Bridges Unbuilt: Comparing the Literatures of Music Cognition and Aural Training

David Butler and Mark Lochstampfor

Introduction

Does any of this sound familiar? Aural training expert #1 writes—based on observations of many, many aural training sessions and a record of some success as an instructor—that the objective of aural training is to develop a keen sense of pitch relations in general, and a solid sense of scale-step in particular; expert #1 then asserts that the use of movable-do syllables is critical if the student is to develop this facility. Our expert also argues that students should never practice with the help of an instrument; that melodic dictation should proceed slowly enough that the student can write down each note before the next is struck on the piano; that the instructor should sometimes play melodies in different keys than those in which students are instructed to take dictation, so that students with absolute pitch will be forced to develop their sense of relative pitch; that students should practice error detection; that tonic-la minor is a vastly superior pedagogical system to tonic-do minor; that only the numerator of the metric signature is

audible, and so the denominator must be specified by the instructor during dictation practice.

Aural training expert #2 writes—based on observations of countless aural training sessions and a record of some success as an instructor—that students can (and if possible, should) develop absolute pitch through aural training, although many examples of "absolute" pitch turn out to be linked to instrumental timbre or vocal tessitura. Expert #2 goes on to state that number and syllable systems are not necessary and that "la" can be applied to every pitch; and that all aural training should take place accompanied by an in-tune instrument. The two experts agree that each exercise in the aural training sequence should be mastered before the next is attempted, thus hinting that aural training amounts to something more than sight-reading practice, or learning as much of the performance literature as can be squeezed into the ear-training curriculum.

If there is anything remarkable about these opinions, it is only that they were in print nearly a century ago.[1] The points of view could have been extracted as easily, in one mix-and-match combination or another, from a number of recent articles in the *Journal of Music Theory Pedagogy*.[2] Topics of debate in aural training pedagogy have

---

[1] Aural training expert #1 is A. Heacox, *Ear Training: A Course of Systematic Study for the Development of the Musical Perception* (Philadelphia: Theodore Presser, 1898); expert #2 is S. Jadassohn, *A Practical Course in Ear Training; or, A Guide for Acquiring Relative and Absolute Pitch,* Eng. trans. by Le Roy Campbell (Leipzig and New York: Breitkopf and Härtel, 1905).

[2]For example, see M. Houlahan and P. Tacka, "Sequential Order for the Preparation, Presentation, Practice and Evaluation of Rhythmic and Melodic Concepts," *Journal of Music Theory Pedagogy* 4 (1990): 243-268, "Sound Thinking," *Journal of Music Theory Pedagogy* 4 (1990): 85-110, and "The Americanization of Solmization: A Response to Timothy A. Smith," *Journal of Music Theory Pedagogy* 6 (1992): 137-152; G. Karpinski, "A Model for Music Perception and Its Implications in Melodic Dictation," *Journal of Music Theory Pedagogy* 4 (1990): 191-229; G. Potter, "Identifying Successful Dictation Strategies," *Journal of Music Theory Pedagogy* 4 (1990): 63-71; T. Smith, "A Comparison of Pedagogical Resources in Solmization Systems," *Journal of Music Theory Pedagogy* 5 (1991): 1-24, and "The Liberation of Solmization: Searching for Common Ground," *Journal of Music Theory Pedagogy* 6 (1992): 153-168; and P. Telesco, "Contextual Ear Training," *Journal of Music Theory*

very long lives. Dictation uses nineteenth-century techniques and technology, and the teaching technique of sight-singing has been around in essentially the same form for nearly a millennium. How serviceable are they for the next century, the next millennium?

Are these sorts of questions important? How big a business is aural training, anyway? How many ears get trained in a typical year? One estimate, based on a chain of assumptions only Rube Goldberg could love, is that more than 40,000 students enroll in one or more college-level aural training courses each year in the U.S. and Canada.[3] Even if the actual number were only a tiny fraction of this estimate, the importance of making a careful and systematic study of both the goals and the methods of our aural training pedagogy should be obvious.

