Building Memory Structures
to Foster Musicianship in the Cello Studio

D.M.A. Document

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By

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Abstract

Musicianship skills such as tonal understanding and music reading do not develop without deliberate training and practice aside from work focused on instrumental technique and repertoire. While these musicianship skills are addressed in sightsinging and aural skills curricula, most cello students do not have access such teaching until college, if ever. The use of variable learning principles in the study of tonal grammar at the instrument — scales, chords, arpeggios—may make learning slower but also broader and deeper and of more use to the student of any level.
Dedication

This document is dedicated to my family, Tom, Daniel, Carol, Joe, Harriet, Jancy, and Robert and to all my students, but especially Audrey, Gillian, Hannah, Rachel, Christine, Jason, Cory, Zachariah, Paul, Ellen, Matt, Emily, Bradley, Peter, Jessica, Alexa, and Kelsey.
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Table of Contents

Abstract ................................................................................................................................. i
Dedication ............................................................................................................................ ii
Acknowledgments .............................................................................................................. iii
Vita ........................................................................................................................................ iv
List of Tables ....................................................................................................................... vi
List of Figures ...................................................................................................................... vii
Introduction ......................................................................................................................... 1
Chapter One: Training and Environment in Normative and Expert Musical Development .................................................................................................................. 8
Chapter Two: Mindset and the Ability to Learn .................................................................. 21
Chapter Three: Skill Acquisition and Deliberate Practice .................................................. 26
Chapter Four: Musicianship Pedagogy in 19th, 20th, and 21st Century String Methods 31
Chapter Five: Research and Teaching Approaches from the Aural Skills Classroom .... 36
Chapter Six: Incorporating Musicianship Skills Into the Cello Lesson .......................... 46
References ............................................................................................................................ 61
Appendix A ........................................................................................................................... 72
List of Tables

Table 1: Comparison of Deliberate Practice and Flow.......................................................... 29
List of Figures

Figure 1: Aebersold's Manifesto ................................................................. 2
Figure 2: Scripp & Davidson's Framework of Subskills and Their Interactions .......... 16
Figure 3: Merk, Op. 11, No. 18 (first page)......................................................... 42
Figure 4: Student Jason Ng’s map of Merk etude.............................................. 43
Figure 5: Map of Scheherazade excerpt ............................................................ 56
Figure 6: Rimsky-Korsakov, Scheherazade, cello part, excerpt bracketed.............. 57
Introduction

In my college-level work with non-majors, I have been sorry to encounter many students who have attained a fair degree of instrumental mastery without the ability to use it independently — musicianship. These are students who cannot read notation fluently or play by ear. Though their tone may be pleasant enough, they cannot create fingering solutions or even locate pitches by name in some cases. They are not equipped either to enjoy playing the cello as a member of a community ensemble, to cobble together a bass line in a jam session with a rock band, or to play simple chords to accompany a song, for instance. Jamey Aebersold’s pithy “The Music Student’s Plea,” a manifesto illustrated by a (reverse) prioritized wish-list of skills and activities (Figure 1), emphasizes these values in music teaching.¹

Surprisingly, performers entering the most elite music schools often perform at low levels on musicianship tasks like sightsinging, notating simple melodies, and error detection. Eartraining instructors at the New England Conservatory “expect about 75% of the entering freshman will be unable to sight read [sightsing] anything beyond a diatonic and stepwise eight-measure melody with fewer than five errors.”² Aural training authority Gary Karpinski cites similar complaints regarding Indiana University School of

¹ Aebersold, How to Play Jazz and Improvise, vol. 1, revised 6th edition, 55.
² Davidson, Scripp & Meyaard, “Sightsing Ability: A Quantitative and Qualitative Point of View,” 52.
THE MUSIC STUDENT'S PLEA

1. Show me how to FINGER MY INSTRUMENT

2. Show me how to get a beautiful SOUND

3. Show me how to READ music

4. Show me how to PLAY IN TUNE

5. Show me how to HEAR music and how to DISCERN

6. Show me how to PRACTICE

7. Show me how to LISTEN and how to APPRECIATE music

8. Show me how to PLAY WITH OTHERS

9. Show me THEORY, HARMONY and COMPOSITION

10. Show me how to use my IMAGINATION and how to develop my CREATIVITY

But most of all, don't forget to show me how to

MAKE MY OWN MUSIC.

Music will then be a part of me.

It's time music education and educators in general realized the need to add imagination and creativity to music programs. This is true for public school music education as well as private music teaching. The time's up! We've short-changed the music student long enough.
Music and Juilliard freshmen.\textsuperscript{3} Plainly these students are neither untalented nor untrained, but their musicianship lags far behind their performing skills.

In an investigation of the musically gifted, Jeanne Bamberger concludes, among other things, that gifted young performers have an unusual capacity of representing musical relations to themselves in multiple ways but without representing or naming the multiple dimensions as separate realms. Bamberger noticed that teachers shifted focus quickly among at least four \textit{fields of attention}, conceptual mini-worlds, in use during lessons she observed. She tracked remarks regarding: 1) the instrument and actions on it, or \textit{felt paths}; 2) notation; 3) sound: actual, imagined or held in memory; and 4) musical structure: grouping, pattern, repetition.\textsuperscript{4} Bamberger notes that as young players enter adolescence and approach adulthood, natural cognitive changes cause this raft of fused representations to come apart, requiring the performers to make self-conscious decisions about these now-separately perceived, multiple dimensions if they are not to founder. This can be a kind of midlife crisis for prodigies, and Bamberger advises that a hands-off approach to early achievers’ musical thinking in the name of “not messing with success” is mistaken, in that the holistically imitative performance strategies successfully used by prodigies early on will naturally disintegrate as they mature in any case.

As David Hargreaves notes, there is a wide variety of goals in musical education today. Hargreaves distinguishes between normative and expert development in music and classifies various pedagogies along continuums of control-autonomy and generalist-

\textsuperscript{3} Karpinski, \textit{Aural Skills Acquisition}, 7.
specialist. Generalist education aims to optimize normative development whereas specialist musical training is devoted to the development of high levels of expertise.\(^5\)

Whereas most nineteenth century string pedagogy was specialist, or professionally oriented, musical training in our country today has become more widespread but also more varied in aim; instrument lessons may be begun as a hobby or as a short-term enrichment experience with no clear goal — generalist or specialist — in mind. Another factor is that whereas elementary and high school curricula in Japan and many European countries routinely include solfège instruction, it is very unlikely that beginning instrumentalists in the United States will have two or three years of musicianship and solfège under their belts. Instrument teachers, confined to 30 or 60 minutes of instruction per week, often scaffold music reading and theory task elements in order to focus mainly on instrumental technique; this helps students “succeed” as soon as possible, perhaps fostering intrinsic motivation.

Music literacy and tonal-knowledge task elements are often scaffolded or simplified out of the way thus: students memorize the sound of a piece from recordings rather than working through the notation; fingerings are provided by teachers and editors (thus building in correct whole and half step relationships); hard-to-hear intervals are performed across two strings (avoiding long shifts) rather than on one, and the like. Such musical backgrounds may account for the superficial grasp of tonal structure noted by Davidson in many incoming conservatory freshmen: “Their performances [of scales] suggest they know scales as whole chunks, as melodies. These structures are difficult to

\(^5\) Hargreaves, “The development of artistic and musical competence,” 146.
pull apart and are unstable if not performed in a manner or speed which allows the student to perform, perceive, or monitor the entire shape as a single unit.6

These pedagogical boosts are appropriate: students need to work from the known to the unknown and on one problem at a time. However, too often fingering patterns and instrumental geography are treated as the known and used for discovering the unknown: sound. To keep the ear, the eye and the hand well-integrated, successful teachers include aural imitation and playing by ear in lessons and continue to introduce new sounds and techniques aurally, before students encounter them on the printed page.

I have long associated independent musicianship with an understanding of scales and tonality and have made it a main focus in my cello teaching. Our notational system embodies the limping, uneven steps of diatonic scales; since the process of realizing notated music depends first of all on accurate pitch identification, naturally reading accuracy improves when scales are understood.

As a teacher, I have strived to keep in mind my own intermediate ways of hearing music and to offer help in a way that resonates with students’ current understanding. Like many instrumental performers, I began teaching with no training in pedagogy beyond my own experience of being taught. Over the years I learned and evolved some successful routines, but I was not equally effective in all areas or levels. In the course of this project I have looked at many string methods and articles on pedagogy, but I have also looked outward to research in aural skills pedagogy, psychology, education, and

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music perception and cognition, seeking to understand the principles underlying the methods and pedagogies.

I believe that teachers should teach as though talent were not innate and should take responsibility for developing talents in their students. Since instrumental instructors are often tempted to trust that students are developing reading ability and tonal understanding as they work on their scales, solos and etudes, in my first chapter I will describe what research on musical development shows about environment and training in both normative and expert development of musicianship in the form of tonal knowledge.

Beliefs about talent have a tremendous impact on the way teachers teach and on students’ ability to persevere and grow, and musical talent has often been equated with “a good ear” or “perfect pitch.” In my second chapter I will discuss the importance of mindset, as described by Carol Dweck, and describe some pedagogies that have laid the groundwork for success by directly addressing students’ beliefs about growth and talent.

