome them?

Work with drones
Exploring how the instrument vibrates when notes are in tune
Being aware of hand position
Being aware of what part of the finger is touching the string

What exercises that specifically address developing consistency of intonation do you use?
None.

How have you personally developed your ability to play in tune?
Slow practice, work with piano, working with a visual tuner, recording myself. I try to play in equal temperament most of the time.

What do you view as the component skills required for playing in tune?
A good ear, sensitivity to the resonance of the instrument, and a consistent left hand shape.

I greatly appreciate your time and participation. If you would like to include your name as part of your response please print it here: Rhonda Rider___________________
Response 3: Hans Jorgen Jensen

What level student do you primarily teach:
(Circle all that Apply)
Advanced: X     Intermediate X     Beginner     Other:___________

What are some challenges you have encountered teaching intonation?

Changing peoples’ mind so that they change how they perceive intonation.

How have you overcome them?

By teaching the theories about the various Intonation systems and then applying that to playing the cello.
I have made a book where Volume I is 18 chapters about Intonation.

What exercises that specifically address developing consistency of intonation do you use?

One of the best is teaching to hear all the sympathetic vibrations on the cello.
As an example the F in the first position when played low activates the 7th partial of the G string.
When raising the pitch so that the F tunes with the C string, the 8th partial of the C string is activated.
Raising it a bit more so that the F tunes with the A string activates the 4th partial on the A string.
Making people aware of all the overtones that can be activated changes fundamentally how people perceive Intonation.
The following is the various chapters in the book about intonation. The book will be published this spring and also have videos that go along with the book.

Part 1: Intonation 1
1 Introduction to Intonation 5
2 The Harmonic Overtone Series 9
3 Tonic Sympathetic Vibrations of the Open Strings 13
4 Cents Explained 19
5 Just Intonation and the Harmonic Series 25
6 Dissonant and Consonant Double Stops 27
7 Just Intonation System for Double Stops 31
8 Just Intonation System for Major Triads 37
9 The Just Scales 47
10 The Pythagorean Comma 55
11 The 24 Enharmonic Pythagorean Pitches 59
12 The Pythagorean Triads 65
13 The Pythagorean Semitones 71
14 The Pythagorean Scales 79
How have you personally developed your ability to play in tune?

I learned it from my parents that would teach me about Just and Pythagorean intonation. They taught it to me intuitively.

What do you view as the component skills required for playing in tune?

The most important is in chamber music settings of knowing when to adjust to the other players and also knowing when to be in charge by playing a solid bass line.

I greatly appreciate your time and participation. If you would like to include your name as part of your response please print it here: ____Hans Jorgen Jensen___________________________________________
Response 4: David Starkweather

What level student do you primarily teach:
(Circle all that Apply)
Advanced         Intermediate         Beginner         Other:___________

What are some challenges you have encountered teaching intonation?
The most significant challenge is when the student has trouble distinguishing what is in tune and what is not.

How have you overcome them?
I have used a variety of approaches:
1. Explaining with use of a diagram how Pythagorean or “expressive” intonation differs from equal temperament.
2. Matching pitch by playing in unison.
3. Pointing to the same note in another octave, or a double-stop with an open string, that will serve as an intonation guide.
4. Teaching to listen for resonance of the instrument.
5. Working toward more relaxed left hand technique. I emphasize release of the thumb, “walking” the fingers one at a time (except in double-stops of course), and finger percussion.
6. Playing with consciousness of the harmony and key in any given passage.
7. Getting a better instrument; if the cello has better resonance it is much easier to play in tune.

What exercises that specifically address developing consistency of intonation do you use?
1. The study of scales is very important. I emphasize scales in double-stops for intonation; especially sixths and thirds.
2. Shifting is another important skill for good intonation. I emphasize substitution exercises for positions that overlap, moving one finger to where another finger is, back and forth. For longer shifts, an octave up and down one string is a good exercise as the intonation is obvious.
3. Chromatic scales are also important. I like to do a 1-2-3 fingering and a 1-2-3-4 fingering up and down an octave on each string. Then Duport No. 3 is a good choice.
4. As intonation improves with very tonal studies such as Lee, Kummer, and Duport, it is then important to use Popper for more chromatic challenges.
5. I encourage the student to always hear the next pitch in their head before playing it, and to practice hearing it by singing it. This makes a huge difference.