But goals and methods are often discussed at a rather shallow level. Many articles offer protocols for presenting dictation exercises, or extol the virtues of one system of solfege syllables or another, without tackling the underlying questions of what these protocols and systems are supposed to do, and whether they are the most effective way of doing it.[4] Innovations in aural training more often relate to

---

Pedagogy 5 (1991): 179-190.

[3]The 1992-94 *Directory of Music Faculties in Colleges and Universities, U.S. and Canada* (Missoula, Montana: CMS Publications, Inc., 1992) lists some 4,549 instructors of undergraduate core-curriculum music theory courses under the rubric "Theory and Analysis." One assumption here is that these courses typically either incorporate aural training or have an ancillary aural training course. The estimate is based on an assumed student-to-faculty ratio of 10:1. The *Directory* does not indicate instances in which instructors teach more than one of these courses, nor does it list unranked staff (e.g., graduate teaching assistants) who might teach such a course. On the other hand, some faculty listed in the "Theory and Analysis" category undoubtedly do not teach aural training.

[4]There are, of course, a number of important exceptions. At the risk of unintentionally excluding any of these, we will draw attention to two charming and challenging essays by Bruce Benward: "The Unbearable Lightness of Perception," keynote presentation at the 1990 meeting of Music Theory Midwest, Northwestern University, 19 May 1990, and "CAI in Music: How are We Doing?" *The ATMI International Newsletter* (May 1993): 1-7; and Michael Rogers' influential book *Teaching Approaches in Music Theory* (Carbondale: Southern Illinois University, 1984).

technology rather than to technique; that is, innovations more often appear to relate to the mode of presentation of materials (for example, tape recorders, microcomputers and MIDI-controlled synthesizers), rather than involving systematic examinations of the perceptual complexity or ambiguity of those materials, of the listening strategies used by the strongest and weakest students, or of the educational objectives set out for aural training courses.[5]

It seems reasonable to expect that the field of music cognition would give us some valuable guidance as we seek to learn more about skilled listening to musical patterns. The research literature generated by controlled experimental studies of musical perception has grown dramatically in the past decade.[6] There has also been an impressive growth in the number of professional conferences[7] and books[8] devoted

---

[5]There are obvious exceptions to this statement, also, including a series of studies by Steve Larson, such as "Scale-Degree Function: Cognition Research and Its Application to Aural Skills Pedagogy," in *CRCC Technical Report #67, Indiana Center for Research on Concepts and Cognition* (Bloomington: Indiana University Press, 1992), and "Modeling Melodic Expectation: Using Three 'Musical Forces' to Predict Melodic Continuations," in *CRCC Technical Report #70, Indiana Center for Research on Concepts and Cognition* (Bloomington: Indiana University Press, 1993), and an article by Gary Karpinski ("A Model for Music Perception").

[6]Contributions from psychologists are found primarily in journals such as *Perception & Psychophysics, Psychological Review,* the *Journal of the Acoustical Society of America,* and *Memory & Cognition.* Journals such as *Journal of Research in Music Education, Music Educators Journal,* and *Psychomusicology* carry predominantly the reports of work done by music educators. Some relevant articles may be found in *The Journal of Music Theory, Music Theory Spectrum,* and *Journal of Music Theory Pedagogy,* with reports contributed primarily by music theorists. Specialized research journals such as *Music Perception* and *The Psychology of Music* (UK) carry reports written by, and read by, a broad cross-section of interested researchers across these several disciplines.

[7]These include the Research Symposia on the Acoustics and Psychology of Music (The University of Kansas) 1981, 1983, 1985, 1986, 1988, 1989; the series of Workshops on Physical and Neuropsychological Foundations of Music (Ossiach, Austria) 1980, 1983, 1985, 1992; the annual (since 1985) Herbert von Karajan Symposium in Vienna; the Symposium on Music and Cognitive Sciences, Institut de Recherche et Coordination Acoustique/Musique (IRCAM, Paris) 1988 and the IRCAM Music

to research in music cognition. A number of insightful and even provocative articles on aural training have appeared recently (including those cited earlier) and most of these acknowledge a debt to Michael Rogers' *Teaching Approaches in Music Theory*. At one point or another, nearly all of these discussions of aural training cite the need for systematic, controlled study of the perceptual and learning activities involved in aural training. There is little indication in the literatures of aural training and of music cognition, however, that this much-needed