In the third chapter I will summarize some of the recent research in expertise and skill acquisition with a particular focus on deliberate practice and on Ericsson’s and Staszewski’s skilled memory theory.

In my fourth chapter I will describe how other string teachers have addressed musicianship, from the nineteenth century to the present. Two modern beginner’s methods I have surveyed, Young Strings in Action and Essential Elements for Strings, put into practice many principles derived from research.

Since eartraining/sightsinging/aural skills classes have historically been the first arena in which basic musicianship skills were explicitly taught, in my fifth chapter I will
survey what aural skills instructors conclude from their research and experiences in the classroom. I will enumerate skills and subskills they address with an eye to how their teaching strategies might be effectively combined with cello instruction.

Finally I will incorporate aspects of all these ideas into the cello lesson. Specifically, I will propose ways to vary the study of scales and other structures of musical grammar to be most effective and interesting and pedagogy that will enable students to decode notated music with understanding and connect it with sound.
Nature or nurture? “Nature” in this phrase is usually taken to refer to genetics, to inborn ability. How much of our musical accomplishment and behavior is dictated or limited by nature, the genetic cards we are dealt? “Nurture” comprehends all aspects of the environment affecting a person’s growth and development: general physical, cultural, economic, and familial conditions. Training, effort intentionally directed at instilling or acquiring skills, is an aspect of nurture often viewed as unrelated to developmental stages. Research shows that environment and training may account for virtually all of expert musical accomplishment — even Mozart’s.\(^7\)

While Piaget’s stage theory of cognitive development deals with natural or universal development — transitions and transformations shared by normal human beings in all classes, countries and cultures — David H. Feldman proposes a view of development that includes non-universal changes as well. In essence, he observes that predictable transformations and transitions take place during training to master cultural, discipline-based, idiosyncratic and unique knowledge domains, just as in universal development.\(^8\) He notes that pedagogies have tended to be based on an expert view of their domains — upon principles and theories — rather than on the way individuals tend

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\(^7\) Syed, *Bounce*, 55-57.

to move along the path from encounter to engagement, from engagement to mastery of early levels, from apprentice to journeyman and so on. J. David Smith notes a similar problem (with implications not only for pedagogy but for programming philosophy and composition as well) when he observes that much research has been devoted to describing fully developed (trained) musical cognition but comparatively little to novice (environmentally developed) perception and processing.

Studies of babies, children and naïve or untrained listeners tell us how people’s music listening changes through natural development, enculturation, and passive, perceptual learning. As children begin musical training, they move into the domain of Feldman’s theory of non-universal developmental stages.

*Universal* developmental stages can be related to musical skills in that some prerequisite cognitive structures and systems of symbolic organization for skills seem to arise in given age ranges. In 1990, Taylor summarized research on the development of *conservation* in various musical dimensions. In the Piagetian preoperational stage, the acquisition of conservation of rhythm occurs at around 6.1 years, followed by area at 7.6, volume (non-musical) at 8.1, and then tempo at 8.3. Researchers surveyed by Taylor found that six- and seven-year-olds can identify pitch alterations in familiar tunes, seven-year-olds notice sudden key changes introduced into familiar tunes, and eight-year-old children can distinguish changes from major to minor. Full acquisition of *concrete operations* provides the basis for conservation of melody and rhythm, and researchers

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12 Conservation can be described as the ability to remember and mentally manipulate a given quality.
found that the number of years of private music lessons has little effect on the refinement of these skills. Successful conservation of meter is resistant to training at the preoperational level, plateaus around age 9, and precedes conservation of rhythm.

Research on music is often criticized for focusing on very limited skills in unnatural settings — does the ability to identify isolated intervals or match pitches really reflect on the way we hear music? Harvard’s Project Zero researchers took a more holistic approach to learning about the normative (universal) development of tonal thinking through observing as many as 78 children over a six-year period.\(^\text{13}\)

Project Zero was founded at the Harvard Graduate School of Education in 1967 by philosopher Nelson Goodman, who believed that arts learning should be studied as a serious cognitive activity, but that “zero” had been established about the field. Project Zero’s research programs are based on “a detailed understanding of human cognitive development and of the process of learning in the arts and other disciplines.”\(^\text{14}\)

Lyle Davidson, then director of Project Zero’s music group, found two problems with earlier research on children’s tonal knowledge: first, that many analyses were too narrowly focused on either interval or melodic contour, but not both; and second, many analyses were based on inappropriate units, interpreting children’s singing in terms of fixed pitches and key relations that do not exist in children’s conceptions of what they are doing. The Project Zero team wanted a means of describing children’s melodies that captured the way the children seemed to be thinking about them. To transcribe the

\(^{13}\) The description of the study is published as “Songsinging by Young and Old: A Developmental Approach to Music,” and I summarize and paraphrase it here.

\(^{14}\) Project Zero website, http://www.pz.harvard.edu/History/History.htm
children’s recorded performances faithfully, they used special symbols in addition to standard musical notation (SMN) indicating speech, contour, and notes half sung/half spoken. The rhythmic notation reflects free groupings, proportional durations, and more metric patterns as appropriate.

Davidson et al. concluded that untrained children’s grasp of tonal relationships develops in two ways: expansion of range and number of contour schemes; and increasing frequency of return to referent tones (stability of tonal center). Project Zero’s researchers discerned five levels of pitch development in children’s singing between one and six years of age, beginning with spans of a third and gradually expanding to a sixth.

Young preschoolers begin with descending schemes, the Project Zero team observed. Expanding the boundaries of tonal space first, then going back and filling in the gaps in previously acquired schemes with steps seems to be the rule for what occurs. Only after a child has acquired the ability to reliably sing a fourth does she fill in the earlier leap (the third) with stepwise motion. This procedure continues until the range encompasses a sixth. (Octaves emerge later and may be related to different processes, registral play, for instance.) The contour schemes function only in small contexts, and the children only achieve tonal stability within single phrases—which are separated by free, unmeasured pauses—not across whole songs.¹⁵

Project Zero researchers theorized that children tend to fuse songs’ elements (pitch, words, rhythm) into single entities based on the observation that children entirely omit phrases to which they don’t remember the words. Jeanne Bamberger, MIT music

Theorist and education researcher, noted similar behaviors in children (and novice adults) working with Montessori bells\textsuperscript{16} to build familiar tunes. Without internalized, fixed reference structures like the scales and meters used by musical experts, tune builders needed a separate bell for each event (each word of the song) in the “tune path,”\textsuperscript{17} although many of the pitches were repetitions. One subject was puzzled and nonplussed when the identity of the first and last notes was demonstrated to him; their distinct ending- and beginning-ness did not allow him to conceive of them as the same pitch.

Elementary aged children shift from creative play with musical materials to learning the standard songs of the culture — the canonical forms — and young adolescents immerse themselves in the music of their peer groups. Does tonal knowledge continue to develop and become more sophisticated and articulate through all this listening?

Not much, both Davidson and Bamberger conclude. Davidson et al. tested the limits of naïve tonal knowledge by looking at the way untrained adults responded to various musical challenges involving performance, perception, and composition. Invented notations of songs created by six- and seven-year-olds and by untrained adults looked much the same,\textsuperscript{18} and such adults seemed still to be organizing their singing with the same contour schemes established in early childhood. When asked to sing “Happy Birthday,” untrained adults, like children, typically compressed the octave range of the Montessori bells are not labeled and appear identical though they differ in pitch.\textsuperscript{16} Bamberger, \textit{The Mind Behind the Musical Ear: How Children Develop Musical Intelligence}.\textsuperscript{17} Bamberger “Cognitive Issues in the Development of Musically Gifted Children.”
third phrase and ended the song in a different key than the opening, typically lower — in the same range as the opening.¹⁹

Davidson, Scripp and Welsh compared untrained children and adults with music students in the task of notating “Happy Birthday” and found that the naïve ear, shaped only by perceptual learning, was able to invent “surprisingly rich notations” of well known songs, whereas music students (teenagers with extensive instrumental training and some music theory classes) attempting to use SMN were surprisingly inaccurate. A second group of music students, whose theory instruction consisted only of sightsinging, were more accurate.²⁰

Of course, “Happy Birthday,” characterized by Davidson et al. as “a simple tune,” is somewhat unusual among the quasi-folk songs people learn by ear (it is a composed, copyrighted song, for one thing). Many of the music students went wrong by trying to force it into the tonic-to-tonic concept they had studied in their theory classes — a concept-driven error — whereas “Happy Birthday” begins on the fifth scale degree and returns to it at every phrase-beginning before finally resolving through a clarifying ⁴ to ⁵ at the end. The melody as sung in C fits equally well in the C and G scales until the first note (F) of the last phrase. When orchestras hijack the tuning A to play “Happy Birthday” for colleagues by ear, wise instigators whisper “Happy Birthday on D” rather than in D to ensure a tonally unified beginning. That wouldn’t be necessary with “Row, Row, Row Your Boat,” “Frere Jacques,” or other nursery standards, more truly “simple.”

