Curriculum Design Series

SIGHTSINGING AT NEW ENGLAND CONSERVATORY OF MUSIC

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PREFACE

This set of articles is intended to open a discussion of sightsinging skill development at the college level. In the course of revising the sightsinging curriculum at the New England Conservatory of Music, we investigated three facets of musical education: a) psychology of skill development; b) reformulation of traditional instructional practice to reflect cognitive-process theory; and c) concepts of assessment designed to take into account these new perspectives.

In the first of the three articles that follow we will reinvestigate the domain of sightsinging skill acquisition from a developmental perspective. Here we share our views about how musical knowledge develops in all children in our culture and how important it is that basic musical skills become increasingly articulate, internalized, and operational with training—independent of instrumental technique. We chart the growth of musical knowledge from the level of *kinesthetic* knowledge (enactive fingering) to the *externalized* knowledge (singing to demonstrate musical intentions) and finally becoming *internalized* representation (inner aural imagination).

In subsequent articles we present the teaching and assessment models that work with this developmental perspective. The *pedagogical framework* adopted by New England Conservatory solfege courses is partly a response to the re-investigation of traditional teaching with respect to a developmental view of musical skill acquisition. The framework defines the task of teaching sightsinging in terms of a *cognitive process model* (Lin, 1979). This view of music reading articulates the structure and scope of the many subskills that can be addressed separately or integrated in musical perform-

ance. In the final article the *multiple assessment techniques* in use at the conservatory are reported. Both quantitative (standardized departmental examinations) and qualitative analysis (error analysis and classroom observations) were developed to help teachers trace the growth of sightsinging skills. We are pleased to report that multiple assessment also makes students active and reflective participants as they track their own stages of development in sightsinging skills.

DEVELOPMENT OF SIGHTSINGING SKILL AT NEC

"By mastering an art such as music-reading, we can see the mind functioning in order to understand, and that might reflect how it works when attempting to solve problems of more abstract nature"—2nd year solfege student (composition major).

The solfege program at NEC is the entry point for developing the skills necessary for a broad musical literacy in performance. On the basis of the strength and depth of the aural skills that are developed in these courses, subsequent work in other areas of music activity proceed with closer connections between the technique of the instrument, the musical score, musical interpretation, and concepts stemming from an informed integration of the musical "eye and ear." Although entering conservatory students are highly skilled instrumentalists, the basic skills of literacy—sightsinging in particular—have not extended beyond the literature for their instrument. Typically, musical realization and concepts are limited to whatever can be performed with technical skills acquired through the instrument. Therefore, it is incumbent upon the solfege course to develop basic literacy skills to the point where students can freely and fluently express music independent of their instrument in a wide variety of musical contexts.

During the first two years the courses feature the development of basic skills. More specialized courses, as well as courses in twentieth-century music, are offered during the third year. The four solfege courses (Theory 101, 102, 201, and 202) lead to fluency in sightsinging and sightreading as developed through a fixed-do pedagogy. The focus is on exercising skills through "problem solving" in performance, not on memorizing materials or literature. Development of skills is measured by standardized departmental examinations in sightsinging (given twice each semester) and course work assigned by each instructor. Readings (in cognitive psychology, reading development, and skill acquisition) and term papers are assigned and form an important part of the class work. Ensemble music performed from scores in class includes Bach chorales, string quartets,

symphonies of Mozart, Haydn, Beethoven, Dvorak, Debussy, Renaissance sacred music (in original clefs), and various pieces from the twentieth century.

Although musical performance is the primary focus of activity in the course, students are asked to do more than develop their performance skills. They are challenged to show they can problem solve during performance (demonstrating various strategies and practice techniques in score reading, coaching, etc.), apply their *performance skills to perception tasks* (through error detection and transcription), and demonstrate a level *of reflection* necessary for integrating their new skills into their musical practice (as a performer, conductor, composer, teacher, etc.). Serving this last goal students are asked to participate in classroom research projects, tutoring and self reflection by writing papers comparing pedagogical techniques, learning strategies or mindfully documenting their own development as they proceed through four or more semesters of basic literacy skill acquisition and development.

LEARNING TO READ: SEMESTERS ONE AND TWO

The first solfege course (Theory 101) assumes no background in reading music. This course serves as a prerequisite for all theory courses. The focus for this course (and the next one) is learning to read without the aid of an instrument. All sections stress knowledge of tonality as represented by scales and scale degree functions. The materials of the course feature melodies in major and minor keys, rhythms in standard meters, modulations to the dominant, the relative major, and the relative minor, and their use in small forms. Readings and papers are assigned and students work with the Humanities faculty on these assignments. Students become fluent in treble and bass clefs. The texts for the course include Danhauser, *Solfege des Solfege* (vol. 1); Bona, *Rhythmic Articulation* (No. 1-90); and Dandelot, *Manuel Pratique.* Ensemble music includes Bach chorales and Mozart symphonies (No. 22-26). Departmental examinations focus on tonal and rhythmic materials within simple diatonic melodies. Students *must* perform at a baseline level of sightsinging competence in the departmental examination to pass the course.

The second solfege course (Theory 102) builds on the skills begun in Theory 101 through extensive drill and practice in basic materials and a carefully expanded range of musical contexts. The basic materials of the course feature melodies in most major and minor keys, more remote modulations, more complex rhythmic subdivision and syncopation, note identification, pattern-reading exercises in the treble, bass, and alto clef.

Score-reading skills continue to be expanded through literature including Bach chorales, classical symphonies, and other vocal and instrumental music chosen by the instructor. To pass the course, students must demonstrate sightsinging competence at a significantly higher level within the more complex diatonic contexts of the standardized departmental examination. To qualify for the highest grades in the course, a student must sightsing the more chromatically enriched melodies of the departmental exam. The texts for the course include Danhauser, *Solfege des Solfege,* (vol. 2); Bona, *Rhythmic Articulation* (No. 91-120); and Dandelot, *Manuel Pratique.* Ensemble music includes Bach chorales, Vivaldi concerti, Mozart quartets, and Haydn symphonies (No. 102, 103, and 104).

READING TO LEARN: SEMESTERS THREE AND FOUR

After two semesters of solfege, students' ability to read diatonic music at sight becomes relatively stable. Recognizing this, the focus of the solfege courses shifts toward a broader and deeper use of basic skills to explore and learn literature beyond the context or range studied in the private-lesson studio. Because the inner musical ear is increasingly refined by the internalization of musical ideas gained *away* from the instrument, student classroom participation depends increasingly on the exchange of musical ideas through solfege performance. A hallmark of the developing mastery is the increasingly spontaneous expression of nuance while singing at sight. Accordingly, the standardized departmental exams shift to this more interpretive aspect of musical performance.

The third semester of solfege follows the same developmental model as the previous courses. At this level, the application of students' more sophisticated skills in increasingly complex performance situations is stressed. The materials include note and pattern reading in five clefs (treble, bass, soprano, alto, and tenor), use of the clefs for transposition when reading scores, rhythms using changing time signatures and complex subdivisions and tonal melodies featuring rapid modulation. The texts for the third level course include Danhauser, *Solfege des Solfege,* (vol. 3.), Weber, *Sixty Lessons in Rhythm,* (vol. 1), and Dandelot, *Manuel Pratique.* Score-reading materials include Bach chorales in open score (4 clefs), Mozart Quintets and Divertimenti for transposing instruments, Beethoven symphonies (No. 1-3), and other instrumental scores with transposing instruments. Appropriately, the departmental test now requires expressive performance in highly modulatory melodic passages as well as score reading requiring the use of clefs and transposition.

The fourth semester features a wide range of musical materials neces-

sary for insuring the development of sightsinging proficiency across various musical styles. Assignments include note reading and transposition in all seven clefs (in wide registers), advanced rhythmic problems in subdivision, syncopation, and conducting, as well as chromatic and atonal melodies. The texts for the fourth-level course include Danhauser, *Solfege des Solfege,* (vol. 3 and 4), Weber *Sixty Lessons in Rhythm,* (vol. 1 and 2), and Dandelot, *Manuel Pratique.* Recognizing that music reading is linked to specific musical styles, this semester emphasizes sight reading in a wide variety of musical styles and formats. Therefore, score-reading materials include more complex vocal, keyboard, and orchestral repertoire: for example, our own anthology of vocal renaissance music in the original clefs, Schubert Symphony No. 5, Brahms Symphony No. 4, Dvorak "New World" Symphony, Debussy "Prelude to the Afternoon of the Faun," Mahler Symphony No. 4, and Stravinsky Symphony of Winds, as well as music from the repertoire of jazz (e.g., Guiffre, "Four Brothers"). Additionally, students are assigned solfege performance projects to prepare literature based on their repertoire. Examples for projects include demonstrations of Indian and jazz improvisation, transposing chamber music at sight, arranging solo works for solfege ensemble, etc.

Throughout all four semesters of study, "solfege parties," which spontaneously occurred at various times during each semester, now have become featured events of the Conservatory's sightsinging program. These are important occasions during which students from all classes and levels have an opportunity to sight read and perform for one another as well as in ensemble. These occasions provide the beginning students with examples of different levels of music-reading skills that help them form realistic self-assessments and goals for their continuing development. The more advanced students, on the other hand, have an opportunity to reflect on the extent and depth of their own development. Recently, literature for sight reading has included songs from Manhattan Transfer, masses by Victoria, cantatas by Bach, Mozart arias from "Marriage of Figaro," Haydn's Concerto for Trumpet, and Beethoven's Piano Concerto No. 3. Solfege students form the solfege orchestra providing the "orchestral" accompaniment for the soloist.

ADVANCED SOLFEGE/ASSISTANTSHIP PROGRAM

Once students have entered the mastery level of sightsinging skills they are candidates for the advanced solfege class and/or the assistantship program. This is an opportunity for qualified graduate and undergraduate students to refine their skills and prepare for teaching basic literacy.

Because teaching assistants are able to work with students at earlier stages of sightsinging development, they are able to observe the developmental approach to skill acquisition and to revisit and re-evaluate the stages of their levels of mastery.

Advanced solfege includes a comprehensive review of solfege materials dealing with clefs, interval studies, advanced rhythmic materials, and advanced score reading. Course work includes individual projects in preparing to conduct scores drawn from repertoire and a survey of texts and pedagogies used in different cultures. Term papers are required that feature topics in educational psychology, philosophy, and skill development. A written proposal for a solfege and ear-training curriculum is developed at the end of the course. A graduate of this course will have the background and experience to teach solfege and sightsinging at any level.

Those students selected as teaching assistants participate in a weekly pedagogy seminar where educational theory—as it applies to a conservatory context—is read, discussed, and immediately practiced in remedial sessions and private tutoring. Videotapes and protocol analyses of classes and individual lessons are used for group review and discussion. The materials for the course focus on the three facets of musical education: a) psychology of skill development; b) re-formulation of traditional instructional practice to reflect cognitive-process theory; and c) concepts of assessment designed to take into account these new perspectives. The following articles have developed out of the discussions in the course and the summer workshops for teachers of basic literacy skills.

Finally, we welcome this opportunity to express our appreciation to those teachers, faculty, and teaching assistants who have helped us formulate this perspective concerning the learning of basic literacy skills in the conservatory. We are particularly indebted to the late Albert Bernard—former instructor of solfege at NEC and conductor's seminar at Tanglewood—for his vision, dedication, and success in adapting traditional solfege materials to the American conservatory; to faculty members F. John Adams, Alan Fletcher, and John Felice, who have contributed greatly to the formation of this curriculum and in particular the development of the standardized departmental exams; to the teaching assistants and students—especially Terry Becker, Jim Torres, Mike Malone, and Matt Sonnenborn—who, with us, participated in the long and arduous task of designing, reviewing, and revising test items, making classroom observations, and allowing documentation of classroom activities, projects, and test performances so useful for teacher workshops; Anna Strickland for her proofreading and help with figure layouts; members of the Harvard Project Zero "Thursday Night Music Group"— especially Patricia Welsh, Joan

Meyaard, and Alys Terrien-Queen—for their helpful suggestions and musical insight; Jack Wohlwill for his lucid insight into the possibilities of investigating musical issues through developmental and cognitive psychology; and finally to Howard Gardner and the support of Harvard Project Zero research projects, which have long supported the investigation of learning, cognition, and development in the musical arts. The following articles represent our best efforts at recapturing the high spirit, hard work, and free exchange of ideas that occurred while pursuing the converging paths of music, education, and human development.

PART ONE

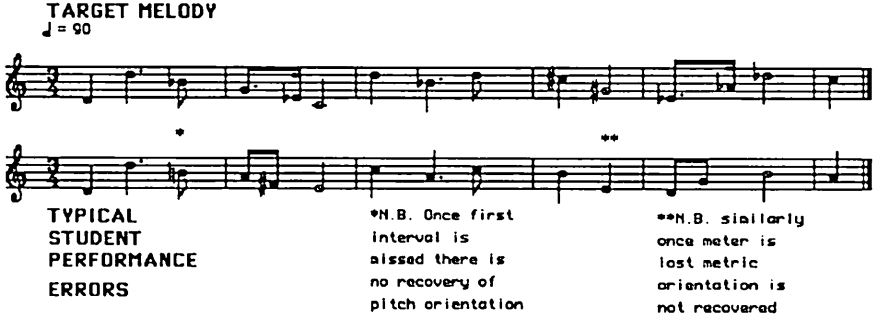
A DEVELOPMENTAL VIEW OF SIGHTSINGING

LYLE DAVIDSON

LARRY SCRIPP

Some years ago we unintentionally used a range of test items (to evaluate a group of junior sightsinging students) that were also used during their first year. Thus, inadvertently, we were able to compare test results with their previous performance as freshman two years earlier (See Figure 1). Many questions were raised among the faculty, because surprisingly little improvement in sightsinging accuracy was evident in the juniors' performances. That students, after two years of instruction, failed to show significant improvement confirmed the worst fears of some faculty members.

Figure 1. Target and Performances Showing Errors Typical of First Year Students.



Why didn't the sightsinging performance accuracy change dramatically in the third year? Were there problems with the students' practice habits? Did students memorize examples by rote, playing them on their instrument over and over? Did students merely learn to guess notes and rhythms in the style of the melodies presented in the text? Was too much expected in assuming that skill in sightsinging would transfer across styles as diverse as *Modus Novus* (Edlund, 1963) and Bach Chorales? Or perhaps the measurement of the performance skills was not appropriate. If we only look at single issues of accuracy or focus only on the rote acquisition of materials, we may overlook important aspects of the development taking place.