---

Perception Workshop (1991); the series of public seminars on music perception sponsored by the Royal Swedish Academy of Music (Stockholm), extending through the 1980s and into the 90s; the Symposium on Musical Development and Cognition (Eastman School of Music, Rochester, NY) 1988; the First International Conference on Music Perception and Cognition (Kyoto, Japan) 1989; the Symposium on Music and Cognitive Sciences (Cambridge University, England) 1990; the second ICMPC (Los Angeles) 1992; and the conference of the Society for Music Perception and Cognition (Philadelphia) 1993. The third ICMPC is planned for 1994 (Liège, Belgium).

[8]Recently released books devoted entirely to this field include D. Hodges, *Handbook of Music Psychology* (Lawrence, Kansas: National Association for Music Therapy, 1980); M. Clynes, ed., *Music, Mind, and Brain* (New York: Plenum Press, 1982); D. Deutsch, ed., *The Psychology of Music* (New York: Academic Press, 1982); P. Howell, I. Cross, and R. West, *Musical Structure and Cognition* (London: Academic Press, 1985); W. J. Dowling and D. Harwood, *Music Cognition* (Orlando: Academic Press, 1986); D. Hargreaves, *The Developmental Psychology of Music* (Cambridge: Cambridge University Press, 1986); J. Sloboda, *The Musical Mind: The Cognitive Psychology of Music* (Oxford: Clarendon Press, 1986); M. L. Serafine, *Music as Cognition: The Development of Thought in Sound* (New York: Columbia University Press, 1988); C. Krumhansl, *Cognitive Foundations of Musical Pitch* (New York: Oxford University Press, 1990); J. Bamberger, *The Mind Behind the Musical Ear* (Cambridge: Harvard University Press, 1991); M. R. Jones and S. Holleran, eds., *Cognitive Bases of Musical Communication* (Washington, D.C.: American Psychological Association, 1992); D. Butler, *The Musician's Guide to Perception and Cognition* (New York: Schirmer, 1992); and R. Aiello and J. Sloboda, eds., *The Perception of Music: Selected Readings* (London: Oxford University Press, 1993). Several other books base substantial portions of their discussions on research conducted in this field; these include F. Lerdahl and R. Jackendoff, *A Generative Theory of Tonal Music* (Cambridge: MIT Press, 1983); E. Narmour, *The Analysis and Cognition of Basic Melodic Structures* (Chicago: University of Chicago Press, 1990) and *The Analysis and Cognition of Melodic Complexity* (Chicago: University of Chicago Press, 1993); J. Kramer, *Time and the Meaning of Music* (New York: Schirmer, 1988).

discourse is on the increase.

A cursory examination of references cited in the literature of aural training pedagogy suggests that there is very little correspondence between research activities in music cognition and pedagogical activities in aural training: although there are important individual exceptions, there simply does not seem to have been a widespread effort to identify, gather, evaluate, and synthesize experimental results from the research area of music cognition so that they may be applied directly to aural training in our college music programs.

Indications of the extent of influence of this research on music education in general and aural training in particular may be found in current publications on music. Because the responsibility for nurturing aural skills falls principally to music theorists, well established journals in music theory seem likely sources for literature regarding aural training. The rising concern for pedagogical issues in music theory curricula during the past decade spawned a journal devoted to this area. The *Journal of Music Theory Pedagogy* has produced six volumes (12 issues) of instruction-based articles on various topics in music theory and aural training since the journal's inception in 1987. Only 14 (26%) of the 53 articles[9] cite any reports of perceptual and cognitive research. Further review shows that less than 9% of the 743 citations are from the literature of music cognition.[10] During those same six years of publication, 1987-92, the Society for Music Theory *Spectrum* published

---

[9]James Bennighof's article, "A Selected Bibliography of Source Materials for Current Music-Theoretical Systems" (*Journal of Music Theory Pedagogy* 3/1 (1989): 47-94), is a bibliography and is excluded from these figures—as are reviews of books and articles.