¹⁹ “Songsinging by Young and Old,” 125-126.
²⁰ Davidson, Scripp & Welsh, ““Happy Birthday”: Evidence for Conflicts of Perceptual Knowledge and Conceptual Understanding,”
However, the researchers’ point that the type of training students receive makes a significant difference in their ability to represent their perceptions accurately is well made: music students in the notation study did remark that though it was easier to conceive of music in SMN, invented notations were more helpful and accurate as to how they heard music.\(^\text{21}\) Why was SMN less effective at depicting students’ aural experiences?

Jeanne Bamberger contrasts figural hearing with metrical hearing. Figural hearing, often characteristic of naïve listeners, is focused on grouping, relationships, and events. Metrical hearing focuses more on comparison of common properties, e.g. note length and pitch. Bamberger points out that SMN, which dominates musical instruction, favors metrical hearing. Students without eartraining instruction (sight-singing classes) had not been taught to hear “metrically,” systematically comparing sound with internalized templates like scales and meter.

As Bamberger emphasizes, access to multiple dimensions of musical structure, including (especially including!) figural ones, is essential to expressive playing. Musical expertise must remain connected to normative ways of listening in order to communicate and connect with emotions. Teaching that ignores or overrides figural hearing and obscures it produces unmusical playing, Bamberger claims.\(^\text{22}\) However, teaching that always allows students to circumvent metrical reading produces inaccurate playing, dependent on example. Before mature musicians move “beyond the notation” to the

\(^{21}\) “Happy Birthday,” 68.

\(^{22}\) Bamberger, *The Mind Behind the Musical Ear*, 262.
figural dimension, they must move through it, and students need to be prepared for this process.

John Sloboda and many others assert that musical talent builds on and is developed from a common human heritage, not on a set of special characteristics. Serious musicians are driven to refine and expand these early core capacities to include superior perceptual and memory skills, strong executive and performance skills, and deep musical understanding. The western classical tradition is above all a textual one.

Taking Feldman’s cue, Lyle Davidson and his colleagues have looked for predictable transformations and transitions in conservatory students as they internalize tonal knowledge and develop their notation decoding skills under NEC’s fixed-do sightsinging curriculum, required for all singers and instrumentalists.

Successful sightsinging depends on mastery of various subskills. Davidson and Scripp structure their curriculum around three: note identification, rhythmic expression, and pitch expression (see figure 2). Greater levels of complexity occur as each skill is increased and as they are combined. In rhythmic expression, students must learn to maintain a pulse, first in isolation, then against more and more complex rhythmic patterns, and then along with pitch identification and performance as well. Pitch expression depends on note identification and advances through note grouping to grouping with rhythm and pulse, actual music.

24 Davidson, Scripp & Meyard, 55.
25 I believe similar advancement can occur in string students as they learn to read if the right underlying subskills are taught and reinforced in the applied lesson, and I will return to this in my seventh chapter.
26 Scripp & Davidson, “Framing the Dimensions of Sightsinging,” 27.
Figure 2: Scripp & Davidson's Framework of Subskills and Their Interactions (“Framing the Dimensions of Sightsing,” 28.)

Each bar of an examination tune is provided with scoring space for rhythm issues (TMRD: tempo, meter, rhythmic pattern, duration) and pitch issues (CKPI: contour, key, pitch, intonation), ordered by increasing control. Issues to the right require some mastery of the basic skills to the left on the continuum. This systematic gradation of task element makes detailed qualitative error analysis possible, in turn enabling very individualized assessment of strengths and weaknesses and the creation of precise programs for improvement. Three students can miss the same note for three different reasons, e.g. loss
of the scale reference, rhythmic distraction, incorrect pitch identification. To improve they would need to practice different things.\textsuperscript{27}

Davidson and Scripp list beginning, intermediate, and final music literacy goals and describe signs that the goals have been achieved. For instance, while second-year students were not always more accurate than first-year students, their performances were qualitatively different: sophomores know from their conducting when they have violated meter, when mispronunciation of solfege syllables results in poor intonation, and can recover from wrong or poorly intoned notes.\textsuperscript{28} While Scripp and Davidson follow development of note identification, rhythmic expression and pitch expression skills, I restrict my summary below to some of their observations on pitch expression.

Early in the first semester, students should be able to construct scale patterns freely, filling in leaps and adding reference tone grace notes when necessary. They will also be able to construct a fully operational tonal system from any scale degree given (in the key of C). The NEC teachers can tell that these skills are internalized when students predict errors by stopping \textit{before} they occur and when they are able to follow tunes silently and jump in later on.

Toward the beginning of their second semester of eartraining, students are able to freely exchange major and minor modes in singing simple diatonic melodies; freely and spontaneously alternate between treble and bass clefs; add accidentals to melodies without losing tonic; and improvise short melodies that change modality. Internalization

\textsuperscript{27} Davidson, Scripp & Meynard, “Sightsinging Ability,” 56.
\textsuperscript{28} Scripp & Davidson, “Framing the Dimensions,” 37.
is evidenced by detecting errors of mode in class and by the need for shorter warmup drills to establish tonal orientation.

After two semesters of training, the students can use scales, intervals, triads, and arpeggios fluently in a wide range of major and minor keys; maintain stable performance through radically shifting keys, registers, and transpositions; reduce instrumental to appropriate vocal expression; and make interpretive decisions of nuance while performing. These skills are internalized when students can study scores without recordings or instrumental performance, detect and hear modulations across parts in the score, and perform and comprehend scores silently.

Students who have completed the two-year course should be able to pose more than one solution to the problem of tonal orientation in difficult melodies; reduce the orchestral score to thematic or harmonic essentials; switch rapidly between parts in the score; and use expressive intonation as nuance. When their skills are internalized, students will be able to detect errors in complex scores.

Classroom observations identified some qualitative changes with regard to focus of attention, degrees of internalization, degrees of stability, and expressivity. Beginners in the course have a note-to-note, visual orientation and are unable to deviate from the written contour of a melody. They have little attention to spare for eye contact with other students or the conductor. They may be able to retain the sound of tonic and perhaps the dominant but need constant external references. Beginners’ performances are not very

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29 I find the observations about focus, response to errors (see Degree of Stability), and expression most interesting and familiar from my own experience as a cellist and cello teacher.
stable: they are easily misled by miscues (e.g. tonic presented as third of foreign triad), disoriented by modulations, and mistakes often cause total performance breakdowns. Expression gets short shrift and only appears with rote drill. The beginning students tend to ignore dynamics and tempo nuances, and they fail to notice repetition or analogy to other pieces studied.

Intermediate level students are still heavily visual but seem to read larger groups of notes and can invert simple intervals to accommodate their vocal range. They can spare enough attention from reading to make eye contact with other performers of the same part and can retain more pitches as internal tonal reference for a longer time. While they are able to negotiate modulations to closely related keys and sing the new tonic accurately, distant scales disorient intonation. Accidentals are often sung out of tune. Intermediate students can use radical strategies to recover from mistakes if necessary. With encouragement, they sing with nuance in familiar keys and contexts, and they compare new material with that previously sung.

Advanced students act on internal representation of the music: when reading across clef changes, for instance, they perform from knowledge of note names rather than the misleading visual contour on the page. They are more likely to make eye contact with performers of different parts, they appreciate and use structural cues, and they are able to integrate notated expressive marks and add appropriate nuance. They have more confidence: they correct instructor miscues and are able to think on their feet and recover quickly and intuitively from mistakes. At this level, they can negotiate highly chromatic
melodic contexts and maintain their orientation to changed keys; tuning strategies include reference tones from focal keys.\textsuperscript{30}

Earlier I stated that serious musicians are driven to refine and expand their core capacities to include superior perceptual and memory skills, strong executive and performance skills, and deep musical understanding. “Seriousness” is often gauged by motivation, the drive to achieve, learn and improve. This too is a talent that can be fostered, however, and motivation is the subject of my next chapter.

\textsuperscript{30} Davidson, Scripp & Meynard, 61-67.
Chapter Two:  
Mindset and the Ability to Learn

Conceptions about the sources of musical ability shape what teachers expect from their students, how they structure training, and even which students they choose to teach. Ideas about talent also shape parental behavior and student motivation and behavior.

Demonstration of aural skill has often been used as a gauge of musical potential. In the twentieth century, educators and researchers designed musical ability tests (often defining musical ability as hearing acuity) in hopes of identifying students who would benefit most from musical instruction. Creators of some tests recommended they be used only to gain more information about students, not as screening tools, but questions received from users indicate the tests’ use as gatekeepers.  

Star violin pedagogue Dorothy DeLay had a different view of the ear. In an interview with Barbara Lourie Sand, she related that

I found myself being interested in how certain talents can be developed because I have always had the desire to believe that environment is more important than heredity. So I said to myself, If somebody doesn’t play in tune, it is because he hasn’t learned how. Mr. Galamian would say, “Oh, he has no ear. Don’t waste your time.” I would say to myself, I want to find out if I can get this person to play in tune, and I would experiment with all kinds

31 Kemp and Mills, “Musical Potential” 5-6.
of things, and Mr. G would say, “You don’t have time for that,” and I would think, Yes, but I want to know, and I would go on trying.32

One of her students, soloist Robert McDuffie, was coached in this way: after a midnight post-recital meeting in which DeLay pointed out “the only note you played in tune all night,” McDuffie “began to learn how to listen…She even sent me to an ear-training teacher for private tutoring.”33

Psychologist Carol Dweck has done research that suggests that talent judgments — positive or negative — can be destructive if they are delivered or received as definitive of the person. How was it that Dorothy DeLay was able to deliver such a negative critique without crushing McDuffie?