The educational "crisis" we discovered in our sightsinging classes illustrates the need to understand skill development from a multi-dimensional perspective. This broad perspective has to be sensitive to musical issues, the demands of educational psychology, and the apprehension and processing of musical knowledge. A more complete accounting requires that we think again about what happens—and what we expect to happen—in sightsinging courses.

MUSICAL DEVELOPMENT

"Domains were [previously] broken down into their principles and theories, but not studied in terms of the ways in which individuals move from encounter to engagement, from engagement to mastery of early levels, from apprentice to journeyman, and so on" (Feldman, 1980, p. 168).

Developmental psychologist David Feldman makes a strong case for the necessity of rethinking the relationship between skill development and educational practice. Traditionally, developmental psychologists have been concerned with building and refining models of intellectual growth within various domains (Furth, 1969; Fischer, 1980). They seek to convincingly describe, whenever possible, invariant and universal sequences or stages representing qualitatively ordered changes in cognitive and skill development from novice to expert. For example, in the case of concept of space, children first create topological features, then conserve geometric relations, and finally are able to represent 3-dimensional features of cubes (Piaget, 1956).

These models, representing stages of intellectual advancement, are useful to researchers and educators alike. Psychologists and teachers also share a concern with *how* students go from one stage to another. Once levels of knowledge within the domain have been diagnosed, the practical ques-

tion becomes "How can students be supported through the various stages of development?"

To be useful as a pedagogical orientation, a developmental view requires that we take into account the entire range of discursive knowledge and intellectual skills a student brings into the classroom. We need to understand how individuals change as they move from "initial engagement" of youth, to "early mastery" of middle teens, from "apprentice to journeyman" and beyond to become mature artists. We want to place conservatory students' range of knowledge against the background of musical knowledge and skills characteristic of children, adolescents, and adults. Additionally, we take to heart Feldman's emphasis that a developmental perspective requires that we identify levels of achievement which are *intrinsic* to a domain (e.g., musical development as expressed through singing, playing, or conducting) as opposed to those *extrinsic* to the domain (e.g., textbook knowledge of music theory or notation systems). Thus we ask about the antecedents of students' current musical knowledge by approaching it from a psychological as well as a musical perspective, in hopes that with this experience, we will be better able to understand and assess the skill, talent, and artistry that support musical expression.

CHILDREN'S GRASP OF MELODY

Most adults would say that children learn to sing by imitation and assume one of two explanations: 1) children use discrete intervals to construct the melody; or 2) through trial and error, children gradually refine the shape of the melody until it matches the tune. Each theory suggests certain pedagogical stances. For instance, if our pitch knowledge is the accumulation of increasingly stable knowledge of isolated intervals, we would expect to see intervals featured in music teaching and assessment. In this particular context one can easily imagine intervals at first linked to specific songs ("Brahms' Lullaby" provides the minor third), slowly become detached from specific songs and associated with patterns of notes (melodies and scales), specific conceptual terms (minor third), and finally with specific symbols on a page or fingers on an instrument. A pedagogy based on this hypothetical developmental sequence would be structured to articulate and reflect these stages in pitch knowledge. Teaching materials, drills, and testing would all be designed and used to diagnose problems or to facilitate progress along the lines of this particular trajectory .

But what if that is not the story? What if children learn the rudiments of tonal structures by "trial-and-error" approximation of melodic contours without regard for intervals? If tonal structures of melodies are the result

of tracing the ups and downs of melodic contours without regard for the intervallic or scalar stability that is characteristic of the phrase, then the pedagogy might be very different. The task for a sightsinging teacher, then, might be to teach several melodies that share the same contours, organizing the entire repertoire according to a criteria such as length of melodic phrases, or maybe teach those songs that characteristically have smooth and one-directional contours before teaching those with more angular shapes.

So how do children, in fact, learn to control pitches of their songs? Systematic observation of nearly 80 children over a seven-year period at Harvard Project Zero, suggests that "contour schemes," rather than gradual refinements in the overall contour or interval matching, account for the route of emerging tonal knowledge (Davidson, 1985). Although other researchers confirm that musical pitch development follows neither course associated with the adult predictions suggested (Dowling, 1984; Pond, 1978), a systematic and empirical model of pitch development had not previously been offered. With the Project Zero research a model emerged suggesting that there are five specific levels of pitch development in young children's singing between the ages of one and six years. These levels characterize children's structural knowledge as expressed through *contour schemes* (see Figure 2).

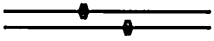
While singing invented and conventional songs, pre-school children first use these melodic schemes with a descending motion. Except for the first contour scheme, the phrases children sing are longer than individual notes or intervals, yet, at the same time, smaller than the individual melodic phrases of model songs. With development, the vocabulary of schemes grows from those that span roughly a third to those that span roughly a sixth. However, these contour schemes do not develop in ways one might logically predict from interval learning (i.e., proceeding from smaller to larger fixed intervals). Although they begin as small, descending motions and expand as leaps outlining a fourth, a fifth, and sixth, this simple line of development does not immediately account for the occurrence of stepwise motion within each tonal frame.

Significantly, stepwise motion within a contour scheme occurs only *after* the next larger contour scheme using leaps is in use. Only then does the child fill in the gap between the top and bottom of the previous contour scheme with stepwise motion. For example, not until a child has acquired the ability to reliably sing a fourth (as a leap) does the child fill in the earlier leap (the third) with stepwise motion. This "backing-and-filling" process continues until finally the contour scheme of a sixth has been achieved. At this point the accretive process of development stops. Contour schemes do not continue to develop beyond the span of the sixth. The octave, which emerges only later, appears to arise from fundamentally different processes.

Figure 2. The contour schemes of young pre-school children.

Levels 1a and 1b: Contour schemes of a third

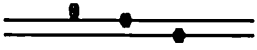
Level 1a, leap: a high-low motion with an unfilled space between the boundary notes.



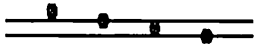
Level 1b, step: the same boundary with the intervening space filled with stepwise motion.

Levels 2a and 2b: Contour schemes of a fourth

Level 2a, leap: level 1a with a step added (either on the top or the bottom).



Level 2b, step: the same boundary with the intervening space filled with stepwise motion.



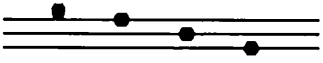
Levels 3a and 3b: Contour schemes of a fifth

Level 3a, leap: some combination of levels 1a and/or 1b which outline an interval of a fifth.

Level 3b, step: the same boundary with the intervening space filled with stepwise motion.

Levels 4a and 4b: Contour schemes of a sixth

Level 4a, leap: some combination of levels 1a and/or 2a which outline an interval of a sixth or a seventh.



Level 4b, step: the same boundary with the intervening space filled with stepwise motion.

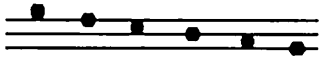
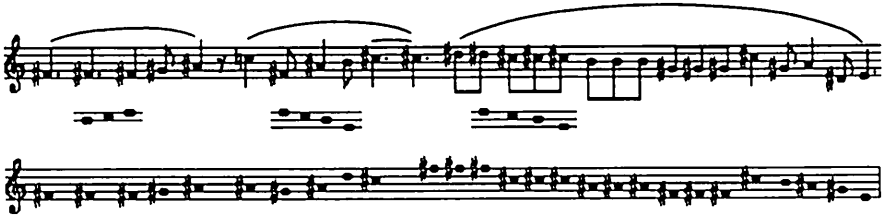


Figure 3 shows how these schemes function only in very local contexts (i.e., within an individual phrase) when pre-school children sing "Row, Row, Row Your Boat." Substantially more developmental change is required to construct a tonal stability that can be maintained across phrases and in a variety of contexts.

Figure 3. Transcription of a typical pre-schoolers performance of "Row, Row, Row Your Boat" with contour scheme analysis below.



The increasing differentiation and stability of pitches are two characteristics of pitch-singing development in the early years. At first, pre-school children fail to return to established pitches or reference points in their songs as they generate only the individual contours that form the child's repertory of melodic schemes. As the repertory of contour schemes grows, the number of different reference pitches used when singing a song decreases until there is a relatively stable one-to-one correspondence between the pitches of a model song and the pitches the child sings. However, the locus of this stability is still within the phrase during the pre-school years. It does not extend across all the phrases of songs yet.

In summary, children's grasp of tonal relationships undergoes systematic development in two ways: first as they expand their repertory of contour schemes, and second as they more often return to individual referent notes of the model song. However, development does not proceed neatly from steps to leaps, nor does it follow a direct sequence from simple to more complex intervals. Nonetheless, by the age of six or seven, a significant preliminary phase leading to mastery of tonal space is complete.

After this first phase, development continues as contour schemes are integrated into the hierarchical structure provided by the scales of the culture. This second phase continues during the elementary school years where there is a great deal of musical activity (organized and spontaneous singing) during which the stability of tonality begins to extend across

phrases. As tonal memory and the use of scalar structures expands, sensitivity to tonal functions increases and the contour schemes are gradually coordinated with the tonal vocabulary of the culture. The culture provides the means of integration, knitting the first melodic units (contour schemes) into the stable, hierarchical tonal structures of songs—the musical scales that support the culture's musical expressions. However, without further intensive formal training (including instrumental *and* theoretical: writing and sightsinging or solfege), the complete integration of contour schemes into stable and operational tonal systems appears to remain incomplete.

SUPERFICIAL KNOWLEDGE OF SCALES AND MELODIES

The musical growth of the young child-musician is a story of how young singers build an increasingly large repertoire of contour schemes that are integrated into more stable structures (scales), and how they develop musical perception of tonality [knowing when notes belong to a "key" (Frances, 1958) or "conserving" melodic structures across many transpositions (Bartlett & Dowling, 1980)].

Accordingly, by the time music students enroll in a college-level sightsinging class, they bring with them a vocabulary of contour schemes, the perceptual knowledge of tonal functions, a first-draft knowledge of the scale, and years of instrumental training and exposure to music literature. Given this background, why does their knowledge of scale systems and tonal melodies remain incomplete and superficial when they enter the conservatory? Why, for example, are approximately 80% of entering conservatory students *unable* to write out the tune "Happy Birthday" correctly (Davidson, Scripp, and Welsh, 1988)?

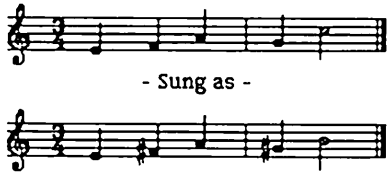
Every teacher of sightsinging can think of many examples of this superficial stage of tonal knowledge. Just a few moments with a beginning class reveals their relatively figurative grasp of scales. Although they may easily learn to sing scales and melodies, they will be unable to easily sing specific notes of a melody or degrees of the scale on demand. For example, if individuals are asked to sing a one-octave span on a neutral syllable starting on scale degree two of a major mode, one of three things happens. Some students will sing the octave but transform the second scale degree into a tonic and sing a major scale. Many more students stop singing when they reach the tonic, instead of completing the octave by continuing up one more note. Still other students use their extrinsic knowledge that eight steps make an octave to determine when to stop. They solve the task by counting

up eight notes as they sing. In each case the students often are not aware of what they've done.

We take these responses as evidence that students have not yet learned to functionally partition their musical space. They are singing the scale as if it were a "melody" and they stop where it "feels right," not where they are asked to stop. In other words, they are unable to monitor and control their performance of the scale to show musical understanding of the parts in the context of the whole; merely counting the number of steps is not enough to engage intrinsic musical sensibilities.

Another example of students' figurative grasp of tonal space is evident from the mistakes they make when asked to sing a melody. For example, a melody that begins 3, 4, 6, 5, 8 will be sung as though it began on scale degree 1 (see Figure 4). These errors are systematic and predictable at early levels of development.

Figure 4. Transcription of pitch errors typical at early levels of sightsinging development.



PARTITIONING TONAL SPACE

If we step back from these examples for a moment and define them in psychological terms, we can gain a new and useful view of what takes place. The psychological task facing adult and child alike is how to partition the physical continuum (the gamut of pitches) into meaningful units (Werner, 1948). The way students partition tonal space depends on their developmental level. A young child substitutes contour schemes for the notes of the melody, while the untrained adult and the beginning music student exhibit the partially formed tonal stability that superficial knowledge of the scale makes possible.

Another view of partitioning tonal space has been carefully described in the research of Jeanne Bamberger. She reports children and untrained

adults arrange the Montessori bells in the order that the notes of the melody are performed rather than first making a scale and extracting the notes from that operational scheme of tonality to form the melody. They require one bell for each of the notes of the melody, including the repeated tones (Bamberger, 1986). In their understanding of the melody, the notes of the tune and the order of the action of bell playing are fused together, making it unthinkable to repeat a bell to sound a repetition of a note. In contrast, musically trained children and adults use their symbolic understanding of hierarchical tonal structures. They represent the melody on the bells by constructing the scale that serves as a tonal model from which many melodies can be constructed.

From this perspective, the sightsinging class presents a context of exercises that gives students the opportunity to integrate the small contour schemes into increasingly larger tonal structures. These tonal structures create a qualitatively different orientation by filling tonal space with functional units that often stand in fragile relation to one another, making issues like key stability and modulation (regulation of a tonal hierarchy) important. With integration, stable relationships that allow measurement across the entire tonal space become possible. In contrast, when contour-scheme knowledge forms the basis for the representation of tonal space, integration of pitches across register or even across phrases is not possible. For the young child, the figurative shape of the contour is sufficient. Intonation and regulation are not yet an intrinsic part of the musical performance.

Given this point of view, the role of teaching can be seen from a cognitive perspective. It is in part a result of the classroom activities that the knowledge of tonal space becomes increasingly operational. The classroom context establishes the circumstances for knitting the contour schemes of early childhood into hierarchical structures that become robust enough to enable the student to make, remake, and undo transformations as requested or at will. In short, the classroom is a specific setting to make knowledge that can be acted upon.

INTERNALIZATION AND OPERATIONAL KNOWLEDGE

"... as a result of their internalized and integrated nature, concrete operations are actions accompanied by an awareness on the part of the subject of the techniques and coordinations of his own behavior" (Piaget & Inhelder, 1969).