How have you personally developed your ability to play in tune?
Careful practice is the key to good intonation. I have found that my recording projects focus my attention acutely on intonation. Intonation is a matter of conscience; if you care about it and notice it, improvement results.

Daily maintenance is important, so I often go through all 24 keys with a variety of scales. Tuning the cello is a moment to get really picky about intonation, putting the fifths slightly narrow (by 2 cents) so as to have the octaves in tune.

What do you view as the component skills required for playing in tune?
1. Proper technique, including elimination of unnecessary tension.
2. Good coordination, so that one can accurately repeat motions and get the same results.
3. Acute hearing, so that one can hear minute differences in pitch, and with a sense of harmonic intonation.
4. Noticing and caring, intonation conscience.

I greatly appreciate your time and participation. If you would like to include your name as part of your response please print it here:  ______________  David Starkweather  ______________
Appendix B

History of tuning and temperament
The primary reference for the history of tuning and temperament. Provides an examination of both the historical theorists that published on the topic and an in depth explanation of the temperaments themselves. The Dover edition is a republication of the original, which was first published in 1951 by Michigan State College Press.

Examines the intonation systems favored by violinists throughout history. Barbieri both describes the temperaments in details and provides historical documentation for their use in practice.

Provides an overview of historical practices. The article also includes a timeline of primary sources that address the topic.

Provides a very clear and well written history of tuning and temperament. Limited by a distinct bias against equal temperament. Like many intonation exercises, Duffin’s book espouses a belief that he knows definitively what it means to be in tune.

Exercises for playing in different temperaments
The most recent and most comprehensive approach to learning to play in different temperaments.

Although only dealing with the difference between harmonic and melodic intonation, Ross provides very clear ways to work on using the different systems.

Describes a method of listening for combination tones to tune in four different temperaments. Equal temperament, Pythagorean, common meantone, and just are all discussed. Provides an historical overview of these tuning systems and how they have been taught.
Studies on how temperament is used by professionals


Approaches what we hear as ‘in tune’ performance from the perspective of psychoacoustics. Presents dynamic model for intonation that changes depending on the musical context.


A study of how six professional violinists use temperament. They found that all deviated from natural and equal temperament. Especially in the expansion of major seconds and thirds, and the contraction of minor seconds and thirds. This approximates the Pythagorean system.


Compared model recordings provided to beginning students. They demonstrated that no performer consistently conformed to any tuning system, although the majority were closest to Pythagorean tuning.
Bibliography


Vita

University of Kentucky, Lexington, KY
Master of Music, Orchestral Conducting, Spring 2017

Boston Conservatory, Boston, MA
Master of Music, Cello Performance, June 2014
Honors: Jewish Federation of Metropolitan Chicago Ruttenberg Scholarship, Chicago Federation of Musicians Scholarship

Carleton College, Northfield, MN
Bachelor of Arts, in Music and in Religion, magna cum laude, June 2011
Honors: S. Eugene Bailey Music Scholar, Concerto Competition Winner

CERTIFICATIONS
Suzuki Teacher Certification, Suzuki Association of America
Pre-Twinkle, Books 1, 2, 3, 4, 5, 6,7, & 8 2011 – 2015

Professional Positions
Centre College, Visiting Lecturer in Cello Performance, Fall 2016 – present
University of Kentucky, Graduate String Teaching Assistant, 2013-present
Central Music Academy, Cello Instructor, Lexington KY, 2015-present
Private Cello Instructor, 2011 – present
Page Music Lessons, Cello Instructor, Boston MA, 2012-2013
Carleton College, Music Theory Teaching Assistant, Northfield, MN, 2010 – 2011
Lexington Philharmonic Orchestra, Substitute Cellist, Fall 2016 – present
Lexington Chamber Orchestra, Assistant Principle Cellist, Spring 2016 – present
University of Kentucky Symphony Orchestra, Principal Cellist, Fall 2014 – present
Cave Run Symphony Orchestra, Cellist, Spring 2015 – present
Lexington String Trio, Founding Member, Lexington, KY, 2014-present
Verdi String Quartet, Lexington, KY, 2014-present
Bach to Now, Concert Series Lexington, KY, Fall 2016 – present
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