People who believe their excellent or mediocre qualities are fixed and innate tend to avoid challenges, give up easily, see effort as fruitless or worse, ignore useful negative feedback, and feel threatened by the success of others. If they are praised for being smart or talented, they will be afraid to risk this reputation, and if they are told they are not, they won’t see the point of trying. Dweck calls this the fixed mindset. When people believe that intelligence, talent and ability can be built and improved, they experience things very differently: they embrace challenges as opportunities to learn, persist in spite of setbacks, see effort as the means to mastery, learn from criticism, and find lessons and inspiration in the success of others. They have a growth mindset34.

The growth mindset enables people to thrive in adversity, to be less anxious and more secure. In a fixed mindset, self-worth is contingent on success in each and every

32 Sand, Teaching Genius, 54.
33 Sand, 209.
34 Dweck, Mindset, 245.
task or interaction, and it must be shored up in the face of any failures or difficulties. Significantly, contingent self-worth is prominent in recent theories of depression.\(^{35}\)

In the course of their research, Dweck and her colleagues have found that mindset can be shifted. Again and again, subjects who were exposed to material expressing a growth mindset about intelligence and ability showed more persistence and resilience when they faced “setbacks” in the form of negative feedback as they worked on tasks, and they felt better during the experiences.\(^{36}\) After seeing strong positive effects on effort and achievement from growth mindset education in experiments in schools, she developed an interactive computer program called Brainology to teach middle-school students all over the country to think of their intelligence as something they can develop.

College and conservatory level aural skills instructors often note that students fear or dislike sightsinging classes, thinking perhaps that their “lack of talent” will be uncovered and that aural skills cannot be built or improved, are an innate blessing, you-have-them-or-you-don’t. These students are laboring under the fixed mindset, trying to convince themselves and others that they have a royal flush when they are secretly worried they’ve been dealt a pair of tens.\(^{37}\)

Lyle Davidson, Larry Scripp, and their colleagues at the New England Conservatory decided to confront this belief directly among their aural skills classes. They took an approach similar to Dweck’s in designing their music theory curriculum: they included a large reflective writing component and several readings in the


\(^{36}\) Nussbaum & Dweck, “Defensiveness Versus Remediation.”

\(^{37}\) Carol Dweck, quoted in Bounce, 127.
sightsinging course, the first of which, Trotter’s “Mystery of Mastery,” is intended to “provide a developmental framework for complex skill acquisition in any domain.”

They made it their first order of business to nurture a growth mindset in their students, whose journal entries and essays document both their strategic discoveries and their new perspectives on previously held attitudes.

One talent developer, Russian ballet teacher Marina Semyonova, actually seems to have selected her pupils according to their mindsets. A former member of her class reported that students first had to survive a trial period while she watched to see how they reacted to praise and to correction. The ones more responsive to the correction were the ones deemed worthy.

To master a complex field such as music, beginners have to practice about 10,000 hours, facing failure and confronting weaknesses and difficulties again and again. When improvement seems possible and not unduly risky, as in the growth mindset, students are able to repair their self-esteem by directly confronting their poor performance rather than by dismissing the validity of negative feedback or by seeking comparisons with worse performances. As many a musician has sighed, the hardest part of practicing can be opening the case. Anything teachers can do to make that easier and more likely is effort well spent.

Dweck recommends that teachers (and parents) take care to foster growth mindset in students by praising their effort and strategies rather than their talent or intelligence.

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40 Nussbaum & Dweck, “Defensiveness Versus Remediation.”
Constructive criticism must help the student understand how to fix mistakes. Goals must be concrete — to expand knowledge or increase a skill. High standards must be accompanied by the means to reach them, and teachers must work to find out specifically what struggling students are misunderstanding, what strategies they lack.  

Often what is lacking is musicianship training. What constitutes effective practice toward mastery is the subject of my next chapter, on skill acquisition and deliberate practice.

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Chapter Three:
Skill Acquisition and Deliberate Practice

Few would argue with the statement that the most important thing music students can learn is how to practice. This is as much about self-knowledge as about knowledge of instruments or music. Effective teaching about practice involves more than requiring a certain amount of it, setting an agenda of tasks to accomplish, and advising the use of a metronome or tuner. In the last thirty years research in fields as diverse as chess, music and surgery has yielded common principles about how skills are acquired and how experts function.

Both Fischer’s skill theory\(^{42}\) and Ericsson and Stasewski’s skilled memory theory look at cognition associated with expertise. Skill theory framework posits and maps “geometrically expanding mental structures” that develop with maturity and increasing task complexity. The first step toward mastery in this model involves regulating a single dimension, such as pulse, or bowing. Later steps coordinate simple relations between any two dimensions of a task (pulse and rhythm, bowing and fingering), and finally systematically integrate complex interactions of relations within a task (pitch, pulse, rhythm; bowing, fingering, aural comparison). Playing a stringed instrument, even inexpertly, requires coordination of the six dimensions above and countless others.

\(^{42}\) Cited by Davidson & Scripp, “Education and development in music from a cognitive perspective.” 64.
While some task elements can be automatized, many others cannot. How do people learn to achieve such complex feats?

Chase and Simon’s 1972 study on chess expertise proposed chunking as a mechanism accounting for experts’ command of huge amounts of domain knowledge. In their theory, organized patterns of information stored in long term memory (LTM)—chunks—are retrieved by association with labels held in STM (short term memory).

Ericsson and Staszewski observed that the number of chunks retrieved by experts in Chase and Simon’s chess study exceeded estimates of the capacity of easy-to-access short term or working memory and noted that another study showed that expert memory functioned well despite a STM interference task. They formed a new theory, taking chunking a step further: experts use familiar, well-organized domain concepts and relations, held as chunks in LTM, as a meaningful encoding principle for domain data. Their experimental findings support the theory that experts are able mobilize this knowledge, stored in long term memory (LTM), on the fly, more quickly than is usual, in effect creating an expanded working memory capacity for domain materials. Relating data to this LTM structure creates multiple potential cues and avenues for retrieval, far more than are available without the encoding principles. Experts learn to anticipate what information is important for future tasks and create systems to keep it ready to deploy.

Deliberate practice is defined by Ericsson et al. as “activities teachers and coaches instruct learners to engage in to maximize improvement, as distinct from playful

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43 Ericsson & Staszewski, “Skilled Memory and Expertise,” 237.
44 Ericsson & Staszewski, 238.
interaction, paid work, and observation of others." More specifically, deliberate practice tasks should build on learners’ preexisting knowledge so they will be easily understood; include immediate informative feedback and knowledge of results of their performance; and should be repeated many times. (Repetition myelinates neural circuits, causing a tenfold speed-up effect both in practiced physical routines and in access to memory structures.)

While Ericsson, Krampe and Tesch-Römer say that deliberate practice is not inherently enjoyable and that “flow” may be antithetical to the focused attention of deliberate practice, I disagree. Their description of deliberate practice tasks coincides with several of Csikszentmihalyi’s components of optimal experience or flow: flow usually occurs when we confront tasks we have a chance of completing (consider the impact mindset can have on this belief), upon which we are able to concentrate, and which have clear goals and provide immediate feedback.

Burton Kaplan, master violinist and practice coach, makes a similar point in writing about concentration: “Concentration is an energy that shuts itself off when the goal is too hard (frustrating) and when it is too easy (boring). When the purpose of employing your concentration is to reach an achievable goal…it offers itself easily, until normal physical fatigue sets in.”

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45 Ericsson, Krampe & Tesch-Römer, “The Role of Deliberate Practice in the Acquisition of Expert Performance,” 368.
47 Kaplan, Practicing for Artistic Success, 36.
Table 1: Comparison of Deliberate Practice and Flow

<table>
<thead>
<tr>
<th>Ericsson’s deliberate practice</th>
<th>Csikzentmihalyi’s flow</th>
</tr>
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<tbody>
<tr>
<td>Builds on preexisting knowledge, is easily understood by learners</td>
<td>Learners can concentrate on the task</td>
</tr>
<tr>
<td>Intended to maximize improvement</td>
<td>Clear goals</td>
</tr>
<tr>
<td>Includes much repetition</td>
<td>Occurs during tasks learners have a chance of completing</td>
</tr>
<tr>
<td>Includes immediate feedback &amp; knowledge of results</td>
<td>Provides immediate feedback</td>
</tr>
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</table>

An essential task in designing practice activities for ourselves or for our students — engineering flow — is setting achievable goals, either by simplifying the problem or by reducing the demand.\(^{48}\) We manipulate or remove task elements to free up mental energy for focusing on a particular musical aspect or skill: it is easier to do and monitor two things simultaneously rather than five. We simplify by changing the tempo, removing the rhythm, removing the pitches, reducing the amount of material, removing or adding slurs, and leaving out ornaments;\(^{49}\) by using tools to support pitch or pulse (tuners and metronomes) or enhance observation (recording devices); and by using improvised or composed etudes which exhaustively explore (warding off boredom) one fingering pattern, articulation or figuration in isolation.