Piaget's concept of operationality is useful when considering the evolving mastery of sightsinging by adults. Piaget describes contrasting

levels of thinking: *figurative* and *operational* (Piaget, 1970). The figurative aspect has to do with the initially passive aspect of knowledge relating to perception, imitation, and mental imagery. According to Piaget , mental imagery at this level is internalized imitation. It is expressed through kinesthetic, visual, and auditory modalities. The finger movements that so often accompany the piano student's sightsinging, the arm movements of the trombone player, or the physical feeling of the vocal placement for the singer are all examples of the kinesthetic mode of representation linked to an auditory image at the figurative level. Similarly, the visual symbol can become linked to an auditory image. With practice, students report they can close their eyes and imagine the written form of a melody on a staff. Additionally, the consistent use of a specific set of syllables or names for notes creates a condition where the mention of two syllables (e.g., "sol" and "mi") evokes a mental image of their sounds or functional relationship. Similar to "silent decoding" in written language, mental imagery plays an increasingly important role in the establishment of music literacy skills as "inner hearing" or "hearing with the eyes" develops.

Musical "figurative" thinking can be enriched and progressively operationalized by requiring students to mix images from different modes of representation. For example, playing notes while singing them with syllables deliberately combines kinesthetic and symbolic modalities. On the other hand, for a sharper focus, one might use a single modality (e.g., only imagining the sound of the melody). Although the solfege student at first imitates the sounds of notes and melodies by singing, gradually, more of the imitation can be imagined and transformed mentally (without vocal expression) as the student's knowledge of tonal space becomes increasingly articulated and internalized.

This increasingly *operational* aspect of musical thinking deals with the transformation and "reversibility" of actions from one state to another (e.g., singing "Happy Birthday" in a major mode and then in minor). Children cannot do that because they lack the stable, internalized structure that makes the transformation possible. They might be able to perform it one way, but not both. As one's grasp of tonal relations becomes internalized, it also becomes increasingly operational. Piaget describes three distinct stages leading to the development of operational and internalized knowledge: sensory-motor, concrete operational, and formal operational (Piaget and Inhelder, 1969). In musical terms, Piaget's stages might translate into knowledge accessible through *kinesthetic, externalized,* and *internalized* operations.

Examples of the kinesthetic stage include learning to repeat back a melody (like a novice chorus member) or fingering a melody (in the sensory-motor fashion of an instrumentalist) without being aware of the

aural relationships made by the sounding notes. The learning process at this stage is usually based on repetition and rote. At this level one can make transformations on the entire melodic set, but not on elements of the set. For example, a student may sing the entire melody at a different tempo or a different dynamic, but cannot easily change or transform the dynamics or tempo of small segments within the melody. In the second stage, students require externalized vocal production in order to maintain appropriate intonation of notes of a melody or to be sure of their written dictations. In contrast, at the third stage students can imagine the notes of a melody and, upon request, sing specific notes with very accurate intonation. When sightsinging or taking dictation, they do not require auditory monitoring to maintain their tonal orientation or to check their notation.

The process of making tonal knowledge operational is the track of development we witness in the sightsinging classroom. At first glance it is surprising that so many strong instrumental performers rely on their sensory-motor knowledge of instruments to monitor pitch when they sing or write down even a simple melody. However, given their lack of internalization that makes knowledge operational, it is understandable that kinesthetic strategies are required. In spite of several years of instrumental training, including private instruction and ensemble experience, many music students are aurally and notationally illiterate without their instruments "in hand" (Davidson, Scripp, and Welsh, 1988). This research strongly suggests that without the intensive and comprehensive training that leads to the operationalization and internalization of musical knowledge through various modalities—sensory-motor, verbal, and symbolic—this transformation of musical learning into aural and notational literacy will not take place.

TRACING KNOWLEDGE: MODES OF REPRESENTATION

On the basis of our research at Harvard Project Zero and the New England Conservatory, we think that development of music literacy skills does not occur symmetrically in all directions, but follows a path from action to symbolic representation. This is easily observed when students take dictation. One hears beginning students, who lack a stable internal reference system, humming to themselves, and sees finger motions as though the melodies were being played on instruments. The student is at first dependent on singing or playing the item (actual or imagined) to maintain it in memory and subsequently to check the accuracy of the notation. With development, and as the musical image becomes internalized, the singing and playing behaviors disappear (even without instruc-

tions to stop them). More of the information and the scaffolding necessary to complete the task is internalized.

Finally, in the later stages of internalized operations, a melody is "heard" and understood as an articulated mental image. During this stage, it is possible to imagine various transformations on the melody. For example, "Happy Birthday" can be easily sung with the notes of a whole-tone scale (instead of a major scale) thereby signifying an advanced level of knowledge. With development, the scope of knowledge "on-call" during a performance expands greatly, not only because students learn more theoretical facts, but because the modes of representation become more integrated. With development, the membranes between knowledge as actions, as images, and as symbols become increasingly permeable and information flows from one mode to another more easily and automatically.

It is important to note that as students first begin to use these modes, they can only do so in a specific environment. When students attempt to use new sightsinging skills outside the classroom context, the ability often appears to break down. For example, one often hears applied teachers announce that their student cannot name or sing intervals. These "out of context" situations (such as when the private teacher asks students to identify a harmony, sing an interval or another voice in a score, etc.) are common. They are important signs that a requisite level of internalization has not yet occurred. Even though levels of mastery are easily observed in sightsinging class, success in that context may not transfer immediately to other contexts. Over time and with encouragement to transfer, however, knowledge and skill begin to generalize across increasingly diverse situations.

By constructing rich profiles of sightsinging development instead of basing assessments on one-dimensional factors, it is possible to detect individual differences within the stages of development represented by the levels of behaviors observed in the classroom. By keeping track of the most stable mode of representation a student uses (action, imagery, or symbolization), it is relatively easy to observe early reliance on actions (finger knowledge) being gradually expanded to include (though not necessarily replaced by) verbal and later, symbolic (notational) modes of representation. The gain in flexibility that gradually occurs as a result of the increased availability and integration of different modes of representation dramatically alters students' ability to read, notate, think, and perform expressively.

To sum up, several concepts are useful when considering sightsinging class from a developmental view. Familiar to developmental psychologists who work with children, these concepts are perhaps not as widely known among teachers of aural skills. The most important include the presence and interaction among the three modes of representation, the stability of the understanding observed within and across the modes of representation, and the operationality and internalization that is a symptom of highly skilled performance knowledge.

To use our developmental model, we must identify what students know and understand how students represent their knowledge across contrasting modalities. It is clear from this developmental approach that the construction, visibility, and operational use of knowledge has more to do with the thinking involved in problem solving than with the acquisition of skills by relying only on rote learning or drill and practice. Ultimately, in classes based on a developmental premise, students come to understand that the end state of sightsinging courses can have more to do with the internalization of these processes than with the refinement of performance practice alone.

Students move from one stage to another by assimilating new information or skill into their current knowledge state, and accommodating what they know to new musical demands. Knowledge within each of these stages, then, can be viewed as a separate (yet related) construction the student undertakes that is qualitatively different from the intellectual skills developed through private instrumental lessons. The remaining parts of this article draw on this point of view. A pedagogical framework for developing this approach in sightsinging is presented in "Framing the Dimensions of Sightsinging: Teaching Toward Musical Development." In "Sightsinging Ability: A Quantitative and Qualitative Point of View," a developmental model of assessment illustrates the symptoms of three levels of growth within tonal knowledge observed over a two-year sequence of sightsinging classes.

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PART TWO

FRAMING THE DIMENSIONS OF SIGHTSINGING: TEACHING TOWARD MUSICAL DEVELOPMENT

LARRY SCRIPP

LYLE DAVIDSON

"I now make it a point to sing along often when I play my cello .... It seems that it is the voice which connects the hands with the ear" (Eugene Friesen—cellist with the Paul Winter Consort after a Symphony Hall Concert in Boston, February 1987).

Musicians of all generations turn to the human voice for musical inspiration. Whether for demonstrating musical nuance or intrinsic knowledge of the music, teachers, coaches, and conductors draw on the expressive powers of the voice. Unfortunately, this resource is not universally nurtured in musical development. Lacking vocal orientation and music literacy skills, many music students prefer to stay within the confines of their own instrumental skill and its role within the ensemble. This rather provincial approach comes under direct challenge in the conservatory environment.

When students first come to the New England Conservatory they are immediately faced with required courses in aural skills/sightsinging in particular. But they do not come with a common understanding about how these skills are learned. Indeed, many believe aural skills evolve as a result of being innately blessed with an good ear and assume those who aren't will be forced to suffer through solfege courses at a constant disadvantage to the more talented students. In short, they question whether the skill can be learned at all. At this relatively late stage in their musical training, few students conceive how the skill can be learned quickly or thoroughly enough to be of any application to their musical studies or professional career skills.

However, most of these same students—sometime within the first two semesters of work in sightsinging—report profound changes in their

musical life. The quotes below illustrate two levels of response. Early on, and much to their surprise, freshmen find that their sightsinging skills can often contribute significantly to performance on their major instrument. Since they now can effectively enhance their instrumental practice using sightsinging as a way to help organize and monitor their rhythmic, pitch, and interpretive skills, they report a new feeling of performance confidence. Checking their rhythm and intonation using solfege, they no longer need wait for studio instructors or conductors to tell them about the accuracy of their music reading. Efficient practice, sightsinging, and sight reading on their instrument is becoming a way of life.

"During my winter vacation I got together with my high school teacher and he immediately noticed that my rhythm is much better. He wanted to know *what* they were teaching me at the conservatory. I told him I thought that my solfege course was really helping me with intonation and rhythm on my instrument"—a first-year solfege student (performance major).

In the second year students begin to think very differently about what sightsinging means to their music making. At this point students begin to *internalize* their sightsinging skills. Solfege students, not unlike conductors, can now use their sightsinging skills to shape musical ideas.

". . . I began to see what my hand could show. It wasn't simply repeating a pattern meaninglessly but it was [expressing] something. A firm downbeat, a rebound that was internalized, a lightness, a heaviness showing in my hand . . . . I found new ways to cope with problems with ensemble in chamber music"—a second-year solfege student (performance major).

Accurately producing music from notation without the aid of their instrument stimulates a more independent point of view of musical interpretation and expressive nuance in performance. Students are no longer dependent on their studio coach's comments or recorded performances when forming their own conclusions about musical interpretation. They use sightsinging not only to express their musical imagination but also to learn literature or compose music on their own.

"Through sightsinging I have learned to hear music with my inner ear—I can now write music without having to play it on the piano"—a second-year solfege student (composition major).

Paradoxically, toward the end of their sightsinging courses many instrumentalists report a potential conflict in their musical practice. Now, the process of music reading differs radically depending on the performance modality. Sight reading on their instruments may not necessarily be fully integrated with their new, more internalized, sightsinging skills; and instrumentalists report they are faced with a new choice: whether to monitor and shape their music *as they play it* or to fully imagine the music *before* it is performed.

Faculty members, fortunately, provide guidance on this issue. Bernard Greenhouse, member of the world renown Beaux Arts Trio and currently on the faculty of the New England Conservatory, describes the effect of *internalized singing* on the process of musical interpretation in performance: "The concentration should be on musical ideas rather than on the instrument as such. When I perform today, I find I am not aware of the cello in front of me. My concentration is entirely on something else; I sing the phrase before it is produced. I hear it in my mind and I get ideas for how to perform that phrase before it comes out of the instrument" (Delbanco, 1985).

Deciding in favor of a self-constructed musical conception that guides instrumental performance is crucial to understanding the purpose of developing sightsinging skills. This distinction allows us to better understand how to structure the teaching of this enormously important component of musical development. Clearly, once students master this skill, its value will continue to be essential to musical endeavors long after the solfege classes are over.

In the following sections we present a description of the instructional framework and pedagogical concepts that guide the acquisition of this complex skill in the conservatory environment. Crucial to this description is the articulation of the "end-state" goals of the skill in the context of professional musical life. Woven into this description are the psychological concepts presented in Part I. Accordingly, the framework builds on a developmental perspective of skill acquisition while the processes of internalization and operationality of subskills across modalities are in the foreground of this growth. Representations of musical knowledge in sightsinging class take on particular significance as an entire range of performance skills become increasingly articulated and eventually internalized without the peripheral support of instruments or accompaniment. Finally, we offer guidelines for the individual sightsinging instructor's application of the framework. Coherently structuring suitable materials and mnemonic techniques—as well as diagnostically tracking student development—becomes more useful and richly rewarding within the context of an instructional framework.

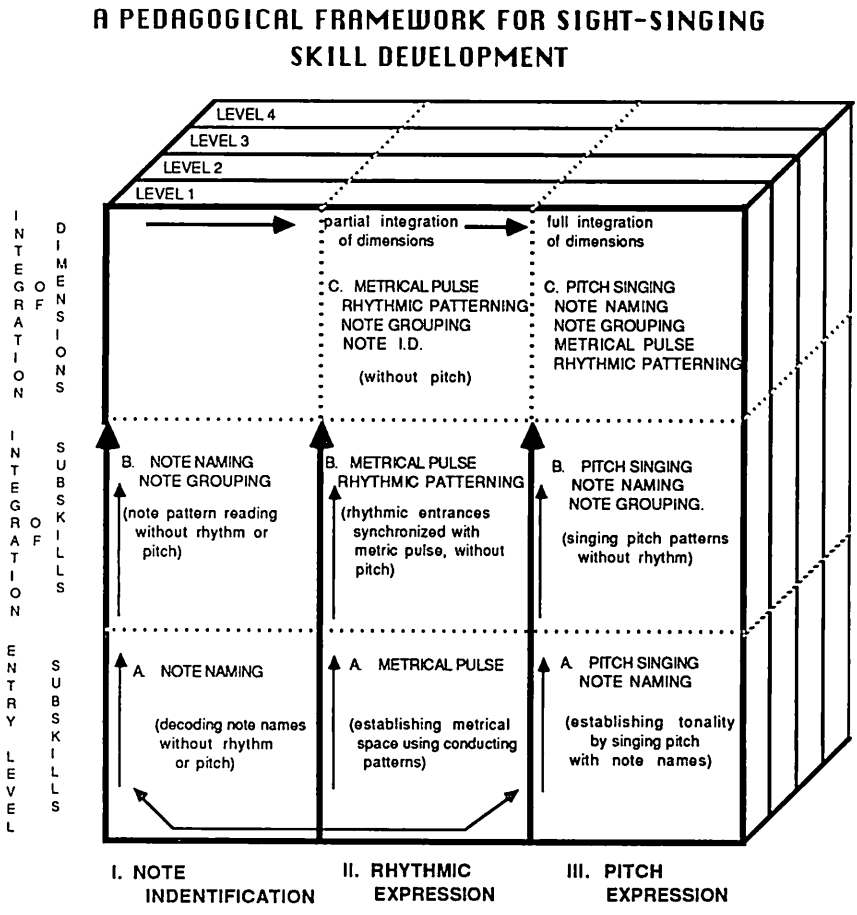
A PEDAGOGICAL FRAMEWORK FOR SIGHTSINGING

In Figure 1 we see how the teaching of sightsinging skills can resemble the mastery and increasing interplay of sightsinging subskills. Using an open-ended pedagogical framework to reflect the process of acquiring sightsinging skills we can explore conservatory classroom teaching in terms of *cognitive process instruction* (Lin, 1979). By building and refining this framework we are in a position to re-examine the psychological underpinnings of traditional instruction and to establish links with separate, yet integrable, processes at work in the sightsinging classroom.