*Scaffolding* is a related teaching technique we use to support the beginnings of a new skill: by guiding the arms and hands, modeling the thought protocol, or feeding the

\(^{48}\) Kaplan, 37.
\(^{49}\) Kaplan, 61.
student reminders as they move through an activity, we simplify the decision-making and directive aspects of the task.

While structuring deliberate practice to develop instrumental techniques and master new repertoire may be merely a matter of giving more specific instructions and guidance for working through lesson materials to develop automaticity in the traditional way, stimulating formation of the expert memory structures necessary for musicianship requires qualitatively different deliberate practice activities. Such memory structures are key in allowing experts to read cues in task situations, which allows them extra time to plan and execute responses. Thus expert memory also accounts for the seemingly superhuman reaction times seen in top-level tennis players, Paganini--esque performers, and proficient sightreaders and accompanists.
Chapter Four:
Musicianship Pedagogy
in 19th, 20th, and 21st Century String Methods

When most European conservatories were founded, in the early nineteenth century, entering students were in middle childhood or early adolescence, and they were embarking on *professional* training, enrolled by their parents as they would have been apprenticed by them to master musicians and artisans a generation earlier. The Conservatoire National supérieur de Musique et de danse was the first to systematize and disseminate uniform methods of musical pedagogy, beginning in 1796. Students began their studies between the ages of 8 and 13 and passed through three phases of instruction, the first of which was almost entirely the study of solfège. 50

Eighteenth and nineteenth century string pedagogues emphasized the importance of musicianship training in their published methods, often as a prerequisite to instrumental training. Friedrich Auguste Kummer, famous Dresden cellist and pedagogue of the early and mid-nineteenth century, remarked, “It is assumed that the student has already mastered the first rudiments of music in general… The pupil will remember from his theoretical studies…” More directly, Pierre Marie François de Sales Baillot, who helped to write the first violin and cello methods for the Paris Conservatoire and later wrote *The Art of the Violin* after a long career of teaching, urges, “Learn solfège

50 Weber, “Conservatories.”
before beginning the violin…To have the student undertake the study of the violin before he has learned solfège is to condemn him to reading music without understanding it.”\textsuperscript{51}

Most of the older methods begin with intervals (seconds through sevenths) and scales. These methods (Kummer, Baillot, other Paris methods) could be described as “expert-based,” as in Feldman’s criticism\textsuperscript{52}: they build from theoretical principles rather than the beginner’s ear. However, the beginning instrumentalists who used them were assumed to be somewhat expert music readers already.

Romberg’s method for beginners was somewhat different from these others. “The Singer, in order to form his voice, begins by practicing scales; but the Instrumentalist, (that is the Player on a stringed Instrument) should not attempt to play scales until he has acquired some mastery over the mechanical difficulties of his Instrument, as this is an indispensable preliminary to the acquirement of fine execution and delicate expression,”\textsuperscript{53} he states. The earliest exercises are simple fingering and string crossing patterns. Later in the method he presents “the Amateur…with a synopsis, by which he may acquire some knowledge of Modulation, Resolution, Intervals, and Progressions of Harmony,” so as to be able to “properly accompany a Quartet.”\textsuperscript{54} He relates harmonic understanding to performance, teaching that “In order also, to express… that light and shade so necessary in Quartett playing, all the leading notes and sevenths which fall to the Bass in consequence of inversions, must be accented, but the

\textsuperscript{51} quoted by Karpinski.
\textsuperscript{52} see p. 8 of this document.
\textsuperscript{53} Romberg, \textit{A Complete Theoretical and Practical School for the Violoncello}, 90.
\textsuperscript{54} Romberg, 121.
accent must not be too marked.”

Like the French methods already described, Romberg also speaks of accompanying students’ scales, although he does not provide counterpoints in his method.

Edward Kreitman, a master of the Suzuki tradition, teaches functional tonality in a simple way, characterizing pitches in musical contexts as either “travel” or “destination” notes.

Most methods and treatises assume an understanding of tonality as a basis for making decisions about intonation. For instance, many of violist Michael Kimber’s guidelines about intonation are couched in terms of scale-degrees. He notes that ¹, ⁴, and ⁵ tend to be stable in all tuning systems and that ³, ⁶, and ⁷ need more radical adjustments, except that when ³ and ⁷ involve open strings, the root and fifth must accommodate instead. He points out that these adjustments relate to the last three flats or sharps in the key signature, which are the first or second notes of the ³-⁴, ⁵-⁶, and ⁷-¹ dyads.

In 1981, New York Philharmonic violinist Theodor Podnos published a self-help course on intonation (Intonation for Strings, Winds and Singers: A Six-Month Course). The course is a series of heuristics, accompanied by illustrative experiments, exercises and etudes, for relating intonation decisions to notation, working from the Interval System through the Accidental System before arriving at what he calls Chordal Intonation. While the Interval System is based on exaggerating the contrast between

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55 Romberg, 121.
56 Romberg, 9.
57 Kreitman, Teaching from the Balance Point, 51, 60.
major and minor intervals, the Accidental System refines the Interval approach by
defining which note of an interval to adjust: “Graphic sharps and flats provide you with
immediate information, particularly valuable in fast tempos, which allow little time for
calculation. Naturals play a double role: in flat keys they indicate that intonation must be
raised while in sharp keys, naturals must be played lower.”

This is similar to Kimber’s key signature guideline.

What Podnos is working toward is a more and more fluent reading and
understanding of notation — Davidson’s musical literacy — upon which intonation
choices can be based and physically anticipated: “Knowing how to plan intonations
(through analysis) before sounding them produces better results than depending on the ear
to solve tuning problems.” (my emphasis) He points out the efficiency of literate
music reading, comparing the use of his beginning system with that of Chordal
Intonation: “In Exercise 81,… twelve alterations were required when using the Interval
System; if Chordal Intonation were used, only six alterations would have been necessary.
In Exercise 96, use of the Interval System would require thirty-one computations,
whereas only eight would be necessary using Chordal Intonation.”

While Carl Flesch’s remark on intonation as “an extremely rapid, skillfully
carried out improvement of the originally inexactlly located tonal pitch” is widely
known, his modifying corollary, stated a few pages later, is less often quoted:

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58 Podnos, 30.
59 Podnos, 75.
60 Podnos, 90.
61 Flesch, 20.
A certain space of time is required for tone correction, depending on auditory sensitivity. At all events, the tone to be corrected must be sustained approximately half a second, in order to be susceptible of improvement. The shorter the note in question, the more prominently the manual *moment of skill* comes to the fore. We no longer have enough time to carry out the complicated procedure just described, and we must endeavor to develop the skill needed to play a tone when we take it for the *first* time, with approximate purity.  

Flesch describes a postural method to develop this skill, but without describing the thought process which must precede the attack. Podnos addresses the anticipatory moments, connecting reading to interpretation, interpretation to focused aural image, and finally image to physical anticipation and execution. Podnos’ course shows how musicianship skills relate to intonation for string players.

The methods discussed above address a variety of readers — interested amateurs, fellow teachers, beginning or advanced students — with a variety of aims. Romberg’s emphasis on well-rounded musicianship for amateurs may account for why his method was not more influential on mainstream professional training, but I think it is essential.

My final chapter will detail more ways to address both musicianship goals and instrumental technique in the cello studio with beginning and intermediate players as well as more advanced students.

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62 Flesch, 23.
Chapter Five:
Research and Teaching Approaches from the Aural Skills Classroom

Various course titles—sightsinging, eartraining, aural skills—mark attempts to describe better the purpose of this component of the music curriculum. “Sight” implies an emphasis on reading notation, and on reading it quickly. When the course is called “Eartraining,” the emphasis seems to be on learning to perceive in a particular way. “Aural skills” promises to encompass more aspects of musicianship, but many of the things that most concern students are still not addressed in the class. Esteemed theory pedagogue Michael Rogers proposed that much of what is termed “eartraining” should more properly be referred to as “mind training,” and observed that *functional tonality* is the real subject of sightsinging.63

Lyle Davidson and his colleagues have not been alone in exploring ways to improve aural skills and musicianship instruction. Michael Rogers noted in 2000 that articles on theory teaching were showing a renewed emphasis on aural skills training after a period of comparative neglect, perhaps due to the blossoming of music perception and cognition research.64 Elizabeth West Marvin’s 1995 survey relating such research to theory pedagogy exemplifies this trend, as does Kate Covington’s article relating current

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learning theories and brain research to aural training. Edward Klonoski called for aural skills curricula based on perceptual fundamentals rather than on the conceptual fundamentals laid out in music theory texts, questioning whether the long tradition of treating intervals as the cornerstone of aural skills training is congruent with perception.