Accordingly, classroom drills and problem solving exercises throughout all four semesters of solfege can be linked to the various dimensions of the pedagogical framework. These dimensions focus on three performance modes in constant use: 1) *note identification*—decoding the identity of written pitches across various patternings and clef references; 2) *rhythmic expression*—rhythm produced within various meters and using various patternings eventually linked with note identification; and 3) *pitch expression*—pitches produced vocally with note names, in reference to tonal centers, and eventually combined with rhythm. Below we use the framework to define the performance criteria of each subskill and suggest a three-dimensional parallel sequence of skill integration (see Figure 1).

The cumulative implementation of carefully interlocking subskills within three overarching performance dimensions is implicit in this instructional framework. Although the components of this model initially should be engaged in parallel sequences, there is an implied progressive complexity that directs the focus toward increasing integration of the three performance dimensions. Most importantly, the skills at each level must be mastered, operationalized, and made fluent (automatized) before they can significantly contribute to the more complex tasks indicated by the cumulative combination of subskills. In this way the instructional framework allows the pedagogical methods and goals of sightsinging to become more coherently structured and understood by both sightsinging teachers and students. In the following sections we will offer a rationale for why this framework can successfully guide the seemingly impossible task of integration of performance skills.

Figure 1. A Pedagogical Framework for Sightsinging Skill Development.

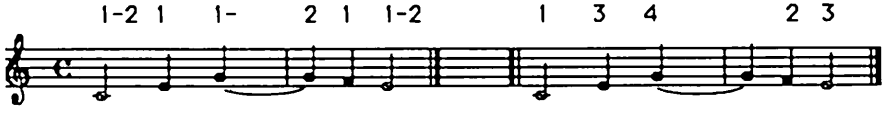


COMBINING MODES OF REPRESENTATION

"[He] teaches his students to sing not only the syllables, but the patterns that can be read in the music itself.... The student is taught to feel the conducting as he or she says the rhythm"—a first-year solfege student (performance major).

A pedagogical framework that accounts for a range of increasingly complex subskills performed simultaneously best captures how instructors promote the interaction of various modes of representation appropriate to each dimension. In this regard, each instructor (consciously or not) is faced with an important decision: to choose a code that reflects the difference between *explicit* and *implicit* knowledge expressed in performance. For example, in "counting the rhythm," either the durations are explicit and the entrances implicit or vice versa. It is difficult to express both points of view at once. At a conservatory the performance focus should most closely reflect the professional performer's point of view. The orchestral conductor usually structures the entrances of musical events within the beat pattern while the durational aspects of those events occur implicitly. In the second example below the entrances (of notes or rests) are *explicit* and, as a result, the musicians infer the duration of each event to be expressed *implicitly*.

Figure 2. Two codes expressing different aspects of rhythmic orientation.



A. COUNTING THE RHYTHMIC DURATIONS

B. CODING THE RHYTHMIC ENTRANCES

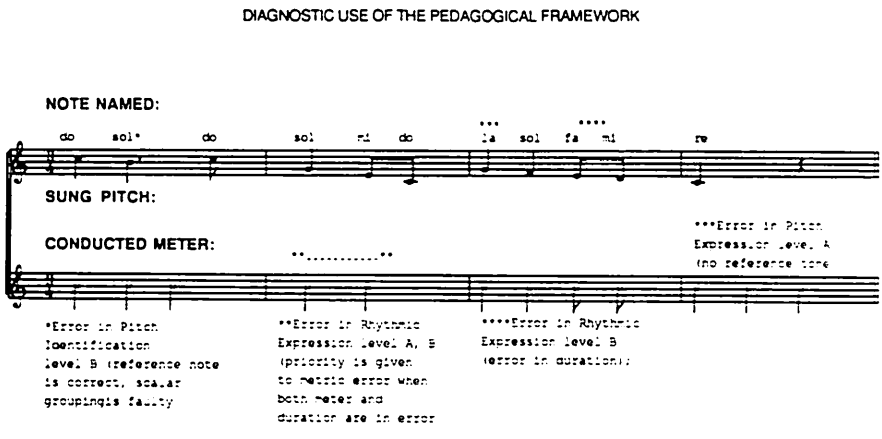
The sequence and combination of subskills in the pedagogical framework reflect this particular point of view. For note identification or pitch production the clef reference, identity, and grouping of notes are the explicit focus in performance, while the intervallic relationships or scale-degree functions remain implicit. From the conservatory point of view, professional performers are more likely to explicitly detect and correct clef or note

errors than to focus on the intervallic relationships or scale functions implicit in the music.

Another important aspect reflected by the framework is the need for combined representations in sightsinging performance. Simultaneously connecting various performance codes in sightsinging subskills captures the ways instructors combine representations to structure explicit and implicit musical knowledge. With multiple representations of the three broad dimensions comes the possibility of increasingly refined measures of assessment in the classroom performance. In contrast to the private lesson or ensemble studio, where musical knowledge and expression are judged by how well the embouchure and/or fingers produce the sound on the instrument, in the classroom there is an extraordinary opportunity to track much more. Through the use of combined modes of representation, musically rich mnemonics such as solfege syllables or expressive gestures such as conducting patterns can be employed to reveal students' understanding of their skill development. Error analysis, for example, is greatly enriched when the mode of representation allows a more precise and extensive array of measures (see Figure 3). We can hear students singing correct pitches yet not identifying them correctly—possibly indicating the student is guessing the melody without identifying the notes in a particular clef or pattern. We might also observe students performing one incorrect rhythm without recovering the meter (conducting, in this case, only represents pulse and not the broader metrical framework of the music). A shared representation of musical dimensions, together with a specific mnemonic, provides students and teachers with a more discrete and varied sense of musical phenomena. Throughout, the framework is intended to facilitate this musical exchange.

Conservatory instructors contributed several other criteria for effective implementation of representational codes, ideally: 1) suitable for fluent use at the most advanced levels (e.g., because of the hard consonances and open, simple vowels, most instructors feel that solfege syllables are more suited to fluent performance than numbers); 2) unambiguous (e.g., it is not practical for numbers to represent both rhythmic duration and scale function if they are to be later combined in performance); 3) capable of a full range of musical *expression* (e.g., conducting serves as a richer expression of rhythmic nuance than foot-tapping); and 4) *drawn from conventional techniques* as much as possible (e.g., conductors and publishers are usually more concerned with using solfege to represent concert pitch than to articulate scale or interval relationships). Relatively obscure mnemonic systems (such as "mod-12" notation, hand signals, or shape-note notation) are either designed for purposes other than performance, limited in scope, or have not been universally adopted.

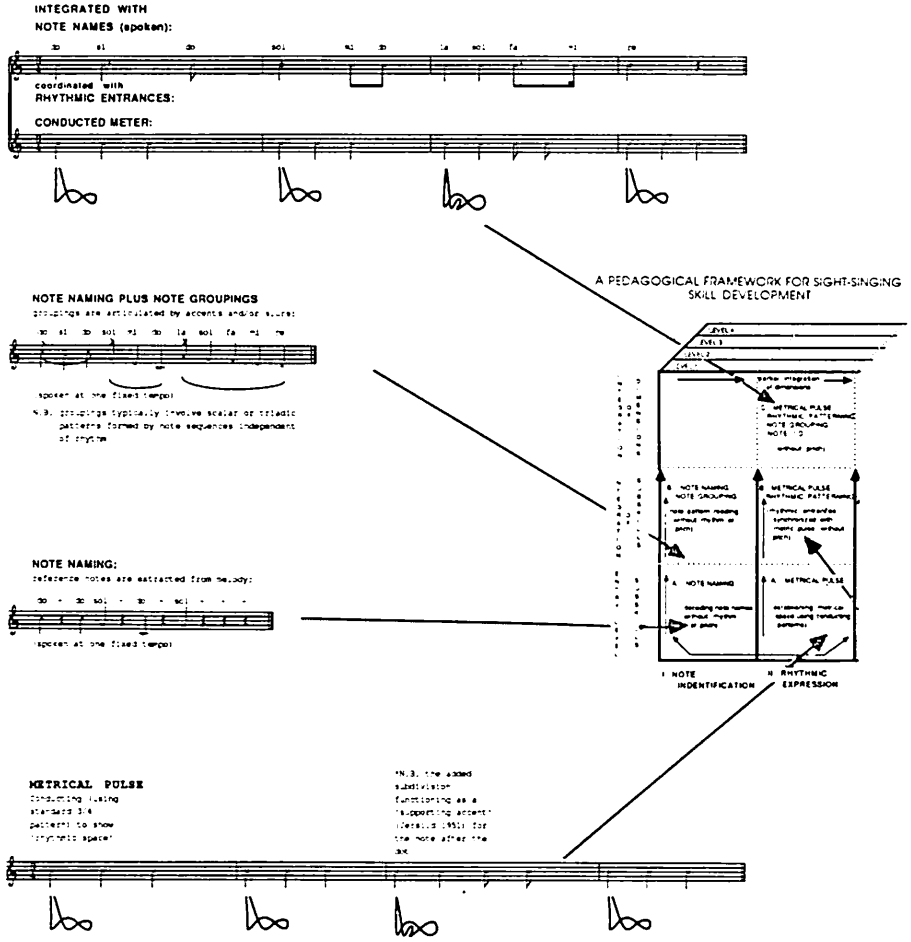
Figure 3. Diagnosing Typical Sightsinging Errors in Terms of the Pedagogical Framework.

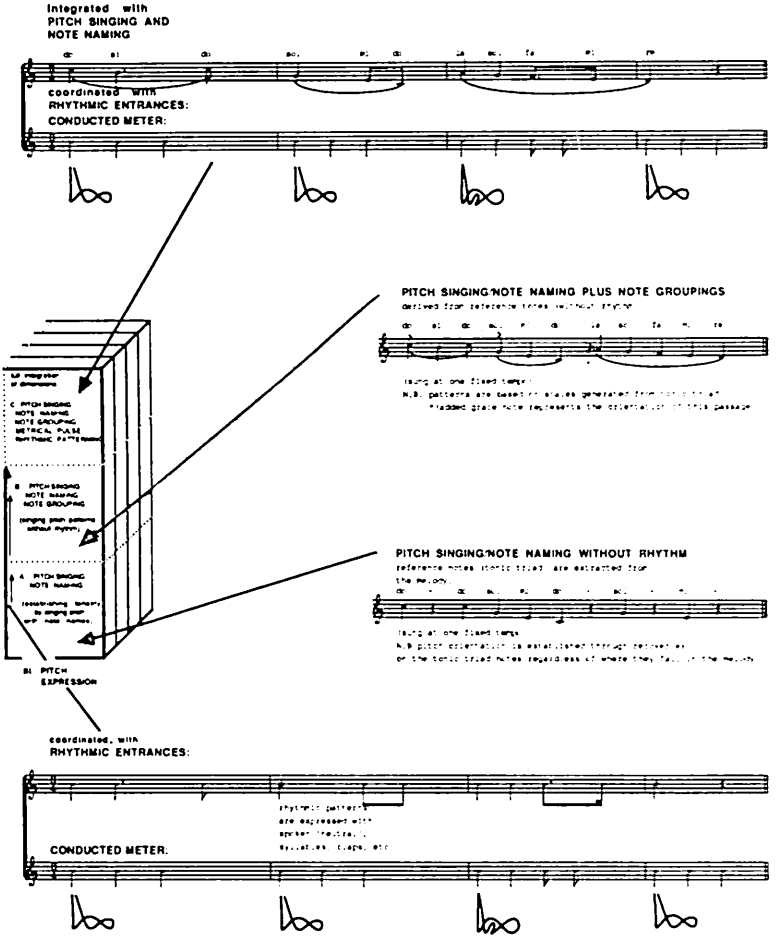


Also, because of the increasingly combinatorial nature of the framework, one must be able to represent two or three musical dimensions at once. In this framework, pitch identification and intonation (vowel resonance) can be simultaneously expressed with solfege syllables, but rhythm is represented with a different code and/or contrasting modality. Choosing conducting patterns to express rhythmic entrances allows for the simultaneous expression of pitch verbally (with or without intonation).

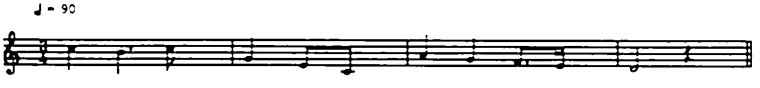
In Figure 4 we can see an example of a short melody notated to capture the transformations most likely to occur in the sightsinging classroom. Performed in the eight ways suggested by the framework, this example articulates the abundant set of subskills appropriate in the sightsinging classroom.

Figure 4. Target Melody and Notated Examples of Component Skills Suggested by the Pedagogical Framework.