Kathy Thompson, an aural skills instructor who has absolute pitch, initiated her own research to better understand the experiences and strategies of relative pitch learners working with musical notation through interviews, questionnaires, protocol analysis and other observation techniques. Thompson’s metaphors for students’ more and less successful strategies recall Larry Scripp’s descriptions of first and second year NEC students’ development. The various strategies her students used and combined in sightsinging tasks are also useful categories for understanding string players’ reading and intonation approaches. They are as follows:

1) **The Follower**, with a history of learning by rote or with accompaniment. “All they have to do is sing in my ear and I can get it really fast.” Followers are quite adept at making instinctive split-second adjustments to match a strong singer or accompaniment.

2) **The Button Pusher** characterizes the skill of translating notation directly to fingerings. This strategy does not include anticipation of the sound before it is played. When musicians use this strategy, notation stimulates playing behavior, not aural imagery.

3) **The Contour-Singer**. Melody was out of focus for Contour Singers. They follow their intuition for what sounds correct. “Just thinking of the notes going up and down.”

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65 Covington, “An Alternate Approach to Aural Training.”
66 Klonoski, “A Perceptual Learning Hierarchy: An Imperative for Aural Skills Pedagogy.”
67 Thompson, “Thinking in Sound: A Qualitative Study of Metaphors for Pitch Perception.”
4) **The Tonal Thinkers** had pre-college experience with syllables such as scalesthenics or shape-notes. Tonal Thinkers could generally assess where uncertainty began. Errors might exchange one chord member for another (ti/sol).  

5) **The Builders** measured distance note-to-note (interval singers). Their sightsinging showed correct contours but inaccurate scale steps.

6) **Combinations**, e.g., the Tone-Builder.

7) **The Pitcher**, or absolute pitch user, not present among her classes.  

Thompson found in her aural skills classes that students with both instrumental and vocal pre-college experience had an advantage over more narrowly focused students. While singers predictably moved from Follower to Contour-singer to Tonal-Thinker to Tone-Builder strategies during the course, no simple linear model for improvement emerged for Button-Pushers, instrumentalists who had learned to read confidently without auralizing.  

Functional tonality (and cello fingering) concerns the relations *among* tones. Can sightsinging, eartraining and aural skills pedagogy be adapted to teach functional tonality and fluent reading in the cello lesson?  

Steve Larson (and many others) describes functional tonality as hearing music in terms of action within a field of forces: magnetism, gravity, inertia. He recommends helping students to experience and identify these directed tensions, both because they help us recognize the functions of musical notes or patterns and because conveying their expressive meanings is central to good musicianship. For this purpose, Michael Rogers

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68 Here and elsewhere, solfège syllables refer to the moveable do system.
69 Thompson, 88-92.
70 Thompson, 95.
and Larson both recommend working with short, 3-4 note scale degree patterns. Rogers identifies Jörgen Jersild’s eartraining method, widely used in Europe, Scandinavia and Australia, as an excellent resource, and I think many of Jersild’s drills and exercises can be as beneficial when they are played as when they are sung.

Jersild lays out 4-note scalar exercises evoking a variety of tonal orientations and contexts, beginning with dominant, leading-tone, leading-tone minor, and minor tetrachords. He juxtaposes several tetrachords starting from the same pitch (open D would be a good place to start on the cello). Students are led to become sensitized to the variety of possible spacings among — and meanings of — four adjacent dots on the staff and to be more flexible and less assuming in reading stepwise progressions.

Jersild’s tetrachord drills may be effective because they take advantage of the variable learning principle. Education researchers have found that for both motor/perceptual and higher cognitive functioning tasks, varying learning conditions may make learning more effortful while also leading to better retention and transfer of learning. Learning is also enhanced when learners are required to translate information from one format to another, re-representation. When a practice drill includes not just a tetrachord — perhaps conceived as “four notes in a row” — but a tetrachord four different ways, students focus both on making a given pattern and on making it not the other patterns, a much more stringent specification.

Researchers have posited and tested theories about melodic memory strategies including pitch-class succession, contour plus scale type, interval succession, scale

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72 Rogers, “The Jersild Approach.”
73 University of Memphis Department of Psychology. “Variable Learning.”
degrees in a key, or some combination of these, and Jay Dowling found that professional musicians seem to use a combination of the scale degree and interval strategies: the Tone-Builder, in Thompson’s terminology. Dowling attributed interval strategies to inexperienced listeners and scale-degree strategies to moderately experienced listeners. However, like Thompson, Bill Lake found both interval and scale degree thinking among students.74

That expert musicians auralize using a combination of strategies tends to support Jeanne Bamberger’s assertion that “the goal of musical development is to have access to multiple dimensions of musical structure, to be able to coordinate these dimensions, and most important, to be able to choose selectively among them, to change focus at will.”75 Lyle Davidson describes the goal similarly when he speaks of “a working integration of musical knowledge… integration of performance skills with representational, compositional or conceptual knowledge,” and the acquisition of “hierarchical structures that become robust enough to enable the student to make, remake, and undo transformations as requested or at will.” Educational psychologists speak of “transfer,” the ability to generalize learning to multiple contexts. Elizabeth West Marvin recommends that even absolute pitch users be helped to develop additional, relative pitch strategies.76

Teachers at all levels should create opportunities for students to think about the sound of notation before hearing it performed, Thompson asserts, and she suggests the

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74 Marvin, “Research on Tonal Perception and Memory,” 34-38.
76 Marvin, 58.
use of mystery tunes, familiar melodies presented in various formats — scale degrees, solfège, SMN. Davidson, Scripp and Welch, urging that “it is up to educators to make sure the symbol system of the domain is not taught in isolation of perception,” note the utility of invented notations, which do not require a student to represent more than he knows.77

Students can be led to think about the sound of notation by challenging them to choose the notation of a named song from an array of anonymous choices, to decode and perform “mystery tunes” (unlabeled melodies which the student knows and can identify aurally) and to translate tunes from one system to another (e.g. scale degree to SMN). I have had advanced students translate portions of etudes, Merk’s op. 11, no. 18 in C# minor78, for instance, into scale degree skeletons and perform from them, with good effect on their intonation (see figures 3 and 4). Covington encourages integration of theory, perception and performance by assigning improvisation of melodies within given parameters such as key, meter, harmony, phrase length, rhythm patterns, and it is a short step from translating patterns, as above, to improvising new ones.

77 “Happy Birthday,” 73
78 No. 152 in Alwin Schroeder’s 170 Foundational Studies.
Figure 4: Student Jason Ng’s map of Merk etude (first page) with teacher's suggested revision of modulation to relative major
Kate Covington’s brain-based approach emphasizes relevant or anchored learning, learning that students perceive as connected to their experience. By choosing the right melodies from movies, musicals, patriotic songs, folk tunes, hymns or familiar classical themes — melodies that a student knows and loves — teachers can bring zest to the tasks of tonal learning. Often students will suggest such tunes themselves; my early lessons with one girl were filled with such requests. Covington’s classes listen to, play by ear, and notate such tunes. I would suggest beginning with simple questions to guide listening, focusing on things like major/minor quality, meter, tempo, and stepwise versus disjunct motion.

Covington contends that traditional methodologies for sightsinging “end just when meaningful listening should begin,” focusing exclusively on pitch and rhythm to the exclusion of timbre, dynamics, register, articulation and texture,\textsuperscript{79} and suggests focusing on perception of cadences; similarity and contrast; symmetry and asymmetry; and on identifying errors between score and performance, among other things. Suzuki violin teacher Edward Kreitman challenges students to listen for meaningful details such as bowings, articulations, line and direction, form, dynamic contrast, fingerings, advanced bow techniques, and interpretations in repertoire recordings, and he tests their knowledge by planting deviations in his own performances.\textsuperscript{80}

Elizabeth West Marvin recommends that very young beginners should have relative pitch training to avoid disadvantages related to overreliance on absolute pitch and

\textsuperscript{79} Covington, 7.
\textsuperscript{80} Kreitman, \textit{Teaching from the Balance Point}, 72.
suggests some activities to help absolute pitch users strengthen their relative pitch strategies: tonal echo patterns on scale degree numbers without notation; translating neutral-syllable arpeggiations into scale-degrees; singing in other than notated keys; dictation in scale-degree numbers or moveable-do solfège; and the use of more black key tonalities.  

Thompson, Scripp, and Davidson all emphasize the importance of individual meetings and student writing for understanding the way students are thinking. Talking through protocols, asking probing questions and making small written assignments can expose and clarify student understanding and misunderstanding. Studio teachers always work individually, a luxury of which we should take full advantage to help students succeed.

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81 Marvin, 58-59
Chapter Six: 
Incorporating Musicianship Skills Into the Cello Lesson — Applications

I have been researching musicianship pedagogy and skill development from the different perspectives of education, psychology, music perception and cognition, aural skills training, and string pedagogy. I conclude that the following could profitably be included in cello lessons to foster aural skills and well-rounded musicianship along with fluent music-reading: a growth mindset — effort and strategy based criticism with concrete goals; correct specialized vocabularies; singing; playing by ear; listening assignments and challenges; journaling; improvisation; Jersild-type tonal patterns; multiple scale fingerings; and church modes and other non-major/minor scales.

The curriculum I envision emphasizes relative pitch strategies in teaching good fingering habits. Concurrently, students refine their listening and learn musical values and vocabulary through solving short listening challenges focusing on similarity and contrast. Challenges deal with timbre, dynamics, register, rhythm, and articulation as well as aspects of pitch and interval.

All pitch concepts are assessed and reinforced by re-representation in multiple modes or formats. Students receive instructions in and respond with SMN, note names, intervals names, solfège syllables, scale degree numbers, fingering patterns, singing, or playing.
Consistent use of appropriate vocabulary can increase the benefit of lesson interactions. Naming things gives things importance, opens a unique file for them in the memory. While numbers, for instance, can be used to refer to scale degrees and metrical beats as well as fingerings, introducing unique terminologies is a way of distinguishing the different dimensions. One solution might be to use moveable-do solfége for scale degrees, letter names for pitches, numbers for fingerings, and a system like takadimi (attack oriented) or Kodály syllables (duration oriented) for rhythm. Another would be to use all of these and numbers, perhaps fixed-do solfege as well, since having students translate from one format to another is an exercise in multiple representation, a form of variable learning.

Part of the challenge of working with beginners is maintaining their interest and perception of progress while moving carefully and deliberately to establish basic and pre-basic foundations. By building in essential work on aural skills and musicianship — counting rhythms, listening, and reading notation — early lessons can spin out the time spent establishing and reinforcing posture and other “boring” instrumental basics: work in each area is at the appropriate slow and deliberate pace, but students experience many accomplishments.

A common early assignment I have made with beginners is simple, two-note fingering drills, played pizzicato, aimed at shaping the left hand and keeping the fingers blocked: “Play 4-1-4, 4-3-4, 3-1-3, 2-1-2 each ten times a day.” These instructions make no mention of pitch names, intervals, or rhythms; use no notation other than finger numbers; and they present at least four tasks as one. By the time Essential Elements, for
instance, reaches this point, students have been introduced to five notes on the staff, clefs, time signatures, and counting, and they have read and played eight “songs” using only open strings. *Young Strings in Action* begins by having students read — using note names, barlines, rests, and time signatures — open string duet accompaniments *plucked with the left pinkie*, to foster hand shape; fingering is withheld until the thirtieth tune in the book!

However else one draws out early steps, the opportunity to foster aural connections should not be neglected. *Essential Elements* calls for each new pitch to be reinforced with *echo-drills*, in which students repeat patterns played by the unseen teacher. Students begin to learn to respond instrumentally both to notation and to sound.

Teaching to the most advanced level can continue along this path, testing, reinforcing and entertaining students with a variety of aural identification drills derived from current instrumental topics. Beginning students who have been practicing 4-3 and 4-2 fingerings, for instance, can be drilled using as prompts or responses the terms whole-step and half-step, fingerings, and note names as well as echoing the teacher, and advanced students who have been practicing diminished scales can spell them or spot errors in teacher examples.

Whole- and half-steps are a good overarching aural skills theme for early study. One activity might be to go note-to-note through a major scale, naming and keeping tallies of the stepwise intervals. “Sightings” of half-steps in other contexts can be tallied and rewarded. Juxtaposition of tunes like *Young Strings in Action’s* “Half-Step March” and “Hot Cross Buns” contrasts the two intervals clearly in musical contexts.
Better listening provides better feedback for refining physical actions. I find that students who have been coached on the movements perform and understand extensions better when they conceive them and justify them in aural terms than they do when they are thinking physically. Asked to play both do-re-me (1-3-4) and do-re-mi (1x2-4), they make a beautiful distinction.

For students to be able to play in all key signatures — to be able to experience D-flat major as just another diatonic scale rather than some kind of fearsome, chromatic thicket — much of their scale work should emphasize the concept of the scale as a transposable interval pattern. Often progress in scale study seems to be equated with playing more octaves — instrumental progress — but progress in playing well in all keys and understanding the circle-of-fifths relationships among them comes more easily from playing more scales (all twelve keys) than from more octaves.

The circle of fifths and the concept and practice of transposition can be introduced at a fairly low level of instrumental skill simply by copying fingering patterns string to string (“play French Folk Song starting on the D string”). Young Strings in Action presents many tunes this way, and exposes students to the sound of modulation by fifths in the very first exercise: the teacher’s part moves in sequences from C to E over the nine bars. One-finger scales, in which the student clearly experiences intervals as traveled distances, and universal scale fingerings, in which the same fingers always play the same scale degrees, reinforce the concept of scale-as-interval-pattern and can be an effective part of shifting pedagogy. The by-now familiar whole- and half-step shift distances are not hard to audiate.
Baillot’s method included short memorized passages to be played in all twenty-four keys. I like to have students play simple patterns, and later scales, by ear or by rote in circle-of-fifths order. The change in resonance, absolute intonation, is gradual and less disorienting than in a stepwise ordering—easier, aurally speaking—while the change in fingering can be more challenging (particularly around B, F♯/G♭, and C♯/D♭) than in motion by half steps.

An easy fingering for just the circle itself is to play 4-2-x1 back and forth across two strings (4, 4, 2, 2, etc.), then shift downhill a half-step to the next lower pair of strings and repeat the fingering. Students can then build up from octaves, cadences and simple ornamentation of each pitch (do-ti-do; do-re-do-ti-do; do-fa-sol-do)—patterns playable in one position—to longer excursions and patterns including shifts (do-re-mi-re-do; opening of “Somewhere Over the Rainbow”; scales). It is important to quiz learners on note names as they play in less common keys, and to have them spell out or notate some of these exercises — after they play them. Jersild’s Diagram of Functional Progressions—15 pairs of notes for each key—would be beneficial when presented as scale degrees to be played or translated into other formats.

Once students have become familiar with all the major scales and comfortable with shifting, another way to improve students’ intervallic accuracy is to have them study the church modes. I theorize that playing all seven modes from the same tonic requires the creation of more refined mental pitch categories than merely playing major and minor scales: every scale degree (except 1) is inflected in two ways. The inflections must be distinct and the pitches common from one mode to the next must be consistent when
played in close succession in order to be comprehensible. Memory tricks which might be attempted with *two* patterns will be rejected as too clumsy to handle seven, and finally memorizing key signatures becomes an attractive, viable shortcut.

Naturally, multi-representational study of modes will include aural identification of what students have practiced — both pitching *and* catching: “Go home and practice Dorian mode in all keys, then come back tell me if *I* am playing it correctly.”

When all the modes have been learned, it is valuable to assign familiar tunes to be played by ear in the various modes and discuss the different musical and emotional effects. Comparing different orderings of the modes, e.g. stepwise (Ionian, Dorian, Phrygian, Lydian, Mixolydian, Aeolian, Locrian) and circle of fifths (Lydian, Ionian, Mixolydian, Dorian, Aeolian, Phrygian, Locrian) can be illuminating with regard to key signatures and key relatedness. Other useful permutations to assign include playing all modes on one tonic (especially in thumb position), transposing patterns up or down a scale while preserving the key signature (tonal sequencing), and requiring or forbidding the use of open strings in the fingerings. Having students set their own parameters can be the beginning of improvisation.

Practicing *groups* of scales, modes, and patterns in the way I have described is effective because it exploits the variable learning principle. Playing Dorian mode, for instance, around the circle of fifths, varies the conditions of practice of that fingering and interval pattern, and playing all the modes in one key signature varies the practice of a diatonic collection. Presenting a mode as a pattern of whole- and half-steps and requiring the student to translate it into pitches and fingerings is re-representation, another form of
variable practice. Just as the brain coordinates the slightly differing views from each eye to produce depth perception, it coordinates multiple views and versions of the scale object to create depth of understanding.

**Re-representation and writing**

While I have shown some ways to use re-representation in lesson work, the use of written assignments to reinforce music reading and decoding skills needs more consideration.

*Essential Elements* has students practice drawing clefs and other notation and provides “Essential Creativity” challenges in which students experiment with writing notes on the staff. Zachary Ebin, a Suzuki violin teacher, arrived at a similar creative approach to using writing to reinforce reading as following from the mother-tongue idea, using language learning as a model for music learning. He progresses from teaching students to draw their clef (analogous to writing their names) to composing and notating rhythms for the open strings and eventually to melodies and short compositions. 82

Setting tight guidelines, as Ebin does, for little composition assignments can be related to decoding and memorization work. Learning to see (and make) repetitive patterns and procedures in music, chunking, is part of expert music reading, akin to recognizing words and phrases without focusing on individual letters in verbal text. Many repetitive etudes and passages of figuration from repertoire are easy to parse and map in condensed, “cheat sheet,” invented notations. An effective sequence can be to map a passage, present the map to be realized (played) by the student, and then present

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82 Ebin, “A Mother Tongue Approach to Reading,” 55-59.
the original notation; students can then make their own maps for the teacher to play or as aids to memorization. Alwin Schroeder’s 170 Foundation Studies contains many suitable compositions: Duport, no. 159; Piatti’s op. 25/ 5 & 7, nos. 148-9; Merk’s op. 11/4-8, nos. 138b-142; and Cossmann’s op. 10/4, for instance, no. 163. Merk’s op. 11/18, as mentioned earlier, can be mapped and described as scale degrees with diatonic upper neighbors; from the map it can then be performed in several keys as well as in the original C# minor.