TARGET MELODY



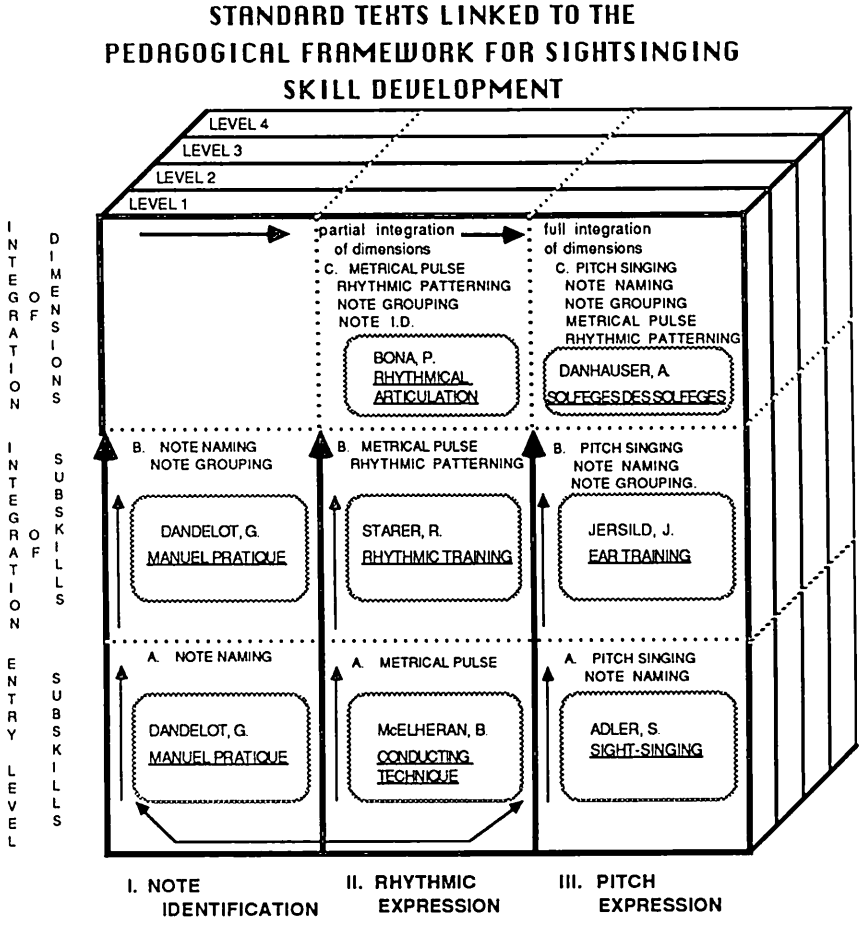
SOURCES FOR A PEDAGOGICAL FRAMEWORK

Not only the relation of the framework to musical performance, but its origins are critical to its validity. There are three sources for this framework: 1) traditional textbooks; 2) observing master teachers; and 3) research in the acquisition of music reading skill. First, there are the textbooks traditionally used in sightsinging courses. These texts, as varied as they are, potentially can be structured to provide an interactive framework articulating various component subskills leading toward rich and fluent sightsinging skills (studies in pitch and clef identification, pattern reading, intervals, rhythm, graduated sets of melodies). Although these texts differ greatly in their organizational features, repertoire, and suggestions for instructional strategies, many of these materials fall neatly into the various modules of the framework (see Figure 5).

Since many of the tasks in these texts were not designed to be integrated into a single, more comprehensive pedagogical framework, the individual instructor or curriculum developer is faced with structuring and combining these materials. As seen from the framework, it is possible to express many dimensions of pitch and rhythm simultaneously. Since publishers rarely suggest that competing texts or pedagogical techniques be used in combination, instructors must make extra efforts to broaden the materials and skills suggested by a single textbook. Additionally, many more sightsinging texts can be considered in constructing or supporting alternative instructional frameworks (Rogers, 1984).

A second vital resource for our framework has been our observation of master sightsinging teachers. Searching for sources of an instructional framework involves careful observation of a master teacher's broad synthesis of individually successful techniques. These can be analyzed and combined to form a pedagogical model that is informed and enriched by some of the best teaching available. Successful and imaginative teachers may use similar materials with different points of emphasis. For example, a master Kodaly teacher from the Liszt Academy in Budapest—Erzsebet Hegyi (Hegyi, 1975)—skillfully guides students in alternating pitch representations from scale-function reference (moveable *do*) to absolute pitch names (similar to fixed *do*). Ms. Hegyi successfully trains solfege teachers to value flexibility and to develop impressive feats of musical operationality through deliberately disparate modes of representation—hand signals, syllables that may alternatively express pitch name or scale function.

Figure 5. Standard Texts Linked to Specific Components of the Pedagogical Framework.



A master teacher who was primarily influential in the forming of the pedagogical framework was the late Albert Bernard. Mr. Bernard—who was a Prix des Solfege winner at the Paris Conservatoire, and responsible for training conductors in solfege at the Berkshire Music Festival in Tanglewood—ingeniously combined many traditional and contemporary texts in his solfege classes at New England and Boston Conservatory of Music. His teaching demanded the highest standards of performance skills while he guided students through a series of carefully ordered subskills requiring the integration of several modes of representation. His students—including Claudio Abbado, Phyllis Curtin, and Seiji Ozawa, to mention a few—achieve remarkable levels of fluency in performance with his methods.

Third, we need to explore music reading research. Experimental research in instrumental sight reading provides insight into what cognitive processes need to be made explicit in an instructional framework. For example, the ability to read ahead in progressively larger phrases displayed by more expert sight readers (Wolf, 1976; Bean, 1938), suggests that pattern reading (represented by the modules IB, IIB, IIIB of the framework) is an essential feature of sightsinging development. In other studies, error analysis reveals that expert sight readers show more sensitivity to musical structure in reading processing than do novices (Sloboda, 1974; 1978; 1984). Experts are better able to make musical inferences based on their comprehension of tonal structures than novices who must continually decode note-to-note in a more isolated fashion. Accordingly, when reading for larger patterns, experts are sometimes more apt *not* to notice misprints than novices (Wolf, 1976). Although this research helps us see what characterizes expert sight reading, no instructional framework is suggested. The question remains: how do sightsinging students become more expert in their sight-reading skills?

Research from the analogous field of language reading (Chall, 1983) suggests effective instruction can be based on ordered stages of development. This research emphasizes the need for teaching decoding skills (letter recognition and phonic pronunciation skills) in the first stages of reading. Translating this into sightsinging stages of instruction, we see support for initially emphasizing sightsinging decoding skills similar to the note-naming skills prescribed in the pedagogical framework. Language reading researchers suggest closer contact between reading instruction and the cognitive analysis of reading skills and reading acquisition (Perfetti & Curtis, 1986). Continuing the parallels to language reading research, engaging musical inference skills in service of reading to expand the musical knowledge base can occur more successfully after decoding skills have been established as fluent and flexible skills.

At New England Conservatory we are pioneering further research in music reading. A study comparing instrumental sight reading and sight singing of freshmen and sophomores suggests there initially exists a largely unintegrated set of reading subskills. Preliminary results suggest that rhythmic development is at first independent of pitch development regardless of performance medium—voice or instrument. Later on, pitch and rhythmic accuracy appear to be more correlated in sightsinging development than in instrumental performance. In this study we will also be able to observe the mnemonics, strategies, and evidence for internalization first- and second-year students bring to sightsinging skills. Although not always more accurate than first-year students, performance processes of second-year students were qualitatively different. In contrast to their first-year performance, sophomores know from their conducting when they have violated meter, when their mispronunciation of solfege syllables results in poor intonation, and they have the ability to recover from wrong notes, or poor intonation, when they are not explicitly aware of key structure in their singing.

In sum, a wide range of materials, instructional practice, and music-reading research support the structure for our pedagogical framework. The framework is intended to help coordinate and combine salient features of numerous sightsinging pedagogies and textbooks. In addition, individual instructors can use the model to creatively and effectively diagnose and respond to particular musical subskills. We intend the framework to provide a comprehensive structure, yet be open-ended enough to generate useful models that can merge and interlock as particular arrangements of the framework's building blocks.

THE END-STATE MODEL: CONTEXT OF THE TASK

"any local organ or activity is dependent upon the context field or whole of which it is a constituent part: its properties and functional significance are, in a large measure, determined by this larger whole or context" (Werner & Kaplan, 1963).

The context of the model must be clearly understood for the framework to specify the various subskills. For example, the scope of the task may vary considerably across different contexts: the conservatory classroom and classes for young children or amateur musicians will likely share many techniques but could be serving contrasting musical goals. As a result, different perspectives must be accommodated. Preparing young children for group singing may not require the same pedagogical model that professional situations demand.

For the conservatory student, the skills of a professional conductor provide a useful end-state model of music literacy. Many examples of the conductor's role as the consummate musical problem-solver can be seen in most rehearsal or performance contexts. During rehearsal the conductor flexibly monitors and shapes elements of the whole performance in progress, anticipates and alerts the musicians to problems of ensemble, balance, and intonation—all the while developing an effective interpretation of the score that goes beyond accurate reproduction of the notation to the heart of the composer's intent. At this point, the ability to internalize the music—hearing the score without the aid of an instrument and unconfounded by recordings made by others—is critical to creating an original interpretation, to making music on one's own, and to thinking on one's feet. Obviously, the underlying component skills of the conductor—the ability to spontaneously perceive, extract, and demonstrate isolated dimensions of the performance as needed—must be extremely fluent.

To serve these ends the component skills identified in the framework need to be fully integrated and operational. Classroom sightsinging provides an ideal and continuous forum for problem-solving skills in performance. The class can be a real-life simulation of the most demanding reading skills. Students are regularly required to individually produce music without the benefit of fingering an instrument, ensemble cues, or accompanying harmonic context. In short, students are left completely on their own for the expression of the music. Asking students to identify specific mistakes in a performance by comparing what happened with what should have happened, or to stop before a performance problem occurs and describe what mistakes are likely, or to specify strategies appropriate to the problem, all illustrate the potential level of problem solving.

In their course evaluation papers, students are quick to cite examples supporting the problem solving nature of the solfege classroom:

"The key . . . is to predict the errors before they happen . . . . We would start off by discussing the 'hard parts' of the piece and finding out what they are, why they are hard and how to practice them. We demonstrate these approaches by trying them in class and seeing how they work and if they are indeed good approaches."

Comparing this environment with courses taken at another school another student remarked:

". . . sightsinging was largely approached as a series of intervals (i.e., remember what each interval sounds like and plug it into the music accordingly) . . . . The only reference tone you had was the last symbol you

sang.... If I missed an interval it was very difficult to recover because I had no real reference tone to know if I was right or not. At NEC there was a new process, a new emphasis then foreign to me. I was now being asked to sing the tonic on demand. I was allowed to invert intervals at will; the main goal was to be musically convincing."

In sum, although the final goals and standards of professional training must be met, the beginning stages of complex skills must also be carefully represented in the pedagogical framework. This condition makes the framework unique to the American conservatory environment. We must start with the beginning stages of a music literacy skill, then quickly and powerfully forge this development toward a goal of leadership in performance that must include a strengthened capacity for musical expression informed by considerable musical comprehension. This development in sightsinging skills must be rapid, reliable, stable—and, after four semesters of work, leave the student relatively self sufficient. The framework is intended to facilitate this seemingly impossible mission.

MUSICAL DEVELOPMENT AND THE FRAMEWORK

Although a new skill may at first appear in a random or irregular fashion to the classroom observer, there is ample evidence for distinct phases of development. Indeed, a model that accounts for rapid acquisition of aural skills through sightsinging must account for developmental levels in that growth. We assume, in this developmental model, a sequence of phases yielding relatively permanent levels of skill. For example, once students can effectively sight read modulations, we do not expect difficulties to resurface with simple tonal melodies. Similarly, once students can read transposed scores we do not anticipate problems with untransposed reductions of the same material.

In the following figures we define levels of musical development within the context of the framework. Students at level one work within one system of reference in each dimension. Within each dimension the level of task materials covered is listed, as well as a description of exercises or skills that form the criteria for operationality and evidence for the internalization of the skill. Each skill level is to be understood, mastered, internalized, and eventually rendered fully operational under a range of diverse conditions. A student does not have an operational command of diatonic melodies, for example, if tonal orientation can only be established by beginning on a given tonic. Similarly, rhythmic expression is not fully operational if a student can only begin on the first part of the measure (see Figure 6).

Figure 6. Pedagogical Framework at Level 1.

SIGHTSINGING LEVEL ONE (EARLY FIRST SEMESTER)

NOTE IDENTIFICATION (without rhythm or pitch)

A. MATERIALS: note reading with one clef (treble) reference; diatonic patterns by seconds, thirds, and fourths.

B. CRITERIA FOR OPERATIONALITY: stable visual orientation using a single clef reference and reference tones (e.g., c and g) within the clef; ability to perform scale patterns accurately derived from reference notes reading up or down, forwards or backwards.

C. EVIDENCE FOR INTERNALIZATION: Ability to visualize the clef reference without music; ability to track patterns without having to perform out loud; ability to perform extended note patterns filling in intervals without notation.

D. SUGGESTED TEXTS: any text can be used ignoring rhythm and pitch; Dandelot, *Manuel Pratique* is designed specifically to deal with this dimension in isolation and with carefully graduated materials.

RHYTHMIC EXPRESSION (with note names, without pitch)

A. MATERIALS: rhythms in simple meters (4/4, 3/4, 2/4); notes and rests explicitly coordinated with conducted beats and simple syncopations implied by "supporting accents" from conducted downbeats and simple subdivisions.

B. CRITERIA FOR OPERATIONALITY: ability to generate a precise conducting pattern in various tempos and meters; ability to coordinate note entrances with any beat of the conducting pattern at various tempos; ability to generate note entrances in between the conducted patterns (syncopation) at various and fluctuating tempos; alternating between performing rests and notes; articulating note patterns in performance independent of rhythmic patterns; ability to improvise rhythms maintaining meter and recovering later in the performance.

C. EVIDENCE FOR INTERNALIZATION: ability to conserve meter alternately conducting and not conducting; use of other body cues in place of the hand to express rhythmic entrances.

D. SUGGESTED TEXTS: for conducting, McElheran, *Conducting Technique;* rhythmic patterns in isolation and with note names; Jersild, *Ear Training* and Bona, *Rhythmical Articulation.*

PITCH EXPRESSION (with note names and rhythm)

A. MATERIALS: vocal warmup with scale, tonic (do, mi, sol) and "tension" or "cadential" (si, re, fa, la) chord patterns in one major key (e.g., C major); diatonic melodies in the one major key.

B. CRITERIA FOR OPERATIONALITY: ability to establish and reorient a stable memory tone reference (usually the tonic); ability to selectively perform the reference tones; ability to construct scale patterns freely filling in leaps or providing reference tone fluently (e.g., as grace-note ornaments to the music); construction of a fully operational tonal system derived from any scale degree initially given (in the key of C).

C. EVIDENCE FOR INTERNALIZATION: ability to predict errors by stopping *before* they occur; ability to silently follow a melody and jump in later in the piece; ability to establish a reasonable reference pitch without the piano.

D. SUGGESTED TEXTS: Danhauser, *Solfege des Solfege,* vol. 1 (no. 1-77), LAZ, *Metodo Graduado De Solfeo* (no. 1-109); warmup exercises suggested by Ottman, *Music for Sight Singing* and Thomson, *Introduction to Music Reading.*

At level one we are concerned with operationalizing one dimension of the materials: note naming in one clef, a small range of rhythms expressed in simple meters, and tonality within a single major scale. Level two primarily introduces a second set of materials or operations to be added to level one: a second alternating clef reference, conducting and subdivision in compound meters, and the harmonic minor scale as well as major. The new set of materials in each dimension is to be mastered while the previous level of skill is maintained. The original tonic must ultimately withstand the

diversion of chromatic inflection that may temporarily tonicize rival pitches. A steady tempo needs to be maintained in the face of sudden subdivisions of the beat. Here operationality and stability demands more than mastery of a new comparable set of materials: through alternation and the first diversification of materials, the student is stimulated to constantly re-explore tonal and rhythmic space. In addition, task dimensions can remain independent of one another. The level of skill in note patterning can be independent of rhythmic complexity. Evidence for internalization increases as students begin to conduct with more ease and to practice silently more often. (see Figure 7).

Figure 7. Pedagogical Framework at Level 2.

SIGHTSINGING LEVEL TWO (LATE FIRST SEMESTER—SECOND SEMESTER)

NOTE IDENTIFICATION (without rhythm or pitch)

A. MATERIALS: exercises in two clefs (treble and bass); ambiguous or overlapping pattern reading drills.

B. CRITERIA FOR OPERATIONALITY: ability to maintain pattern reading within clef changes either in isolation or mixed in the grand staff; ability to reread exercises prepared in one clef in the new clef and vice versa.

C. EVIDENCE FOR INTERNALIZATION: ability to follow performance of note identification drills and identify clef reference without prior knowledge of the clef initially used; ability to generate note patterns in unfamiliar clefs or transpositions.

D. SUGGESTED TEXTS: Dandelot, *Manuel Pratique.*

RHYTHMIC EXPRESSION (with note names, without pitch)

A. MATERIALS: examples in compound meters; more extensive syncopations (requiring more subdivision in the conducting patterns—especially on dotted-note patterns; subdivisions of 3 (triplet subdivisions within the beat).

B. CRITERIA FOR OPERATIONALITY: ability to alternate freely and fluently from simple to compound meters; ability to alternate subdivisions by two and three; ability to establish and control tempos with carefully chosen thematic materials integrating a range of durational proportions (ranging from 64th to whole notes); continuing to articulate note patterns independent of rhythmic patterns.

C. EVIDENCE FOR INTERNALIZATION: ability to express subdivision internally or with alternate cues; ability to silently establish tempos in complex pieces.

D. SUGGESTED TEXTS: Jersild, *Ear Training*, Starer, *Rhythmic Training* and Bona, *Rhythmical Articulation*.

PITCH EXPRESSION (with note names and rhythm)

A. MATERIALS: full range of chromatic inflection and alterations within a major key; chromatic inflection usually tonicizing the dominant; full fluency with a second key—the relative minor of C major (harmonic minor).

B. CRITERIA FOR OPERATIONALITY: stable performance of singing simple diatonic melodies freely exchanging both major and minor mode performance of the material; free and spontaneous alternation of treble or bass clefs; ability to freely add accidentals to melodies without loss of tonic stability; ability to improvise short melodies that change modality.

C. EVIDENCE FOR INTERNALIZATION: ability to detect errors in modality in class; shorter warmup drills are necessary to establish or re-establish tonal orientation.

D. SUGGESTED TEXTS: Danhauser, *Solfege des Solfege*, vol. 1 (no. 77-106); Bach, *Chorales*; Mozart, *Symphonies 22-26*.

After carefully expanding the range of materials in the first two levels, level three suggests a broad accommodation of materials. Skill levels increase and transfer in geometric proportion to level one or two. For example, now that two clefs are proficient we can quickly test how this skill generalizes across a wide range of clefs. Now that rhythmic skills have been

diversified, we test their stability by adding a greater range of subdivisions to the task. Since a major and a minor scale have been operationalized, we quickly generalize this skill to a wide range of tonic references and frequent changes across many tonal centers (see Figure 8).

Figure 8. Pedagogical Framework at Level 3.

SIGHTSINGING LEVEL THREE (LATE SECOND SEMESTER—THIRD SEMESTER)

NOTE IDENTIFICATION (without rhythm or pitch)

A. MATERIALS: ability to identify notes from multiple clef references (treble, bass, alto, tenor, soprano); patterns by compound intervals; pitch identification from the open score.

B. CRITERIA FOR OPERATIONALITY: ability to maintain pattern reading within clef change; change clef reference freely within melodic lines; identify concert pitch from transposed scores; transpose scores by substituting appropriate clef references.

C. EVIDENCE FOR INTERNALIZATION: ability to pattern read through multiple clefs without checking clef placement; infer patterns in novel clefs or transpositions.

D. SUGGESTED TEXTS: Dandelot, *Manuel Pratique.*

RHYTHMIC EXPRESSION (with note names, without pitch)

A. MATERIALS: examples in changing meters; radical changes in subdivision; extreme syncopations; rhythms combined with dynamic and articulation markings and radically changing registers; examples with radical alternations of subdivisions.

B. CRITERIA FOR OPERATIONALITY: ability to produce rhythmic nuance in performance; stable performance of rhythms across a wide range of tempos and changes of subdivision, articulation, and dynamics; ability to lead and conduct with nuance; ability to read composite rhythms across the clefs and staffs of the score.

C. EVIDENCE FOR INTERNALIZATION: ability to anticipate rhythmic features with expressive conducting gestures; ability to anticipate and select measures where ensemble problems are most likely to occur before performance trials.

D. SUGGESTED TEXTS: Weber, *Sixty Lessons in Rhythm* (vol. 1); Starer, *Rhythmic Training*; and Bona, *Rhythmical Articulation.*

PITCH EXPRESSION (with note names and rhythm)

A. MATERIALS: melodies in a wide range of major and minor keys; frequent changes of tonal center (modulation); extended length of melodies; full range of expressive nuance indicated in the notation; score reading with multiple clefs and/or transpositions to clef knowledge.

B. CRITERIA FOR OPERATIONALITY: use of full scale, interval, triad, arpeggio fluency in a wide range of major and minor keys; ability to maintain stable performance through radically shifting keys, registers, and transpositions; ability to reduce instrumental parts to vocal expression; ability to make interpretive decisions of nuance while performing.

C. EVIDENCE FOR INTERNALIZATION: ability to study scores without recordings or instrumental performance; detect and hear modulations across parts in the score; perform and comprehend scores "silently."

D. SUGGESTED TEXTS: Danhauser, *Solfege des Solfege*, vol. 2; Ottman, *Music for Sight Singing*, Haydn, *London Symphonies*; Mozart, *String Quartets, Horn and Clarinet Quintets*; Beethoven, *Symphonies*; Taylor, *Introduction to Score Reading.*

Finally, at level four, we approach the end-state of sightsinging. The range of materials and operational skills approaches a fair sample of what professional musicians may face in performance: fully transposed scores, open-score vocal music in the traditional clefs, changing time signatures, and ambiguous tonalities. At this level skills increase and transfer in exponential proportions to previous levels. Complete mastery of this level

is unlikely to be fully achieved in two years. However, it reflects a measure of the potency and energy required to participate in music making, interpretation, and problem solving in musical performance (see Figure 9).

Figure 9. Pedagogical Framework at Level 4.

SIGHTSINGING LEVEL FOUR (FOURTH SEMESTER)

NOTE IDENTIFICATION (without rhythm or pitch)

A. MATERIALS: note naming in seven clefs (treble, bass, alto, tenor, soprano, mezzo soprano, baritone); maintaining pattern reading within all clef changes; reading the open score and transposing score using all clefs.

B. CRITERIA FOR OPERATIONALITY: ability to transpose scores or melodies from transposing instruments to new transposing instruments or new keys.

C. EVIDENCE FOR INTERNALIZATION: ability to pattern read through multiple clefs without checking clef placement; ability to infer patterns in novel clefs or transpositions.

D. SUGGESTED TEXTS: Dandelot, *Manuel Pratique*; using rhythmic texts with new clefs.

RHYTHMIC EXPRESSION (with note names, without pitch)

A. MATERIALS: examples in odd or unusual (7/8, 5/4, etc.) meters and changing time signatures; rhythmic ornaments and cadenzas; rhythms in opposition (3 against 4, etc.).

B. CRITERIA FOR OPERATIONALITY: ability to conduct with nuance and effective ensemble leadership; conducting two meters in combination; generating opposing rhythmic subdivisions during performance.

C. EVIDENCE FOR INTERNALIZATION: ability to construct transitions in meter silently; full internalization of conducting habits in instrumental performance (as evidenced by rhythmic errors not causing metric errors, etc.).

D. SUGGESTED TEXTS: Weber, *Sixty Lessons in Rhythm* (vol. 1); Starer, *Rhythmic Training;* and Bona, *Rhythmical Articulation.*

PITCH EXPRESSION (with note names and rhythm)

A. MATERIALS: melodies that are tonally ambiguous, bitonal or atonal; full chromatic accidentals added to all conventional keys, enharmonic keys, synthetic modes, and scales.

B. CRITERIA FOR OPERATIONALITY: ability to pose more than one solution (tonal frame, etc.) to problem of tonal orientation of difficult melodies; reducing the orchestra score into compact thematic or harmonic structures; switching rapidly between parts in the orchestral score; ability to demonstrate and incorporate expressive intonation as nuance.

C. EVIDENCE FOR INTERNALIZATION: ability to study scores without recordings or instrumental performance; detect and hear modulations across parts in the score; ability to perform scores 's "silently"; detect errors in complex scores.

D. SUGGESTED TEXTS: Danhauser, *Solfege des Solfege,* vols. 3, 4; Edlund, *Modus Novus;* Thomson, *Advanced Music Reading,* Symphonies by Beethoven, Dvorak, Mahler, and Schubert; Debussy, *Afternoon of a Faun;* Stravinsky, *Mass;* Renaissance Masses in open score.

SUMMARY

"I had a new-found stability in pitch and intonation. I had, in effect, developed a new musical skill from what before made me frustrated, frightened, and insecure .... What's more, there were immediate results with actual pieces ...—a second-year solfege student (performance major).

The purpose and goals of sightsinging for the professional musician, the criteria for choosing traditional or new materials for instruction, and methods for gathering empirical evidence for how the skill is successfully developed in the classroom, all need to be considered. Re-examining traditional approaches to sightsinging development requires the integration of several perspectives: the developmental profile of the skill; the context and goals of the skill acquisition; the course materials and instruc-

tional techniques used in various combinations to develop various levels of the skill; music and language reading research from the point of view of cognitive processes and evaluating instructional methods; observing master teachers and their different materials and their pedagogical points of emphasis. When structuring a sightsinging curriculum, hard choices have to be made. For the student and the teacher, the pedagogical framework becomes a system for monitoring the process of skill growth. The structuring of subskills and their combinations, diagnostics, and error analysis all gain additional meaning within the context of a coherent instructional framework. With this framework the student and the instructor are also in a better position to profile and forecast overall development. By participating in classes articulating cognitive process models of instruction we see evidence for students taking a more active role charting their own course of sightsinging development. The task is considered in the context of problem solving rather than rote learning and the course, once defined, emphasizes more *how* to learn rather than *what* to learn.

Finally, modelling the acquisition of a complex skill such as sightsinging makes the process of instruction more visible. As teachers seek to better describe, explain, and understand the multiplicity of skills involved with singing at sight, we will find learning environments that reflect a more insightful developmental perspective of complex skill acquisition. Hopefully, instructional frameworks will enable a broad population of sightsinging teachers to actively contribute other points of view and share their understanding of how this essential—and highly refined—skill is developed.

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PART THREE

SIGHTSINGING ABILITY: A QUANTITATIVE AND QUALITATIVE POINT OF VIEW

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Small groups of students are standing in the hallway, leaning against the walls, sitting on the floor. A classroom door opens. A student emerges, confident and smiling.

"How did you do?" her friend asks.

"I got through eight this time! Last time I only did two."

"I got five last time. I hope I can do better this time," another student adds.

"I can't believe it," the student, fresh from taking the departmental performance examination, explains.

"I almost broke down on one of them, but I was able to keep going. I can't believe it! I got eight!"

These numbers, two and eight, are significant. They tell a story of a dramatic increase in this student's ability to read music. "Getting a two" means that when this student started in the fall, she could only sight read melodies in C major that consisted primarily of stepwise motion. Figure 1 illustrates the level this student could perform at sight with errors in fewer than five of the eight measures.

Getting through eight melodic examples means she can now read diatonic melodies that feature steps and leaps in keys through three accidentals, and can maintain her performance when she makes mistakes (Figure 2). Perhaps at no other time has her progress been as dramatically demonstrated as during the taking of this second examination—at the end of which her first and second tests were compared and discussed.

Figure 1. Example Illustrating a Number Two on Departmental Exam.