The variable practice work for scales and modes described above can also be used for chords and arpeggios, naturally. A sequence which could culminate in the performance of my Scheherazade map would begin with practice in spelling, recognizing, and performing chords. (On the cello there is usually only one possible voicing including three chord members for a given chord inversion, leaving aside open strings: root-fifth-third (fingered 1-1-3 or 2-2-4) for root position major, for instance.)

The student will begin by concentrating on one chord class each week (first inversion minor, for instance), spelling, notating, performing, recognizing and identifying the chord on all twelve pitches in both closed position (me-sol-do) and in the open voicing (me-do-sol) convenient for cello fingering. The student will study root position, first inversion and second inversion major and minor triads, root position dominant seventh chords, and diminished triads and seventh chords. As each chord is mastered, exercises mixing and comparing all the chords learned to date will precede work on a new chord class. I find it useful to give one of two basic handouts, which merely list the twelve keys with and without staff lines, as the worksheet for each week’s exercises.
Generally, spelling and notating can be done as homework, and more lesson time can be spent on performing the fingerings, spotting the chords in scores, and aural quizzing.

In setting the assignments the first few times it may be necessary to model a thought process for finding a cello fingering template for a chord class: 1) determine a root-position solfège or scale-degree spelling (do-me-sol); 2) associate a pitch class with each syllable (C-E♭-G); 3) decide which chord member must be in the bass (me, E♭, for first inversion); 4) fingering the bass note on the G or C string with the first finger\(^{83}\), look for the other two pitches within the hand position on the two strings above.

Here is a protocol for constructing a passage from J. S. Bach’s *Suite in C Major*, Prelude, mm. 37-44, simpler than the *Scheherazade* as it only uses root position major and minor triads:

1. Choose a key. On the C string, play ascending 1, 2, 3, 4.
2. On each scale degree, play an ascending 6th (in the key). (In minor, use natural minor). You will have four pairs of notes, four sixths.
3. Taking each note of these pairs as a root, play a root position major or minor chord as appropriate to the main key; substitute minor chords where diminished would appear. (What notes are altered?)
4. Arpeggiate each chord upward twice over 3 strings.
5. Arpeggiate each chord downward twice over 3 strings.
6. Alternate downward and upward arpeggiation by chord (one down, one up per pair).
7. Make a 4-note pattern by returning through the middle string to begin the repetition on the next beat. Play twice.

\(^{83}\) Ten more pitch classes are within reach of the first finger bass note on the two strings above; only the minor second above the bass is missing. Since the hand’s reach contains the octaves above the other fingers, only nine more pitch classes are available when you finger up from 2, 3 or 4.
8. Connect the paired chords with a four-note descent from the third of the first chord in each pair.

9. Connect each pair to the next with a four-note descent from the upper root of the second chord.

10. Replace the upper root in the second descending figure with the lower root, creating a minor seventh leap (and eliminating a shift).

The following chart for Scheherazade is read left-to-right, top-to-bottom. The chunk column is redundant; when players become familiar with chunks A and B they may be able to disregard the second column, recalling the chords as groups. The first column indicates the scale degree to be used as the bass of the chords whose quality and inversions are indicated in the second column. The first 3 chords are all played on scale degree one (tonic) of the key chosen for the exercise. This excerpt is mostly sequential, and I have divided the chart between sequences. In Chunk A, the notation 5=4 means that the root and third of the previous chord are retained while the fifth is lowered one half-step.
Arpeggiate up and down over 3 strings (6 notes):

<table>
<thead>
<tr>
<th>Bass movement</th>
<th>Chord</th>
<th>Chunk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M 3 (5=44) (m 3)</td>
<td>A (model)</td>
</tr>
<tr>
<td>7</td>
<td>M6 (5=44) (m6)</td>
<td>A’ sequence</td>
</tr>
<tr>
<td>i7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Dom7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move up to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1\2</td>
<td>M6 (same root)</td>
<td>B (model)</td>
</tr>
<tr>
<td>1</td>
<td>Dom7</td>
<td></td>
</tr>
<tr>
<td>1\2</td>
<td>dim6</td>
<td></td>
</tr>
<tr>
<td>1\3</td>
<td>M6</td>
<td>B sequence</td>
</tr>
<tr>
<td>2</td>
<td>Dom7</td>
<td></td>
</tr>
<tr>
<td>1\3</td>
<td>dim6</td>
<td></td>
</tr>
<tr>
<td>Only 3 notes per chord, alternating up and down. Start on bass</td>
<td>Only 3 notes per chord, alternating up and down. Start on bass</td>
<td></td>
</tr>
<tr>
<td>1\4</td>
<td>M6</td>
<td>B sequence</td>
</tr>
<tr>
<td>4</td>
<td>Dom7</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>dim6</td>
<td></td>
</tr>
<tr>
<td>Only 3 notes per chord, alternating up and down. Start on bass</td>
<td>Only 3 notes per chord, alternating up and down. Start on bass</td>
<td></td>
</tr>
<tr>
<td>1\5</td>
<td>M6</td>
<td>B sequence</td>
</tr>
<tr>
<td>5</td>
<td>Dom7</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>dim6</td>
<td></td>
</tr>
<tr>
<td>Return to up-and-down arpeggiation</td>
<td>Return to up-and-down arpeggiation</td>
<td></td>
</tr>
<tr>
<td>1\6</td>
<td>M6 (5=44) (m6)</td>
<td>A’ recurrence</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retaining upper voices, move down to 5</td>
<td>Retaining upper voices, move down to 5</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>M3</td>
<td>Resolve top voice -1/2</td>
</tr>
</tbody>
</table>

**Symbol key**

- \(M\) = major
- \(m\) = minor
- Dom = dominant
- \(\frac{3}{2}\) = root position
- \(7\) = root pos. seventh chord
- \(6\) = first inversion

Figure 5: Map of *Scheherazade* excerpt
Figure 6: Rimsky-Korsakov, Scheherazade, cello part, excerpt bracketed
My husband, a violinist, was able to play this once we had better specified the fingering rules for violin, and making it has strengthened my performance of the passage as written.

Teachers must use their judgment as to what activities will challenge a student to revise and improve her schemes. In listening to a student, it is useful to focus on two questions: is he hitting the notes he intends to hit; and is he intending the right notes? Or: was that note out of tune, a wrong note, or both? We can then begin to distinguish failures of decoding, image, focus or memory from physical failures of accuracy.

**Conclusion**

As I observed earlier, we often scaffold formation of the mental image — auralized from notation by mature musicians — with recordings and modeling or bypass it with fingerings or fingering-based notation. As Davidson, Scripp, et al. emphasize in their sightsinging skill matrix, the process of realizing notated music depends first of all on accurate pitch identification. If we are going to teach students using notation, it falls on us to explain its underlying structure, the scale hidden in the staff; we cannot assume they will learn it elsewhere or later on.

Studio string teachers want their students to be able to read and understand music and execute it with good tone and expression—indeedently and at sight, ultimately. We constantly strive to get students to transfer the natural and expressive playing they achieve over months of coaching and drilling to their reading and performance of new and unfamiliar music they study on their own. Reading without understanding leads to
performances that are technically awkward, prone to errors, and shallowly expressive at best.

While mental musicianship is the main and explicit focus of aural skills training, the same skills can and should be integrated into instrument study. Work on music reading in the cello lesson poses opportunities to select and employ a range of strategies for both decoding and exploring the meaning of music, essential for musical artistry. “Practical” skills like intonation, memorization, sightreading, and even fingering are cumbersome or impossible without such training, and expressivity, supposedly intuitive and natural, is enhanced by it.

As I hope the earlier chapters have made clear, fully operational tonal knowledge and aural skills do not necessarily develop in the course of instrumental technique acquisition or of learning music for performance. In the words of the old song from South Pacific, you’ve got to be carefully taught.

I believe such teaching should happen as soon as possible in children’s music education. Certainly pre-teen and adolescent musicians are capable of learning the labels for the things they are hearing and playing, and all of their musical development (creativity, technique, expressivity) will be nourished and stimulated by improved ability to understand and process music. Instrument lessons can be more like obedience training without this higher order enculturation. At some point, young adults need to be told why.

Skilled memory theory posits that experts use meaningful encoding principles to organize concepts and information in long term memory, strategically creating multiple
potential cues and avenues for retrieval or retrieval structures.\textsuperscript{84} Musicianship training exposes students to such meaningful encoding principles. As simple an activity as scale practice can do more to build musicianship by varying the retrieval cues presented to the student and the means by which they are required to respond.

\textsuperscript{84} Ericsson and Staszewski, 239.
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Appendix A

Notation and spelling worksheets.
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<tbody>
<tr>
<td>C</td>
<td>G</td>
<td>D</td>
<td>A</td>
<td>E</td>
</tr>
</tbody>
</table>
| F#/G♭ | C#/D♭ | A♭ | E♭ | B♭ | F