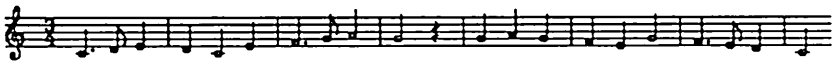
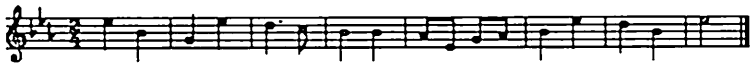


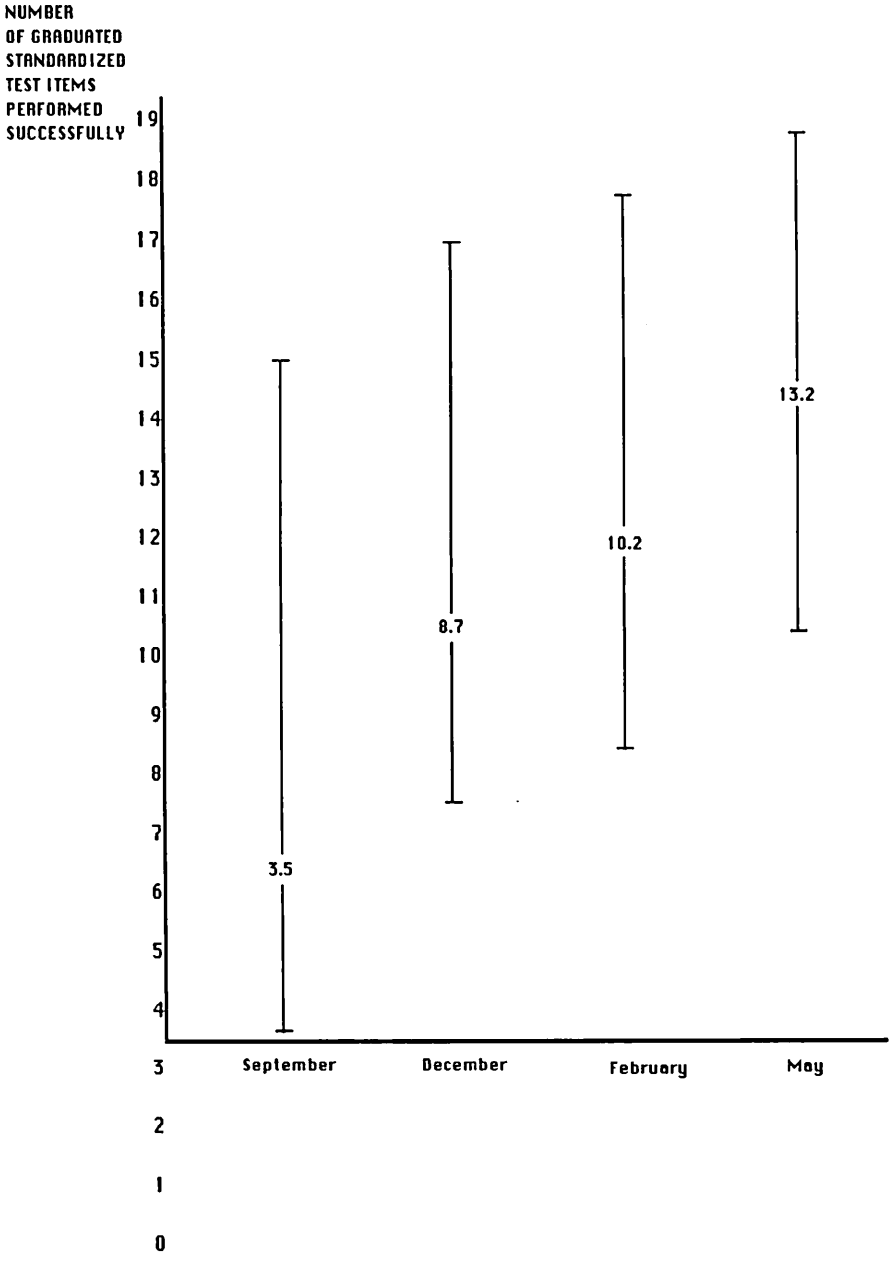
Figure 2. Example Illustrating a Number Eight on Departmental Exam.



Four times a year the third-floor halls of the New England Conservatory of Music echo with exchanges like the ones recorded above at the end of the first semester. At the beginning and end of the semester students take an equivalent sight-reading examination as part of the placement and evaluation process and likewise about five weeks into the second semester and again at the end of the year in May. Figure 3 shows the range of performance and the average scores for each of the tests.

Usually about 25% of the new students will be unable to sight read *any* melodies with fewer than five measures wrong. We expect about 75% of the entering freshmen will be unable to sight read anything beyond a diatonic and stepwise eight-measure melody with fewer than five errors. Although an average of six years of private instrumental study forms the most important part of an entering student's musical background and preparation for advanced study, year after year the results of this examination show there is surprisingly little transfer of skills (gained through instrumental practice) to a broader musical context.

Figure 3. Average Range of Performance Scores for First Year Tests.



MONITORING SIGHTSINGING SKILLS

Comprehensive evaluation of sightsinging development is a challenge. As we currently assess the development of sightsinging ability at NEC, we keep in mind how we might conceptualize typical changes in music reading skills. This helps us specify current levels of ability for individual students and gives us a template for predicting what future changes will look like. We also conduct empirical and observational research so we can begin to explain how those changes might take place. Finally, on the basis of what we have learned, we decide how to best promote and stimulate the growth of knowledge necessary for the development of high levels of music reading skill.

Because of our developmental agenda, we pay unusual attention to two types of evaluation that appear, at least on the surface, to be at some distance from learning to sightsing as it is usually conceived. At the start, we design departmental examinations that provide a *quantitative* means of rank ordering students on the basis of their sightsinging performance. But we expect the examinations to do more than that by providing a means for making detailed comparisons with a student's own past performance levels as well as comparison with peers.

Beyond the conventional measures of accuracy we also gather evidence of a very different type—that of *qualitative* changes in sightsinging abilities—by making careful observations of classroom behaviors. For this purpose, we employ extensive notes taken by in-class observers, review of video tapes of classes collected on a regular schedule, and intensive interviews with students. We find these means to be extremely valuable ways of developing an understanding of what qualitative changes occur and how these correlate with the quantitative changes we observe on the departmental examinations.

The sightsinging examinations at the Conservatory are based on assumptions about the traces, direction, and impact of development. The more we know about the roots and background of present levels of skill, the more we can use the knowledge students bring with them to the class and rehearsal. So our first assumption is that our students' continuing musical development is based on their prior skills and understanding. Specifically, our evaluation process is based on the assumption that continued musical development (in particular, the development of music reading skills) will grow out of a core of skills that can be found in musically untrained individuals. For musicians these core skills comprise various symptoms of talent. Part I outlines the early evidence of musical behaviors at least in relation to the development of tonal knowledge in the early and middle years. For musicians, these early behaviors are refined and expanded to

include superior perceptual and memory skills, strong executive and performance skills, and a highly personal stake in one's own musical understanding.

Our second assumption is that continued musical development will be orderly, not random. Part II presents a program for carrying out instruction, and our examination structure is based on the assumption that change in abilities occurs systematically. We expect that future development not only continues the direction of growth outlined in the first paper (i.e., from the use of contour schemes to the development of stable hierarchical tonal structures) but also follows the direction of the class work, drills, readings, and assignments.

Third, we assume that continued development of sightsinging skill will have broad and powerful impact on students' musical knowledge and functional level of literacy. At NEC, we are most concerned with the musical and musicianly use of the abilities developed in the solfege classes. Therefore, at the departmental level, we seek evidence that students' ability to read at sight improves to meet minimum standards during the first year, and that continuing development occurs across a variety of musical contexts during the second year. In short, we want to know that the new knowledge can be used to solve different musical problems. Therefore, we expect the effect of new knowledge and skills to be broad in scope, and to transfer far beyond what is taught in the classroom.

Thus, we have designed comparable sets of departmental examinations that allow us to easily assess the differences between individual students at any one time. Because we have equivalent examinations, comparisons are possible between an individual student's performance on one test and any of those taken earlier. We also are able to see differences between entire groups of students each time examinations are held.

ASSESSMENT BEYOND IDENTIFICATION OF ERRORS

To identify a student' s level of development and give the most useful advice, it is necessary to determine the nature and background of the errors made across a variety of increasingly more challenging melodic examples. Some examples will be too easy while other examples will be too difficult. Taken together, the profile of errors that occur during performances across a wide range of difficulty levels allows us to see the particular level at which a student performs. Because we spend so much time watching the errors students make, we are beginning to see there are many different types and causes of errors. A student may miss a pitch or even break down for a

variety of reasons. For instance, one student will miss a pitch because the reference system of the scale has become fragmented. Another student may miss the same pitch because rhythmic complexity occupies the center of attention. A third student may make a mistake because of not correctly naming the pitch or identifying the duration. Giving each of these students the same advice, "practice your scales," "your intervals," or whatever, will not yield the same results. Each student needs to be supported by advice that draws from an understanding of the causes of the problem, from an understanding of the level at which the error occurs. Our carefully constructed assessments, together with our extensive interviews of students, illuminate the roots of individual errors and begin to sculpt profiles of error types.

The departmental examinations serve many functions beyond monitoring basic minimal standards. Beyond providing a highly visible articulation of standards of performance that help students and faculty understand the goals of the course, the departmental examinations become part of a student's profile—as well as a useful diagnostic tool.

Because they are diagnostic, the examinations help make teaching and learning intra- and interpersonal activities. Teachers and students alike find the diagnostic use of examinations an important part of the process of instruction when advising students what materials to work on, what strategies to use, or what courses to take. Individual critiques (among the most important uses of these exams) make it possible to engage students in dialogues and self-reflection about their musical education, learning styles, and their individual strengths and weaknesses—clearly a central part of the learning process.

STRUCTURE AND ADMINISTRATION OF THE NEC EXAM

The examination for the first and second semesters of solfege consists of 19 graduated eight-measure melodies to be read at sight. Each melody has a detailed scoring system to identify the location and type of errors a student makes during the performance. Above and below *each* bar are letters that stand for the issues to be scored by the examiner during a performance of the test. The issues for rhythm (TMRD) consist of Tempo (T), Meter (M), Rhythmic Pattern (R), and Duration (D). For pitch, the letters (CKPI) represent the issues of Contour (C), Key (K), Pitch (P), and Intonation (I). These categories are arranged in order of increasingly more controlled behaviors. At least some control of the issues to the left within any single category is necessary before those to the right can be successfully

addressed. For example, if the durations of notes are accurate, then the rhythmic surface of longer and shorter notes, the meter, and the tempo are probably also clear, even though there may be a great deal of expressive nuance throughout the performance. On the other hand, if a student's performance shows problems maintaining the contour of a melody, it is likely that key, correct notes, and intonation will be even less stable and reliable.

The examinations for the third and fourth semesters are similar. However, a much wider range of examples is featured, including melodies that are extremely chromatic, some atonal, and at least one of every three requires students to sight read portions of scores that feature transposing instruments. In the more advanced examination there are five levels of difficulty with three examples in each level—fifteen in all. In this set, the teacher critiques are expected to be broader in scope by including evaluation of articulations, dynamics, phrasing, and musical expression (in addition, of course, to pitch and rhythm).

We do not insist on a specific pedagogy or set of routines in any examination. We count the best of two performances. If, in two attempts, the performance still contains five or more measures of mistakes, the student looses credit. When the student fails two consecutive melodies the examination stops; credit is given for the last successfully completed melody, and the examination score is equal to the number of that example.

Before each evaluation period (four times a year) the solfege faculty practice giving the departmental examination. Tapes of typical performances by students at different levels provide samples on which we can practice identifying the type and the number of errors. We practice with these until we have reached a satisfactory level of agreement.

ASSESSING SIGHTSINGING ABILITY IN THE CLASSROOM

The example of the students who were unintentionally tested with the same materials in different years (presented at the beginning of Part I) raises questions about what measures should be considered when assessing sightsinging skills. Assessment of learning depends on the orientation of the course, but also on a broader understanding of the depth of the changes taking place. Beyond a certain point, measures of accuracy alone do not provide sufficient detail to show how development continues.

Simple quantitative measures of accuracy appear to approach a ceiling by the end of the second semester. However, this leveling off of scores does not mean the end-state has been reached. For example, a solfege student and an experienced conductor may both represent a beat pattern clearly.

However, although it may be possible to award each an "A" for accuracy or clarity, that grade does not begin to convey the differences between them. It obscures one important difference: the conducting pattern of the relative novice is only clear; the conducting pattern of the expert is clear *and* expressive. The desirability of accounting for *more* than accuracy makes it necessary to award a qualitatively different score to each musician. Descriptions of behaviors displayed by novices and experts can capture differences that are useful when evaluating an individual's performance. These differences can be called *qualitative* measures.

Qualitative measures are common in developmental research, but are less often articulated and integrated into music classrooms or lessons. Qualitative measures can be used to describe the structural character of the developmental changes under study. For example, when three students at different levels of development sightsing a given melody, their responses may be the same quantitatively (i.e., they may make the same number of errors), but may differ qualitatively. The errors in one performance may suggest an unstable base knowledge of contour matching within a single scale, while those in another may show an unstable grasp of pitch only across different scales, while the third student's recovery from performance errors may reflect a refined sensitivity to the function of scale degrees despite chromatic alterations.

Subsequent work comparing the sightsinging and instrumental sight-reading ability of first- and second-year students also suggests that once students have progressed beyond a critical threshold of skill, simple measures of accuracy no longer capture the range and depth of the dramatic changes that continue to take place in other musically important dimensions. For instance, our measures of incidental learning show that students at the end of their second semester have a much more powerful memory for music than first-semester students. Similarly, the third-semester students are able to infer far more about the expectations generated by a melodic fragment (i.e., its possible continuations) than the first- or second-semester students. Again, because these changes occur where both groups make a similar number of pitch or rhythm errors, one needs a broad array of qualitatively different measures to be able to see the depth and breadth of changes taking place along these other dimensions.

QUALITATIVE DIMENSIONS OF CHANGE

When assessing sightsinging, since students cannot rely on rote learning to demonstrate application of and the level of mastery of reading skills, we want to have a variety of measures available to assess a broad range of

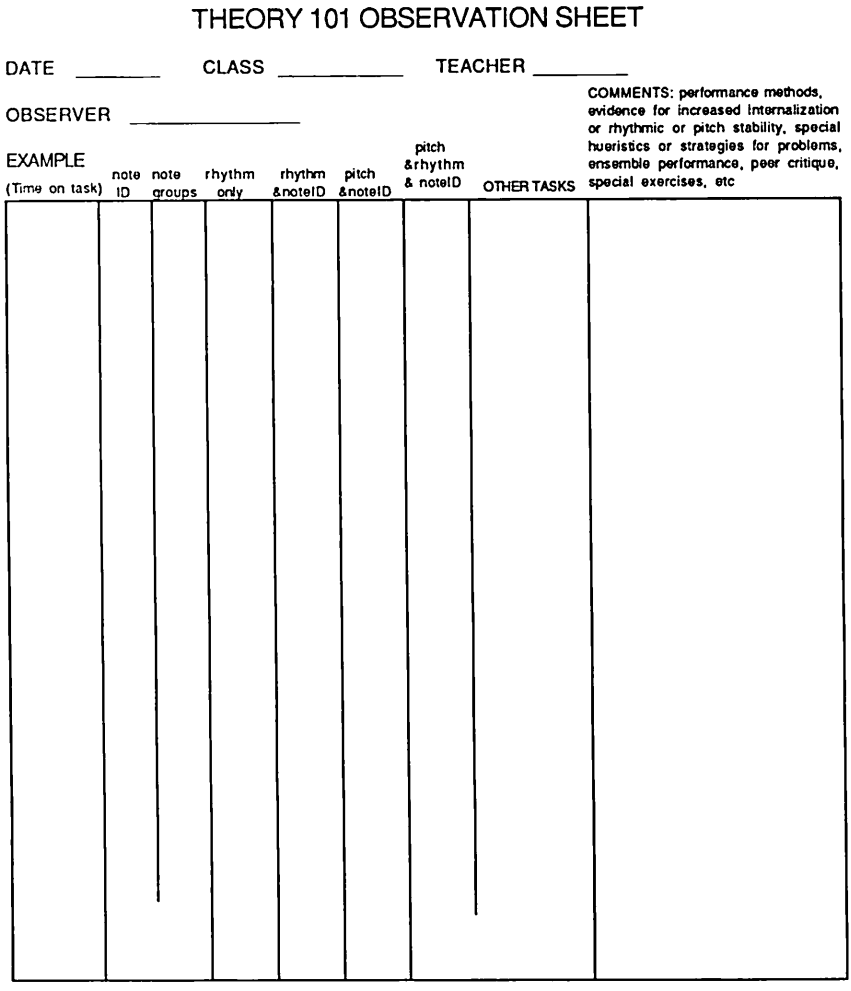
development. In addition to measures of accuracy, it is extremely useful to have a description of easily identifiable behaviors along which moments of change can be seen to alternate with periods of stability. The extent to which student responses are stable, specific, and operational (e.g., reversible or transposable), we can use them to appraise changing levels of development. In this section, we want to specify some of the sub-skills that either support or are concurrent with the focal task of sightsinging.

The following information draws on observations of solfege classes. The results were not subjected to statistical analysis for three reasons. First, we are only starting our research and the beginning step in any developmental research strategy is to identify candidate dimensions along which change might be expected to occur (Wohlwill, 1973). Second, we do not yet have the conditions necessary to conduct such an experimental study. Third, we are primarily engaged in the education of professional musicians and must focus our activity there. In the future we will undertake a more rigorous investigation of these issues using the paradigms of basic psychological research.

Nevertheless, the characteristics of different levels of development sketched below are useful. They can be interpreted in at least two ways. First, they can be used in conjunction with the pedagogical framework to aid instructors and students when identifying progress and forecasting development. Second, these dimensions can be used as the basis of research study, either within a cross-sectional design employing regression models or within a developmental design employing correlational and ordinal analysis. We are encouraged that these candidate dimensions, ordinal scales, and observations can serve different purposes.

The dimensions and measures were developed from making in-class observations of four semesters (see Figure 4). Two observers attended three classes a week on a regular basis, made observations of students (who performed individually and in groups), and reported surprising results. Interestingly, many behaviors had not been noticed by the instructor, in spite of many years teaching solfege. Additionally, every two weeks students took a private sightsinging examination that was taped and later transcribed for analysis. Taken together, the quantitative individual exams and the qualitative observations over the two-year period provide the background for our assessment of sightsinging and music literacy.

Figure 4. Sightsinging Classroom Observation Sheet.



Over the two-year curriculum, we find three broad characterizations of the sightsinging ability. In the first level, there is a *focus on a single attribute*: for example, reading on a note-to-note level. With development, the characteristics of reading music change. Reading at the second level is characterized by larger chunks (students now turn the pages far earlier) and by *unstable relations among several attributes* (students may read either the notes or rhythms, but may not be able to reliably incorporate the expressive nuances in the notation). At the third level, there is a *stable ensemble of attributes* that emerge with apparent independence and that are finally knit together into a flexible multi-dimensional base that students exhibit as "knowing-in-action" [the student can switch from one mode to another easily, and can recover from mistakes without losing the basic references (Schon, 1987)].

Over the two years, one can observe students developing across all three levels of the following behaviors: the focus of attention, the degrees of internalization, the degrees of stability, the flexibility of scale reference, and the extent to which the student is able to read beyond the notation. Below, each of these behaviors is described with brief examples of the three qualitatively different levels.

A. Focus of Attention

One of the more important observable characteristics is the focus and scope of students' attention. Making correlations between the extent to which a student bases his or her performance on the visual display and the sound of the melody is a very powerful means of determining developmental level. At first, the student relies almost entirely on the visual appearance of the melodic line. Gradually, the student is able to ignore the visual display of the melody, while simultaneously demonstrating an ability to perform it from an internal image of the sound of the line. While this change is taking place, a parallel change takes place in the degree to which eye contact is independent of the single part being sung during the reading of ensemble music.

1. Reading processes (this measure addresses the relation of the visual and the auditory components of sightsinging).

Level I: the student appears to read from note to note. The orientation is predominantly, if not totally, visual. The student is nearly unable to deviate from the written contour of the melody.

Level II: the student appears to take in larger groups of notes but still relies heavily on the use of visual cues. Focal notes become stable, resulting in a quicker response to non-chord tones. When score reading, students are able to invert simple intervals (fifths and fourths, octaves and unisons) to accommodate their vocal range.

Level III: the student relies less on visual cues and begins to act on internal representation of the music. When score reading, the student is able to easily transpose registers and intervals so they better fit the voice. When reading clef changes, the student performs from knowledge of note names, not from the visual display of the melody.

2. Eye contact in ensemble (this is a measure of the degree to which students are able to attend to different demands simultaneously).

Level I: there is no eye contact among the students. They look at the conductor (teacher) only occasionally. The focus is entirely on performing their part without errors.

Level II: there is some eye contact with other performers, but usually only with a person who is singing their part. This suggests the student is able to follow the score and coordinate his part with another person singing the same part.

Level III: there is eye contact with other performers, but it is frequently with a person who is singing a different part. This suggests the student is able to follow the score and simultaneously coordinate his part with others in the ensemble.

B. Degrees of Internalization

The three indices below describe the development of increasingly internalized (and therefore operational) knowledge. They all express the development of a stable internal reference system. The contrast between the warm-up behaviors of beginners and more experienced students provides a very clear example of the effect of internalization. That students spontaneously sing pitches they have been asked to name suggests they do not yet easily separate the name, function, or sound of the pitch. The ease with which memorization of pitches occurs is striking in the more advanced

classes. Their pitch memory becomes so stable that once they have tuned up, they require no more references. Working on score reading with students at this level is almost like rehearsing an orchestra.

1. Tuning and warm-up procedures (before singing, students are asked to tune up: to ground oneself in the tonic key. There are big differences depending on the level of the student's development).

Level I: if the student tunes up before singing a melody, it is usually done by singing the scale up and down out loud.

Level II: the tuning procedure now includes singing the scale, perhaps the tonic triad, and even some other scale degrees out loud.

Level III: tuning is completely internalized. The only way of knowing whether a student tuned up is by observing a brief period of concentrated looking through the melody. This is often followed by the student sitting back and turning to the instructor.

2. Naming notes (students are asked to identify individual notes when played on the piano. Whether they respond by singing or speaking indicates their level of development).

Level I: beginning students sing and name the pitch when asked to identify the notes played on the piano.

Level II: this level marks an in-between stage. Sometimes students sing the name and pitch of most of the notes when asked to identify those played on the piano and sometimes they only say the names.

Level III: students only say the names. There is no singing. This is taken as evidence the sound is internalized.

3. Unit of memory (one dramatic result of solfege classes is the amount and ease with which students can memorize without making that the focal task).

Level I: the student retains the mental image of the sound of tonic and perhaps the dominant of the scale. There is a need for constant reference and

tuning to those notes during the class period. Certain salient constellations of notes are relatively stable (e.g., scale degrees 7 to 1; 2 to 1; and 6 to 5).

Level II: students are beginning to expand their tonal references to include more pitches over a longer time. There is less need to tune and re-establish the reference notes during class.

Level III: students are developing a memory for most of the 12 chromatic tones. Once the class is tuned up there is little, if any, need to re-tune or re-establish reference tones. If the class is working on score reading, one gets the sense of working with an orchestra—the pitches are on call, the rhythmic nuance is clear, the reading is expressive.

C. Degrees of Stability

Using miscues as a measure of students' stability is a simple, yet effective, strategy for revealing levels of development. At first students are unaware of the conflict. Within two semesters, most students begin to notice, but cannot always resist the implication of the given miscue; during the third semester, students notice the miscue, but sing what is written; by the fourth semester, students ignore the miscue entirely. The second measure of stability charts students' ability to separate the name of a note from its function in a scale. The effect of modulation on performance appears to be highly correlated with stable scale references and with intonation. The effect of mistakes completes the picture, for initially students knowledge is so fragile that they are unable to recover from mistakes. Later, and closer to the end-state, mistakes do not interrupt the performance.

1. Effect of miscue (before beginning to sing, students are given the first note in a context that either reinforces tonic or varies from it).

Level I: when students are given the starting note as part of a non-tonic chord (e.g., the pitch "C" is given as the third of an A-flat major triad), they will sing the contour of the melody in the key of A-flat. This is taken as evidence the students are using their knowledge of contour schemes, which are weakly integrated into scales, and matching the visual contour of the melody.

Level II: the context of the starting note is now handled more subtly (e.g., scale degree 3 being presented as the fifth of a triad).

Level III: students now correct the instructor, or give knowing looks and comments about the true context of the starting note.

2. Scale reference (the observations here reflect the fixed-do materials and pedagogy in use at NEC. We suspect parallels with other pedagogical materials. The student is initially locked into a single tonality, but slowly is able to generalize to tonic references of other scales).

Level I: a single scale is the most important reference. Students use it as an inflexible template. To sing in a different key, students must start from the beginning and re-tune. They are unable to perform accurately melodies that lie outside that scale.

Level II: students are still unable to let go of the initial aural scalar reference. Their performance of accidentals (in melodies implying keys closely related to the original tonic) is unstable. They are unable to distinguish between the aural function and the visual identity. For example, if students have been singing in the key of C, they will sing the pitch "C" when they are asked to sing tonic—even when the key is not C, or when the melody has modulated to the dominant or the submediant.

Level III: students can quickly construct any tonic and key reference. They can negotiate highly chromatic melodic contexts and maintain their orientation to changed keys.

3. Modulation (this measures the student's tolerance for disorientation. The effect of a modulation can be interpreted as an index of the degree to which a student can reconstruct a stable internal reference system).

Level I: modulations completely disorient the student. Anything beyond the tonic scale becomes an occasion for mistakes and a decline in the sensitivity to intonation.

Level II: the student can negotiate modulations to near keys. The more well-defined the modulations, the more successful the performance. On demand, they can now sing the tonics of new keys, thus giving evidence they can keep separate the home from the local tonic.

Level III: modulations now pose no problem for the student. Chromatic tonal and atonal contexts pose few difficulties.

4. Intonation (with development, there are dramatic shifts in the ability to perform in tune).

Level I: students can use only the most salient notes (the dominant and especially the tonic) as reference points against which to tune other notes of the melody.

Level II: students can use all the notes of a major scale as reference for intonation. A new scale, especially those at some distance, will disorient intonation.

Level III: students tune to a variety of melodic and harmonic contexts. Distant key relations are no longer problematic. Tuning strategies include reference tones from focal keys and intervals now adjusted to specific tonal contexts.

5. Effects of mistakes (when errors occur in performance there are radically different levels of response).

Level I: orientation is fragile because mistakes are often difficult to undue or the student is slow to respond effectively to the error and often never fully recovers. Musical uncertainty or obliviousness produces hesitations or total breakdowns in performance.

Level II: in this intermediate stage the student can draw on certain salient pitches to re-orient the performance. Although mistakes can be distracting, the student is committed to a full musical recovery. More radical strategies (such as leaving out notes or filling in leaps) are employed toward this end.

Level III: students respond quickly and intuitively to their mistakes. They can think on their feet as they spontaneously recover the flow of the melody—or choose to ignore their mistakes altogether.

D. Beyond the Notation

At first, performances are characterized by wooden, note-to-note qualities. Over time, students spontaneously begin to sing with expression. As they become less concerned with every note and rhythm, they appear to

have more time during performance to devote to other features of the music. They also are able to scan melodies and scores while performing—suggesting in another way that less attention needs to be focused on deciphering their own single part.

1. Expressivity (performing with appropriate expressiveness is a constant requirement and is linked to levels of development).

Level I: a musically expressive performance will not appear without more or less rote drill. Reminders to make a diminuendo or ritard will be quickly forgotten and dynamics will be ignored.

Level II: in keys and contexts that are easily understood and familiar, students will be able to make expressive nuances while performing—especially if encouraged.

Level III: this level marks a major milestone. Students spontaneously integrate notated expressive marks and often add others they feel are appropriate. Sightsinging now sounds qualitatively different; expressive performance has become automatic, not the result of coaching and rote drill.

2. Unit of analysis (students' behavior, when they study a melody to perform, is linked to levels of development).

Level I: asked to look through a melody and comment on its structure, or to locate the areas that may cause difficulty, the student will search through the piece note by note. Comparisons to the piece just sung are slow and difficult. Students easily lose their places, have trouble locating the recapitulation of material, and are slow to start from the middle of the piece.

Level II: the student will easily locate the tonic and dominant notes of the common scales, will scan quickly, and make comparisons to the piece just sung.

Level III: students maintain their orientation within and across nearly any keys and scales and make quick comparisons with other pieces. They appreciate structural cues and use them in their performances.

The range of these observations is broad. They cover the span from first exposure to mastery. To gain a perspective of each developmental level, the reader is encouraged to regroup the behaviors by level rather than by category.

SUMMARY

One of the primary goals of the sightsinging program at NEC is to develop music reading to a high degree of fluency. This is a necessary support for the performance focus that is a special feature of a conservatory education. Thus, we place a high value on being able to sightsing melodies with appropriate nuance and musical expression. Of course, other programs may emphasize different goals.

Using both quantitative and qualitative measures for optimal assessment of ability, we found three broad levels that expanded our understanding of development in sightsinging. The first level is restricted to reading of local units. If development stops here, the skill is reduced to reading only contours and intervals. The second level is characterized by reading based on a strong scalar reference, but without the capability to switch keys easily. While the knowledge base is broader, it is not yet fully operational, so modulations disturb the stability of scale reference and relationships held across keys. Finally, in the third level there is a reliable tonal reference system that permits chromatic or even atonal music to be performed.

Because of the structure of our evaluation system, we can use the test as a baseline measure of sightsinging skill, and also as a diagnostic test. Because of the specification of issues made possible by the scoring system, one can construct a profile of errors for an individual student. With this profile of sight-reading performance and the observations made in class, an instructor is able to give each student a detailed summary of strengths and weaknesses, and point out which areas are leading development and which are lagging behind.

In sum, we think the predominant model for evaluating skill in sightsinging should be based on musical performance values rather than language skills and theoretical knowledge; should not rely on single measures (e.g., accuracy alone); should employ quantitative measures as well as qualitative measures that grow out of the specific educational context; and should be useful for diagnosing strengths and weaknesses. Finally, the means of assessing what is learned and developed will depend on the immediate objectives of the specific curriculum.

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