[10]Identification of the perceptual and cognitive research are not reserved to mainstream experimental psychology literature, but considered in the broadest sense including publications such as *Journal of Research in Music Education*, and other articles in the *Journal of Music Theory Pedagogy*. Excluded items are scores, musical excerpts, musical recordings, additional citings of different editions of a textbook, and instructor's manuals if the primary text was already cited.

43 articles[11] with 1,039 citations, of which roughly 2.5% are from the music psychology literature. The *Journal of Music Theory*, with more than 30 years of publication, includes no references to any perceptual or cognitive literature within its 1987-92 publications. Sources such as the *Journal of Research in Music Education* and *Psychomusicology* focus much of their attention on educational studies on early and intermediate music development. Hence, these journals also contain relatively few references to music cognition research.

Nor is there much evidence of a strong influence the other direction: As the principal interdisciplinary journal for research on music perception and cognition, *Music Perception* includes citations from experimental, psychological, acoustical, and linguistics publications, but only 12% refer to publications in music theory. Moreover, citations in both mainstream psychological journals and specialized journals such as *Music Perception* often turn out to be anthropomorphic assertions that "Music theory states that...," supported by citations of introductory-level harmony texts. In fact, "music theorists" sometimes turn out to be psychologists discussing their impressions of music theory; one such "music theorist" is psychologist Gerald Balzano, whose often-cited discussions of pitch-class sets turn out to be essentially a re-plowing of one patch of the ground tilled much earlier (and a bit deeper) by Milton Babbitt.[12]

Besides this, scientists must work painstakingly on very narrowly defined problems as they piece together the gigantic jigsaw puzzle of perception. Studies too hasty in design or execution tend to produce misleading or even worthless data: results that could have been caused

---

[11]Volume 11/1 (1989) is excluded. As a special issue about the "State of Research" in music theory, it may be an invalid sample of the generally published literature.

[12]G. Balzano, "The Group-Theoretic Description of Twelvefold and Microtonal Pitch Systems," *Computer Music Journal* 4 (1980): 66-84, and "The Pitch Set as a Level of Description for Studying Musical Pitch Perception," in M. Clynes, ed., *Music, Mind, and Brain* (New York: Plenum Press, 1982), 321-351; M. Babbitt, "Twelve-Tone Invariants as Compositional Determinants," *The Musical Quarterly* 46/2 (1960): 246-259.

by more than one musical variable, or by test subjects operating on a level of musical comprehension above or below that expected by the experimenter, or simply results produced by a test based on musically invalid or trivial premises. Even when we appreciate these difficulties, the pace of experimental research can seem glacial. One example: in an interesting letter many years ago, Daniel W. Martin pointed out that contemporary research showed that the muscles of the vocal mechanism move subtly and involuntarily as people read silently, and assumed that this movement was directly related to the auralization—and thus much of the aesthetic enjoyment—that accompanies the reading of poetry.[13] The relationship with musical auralization in general, and with aural training in particular, offers an intriguing question begging to be investigated: could the over-learning of vocalized numbers or syllables, linked to scale degrees, produce an equivalent sharpening of aural imagery for tonal relationships? That is, is there a motor-learning link, as well as a memory link at the cognitive level, between the pedagogical devices of numbers or syllables and the clarity and strength of our mental images of tonal pitch relationships? The technology for testing this question existed when Martin wrote his letter, and is certainly both much more precise and more accessible now than it was then, but no one seems to have conducted such a study just yet, more than four decades later.

Music Perception in the Aural Training Classroom

These mild criticisms notwithstanding, on the whole it seems quite evident that the psychologists are becoming much more sophisticated about music theory than was evident a generation ago. How are we musicians doing in understanding the psychological

---

[13]D. Martin, "Do You Auralize?" *Journal of the Acoustical Society of America* 24 (1952): 416. Martin seems to have coined the term "auralize" in this letter, defining the term as the formation of "a mental impression of sound not yet heard." Martin (now a vigorous 75-year-old) currently writes the monthly report of acoustical patents for, and is Editor-in-Chief of, *JASA*.

literature? To re-direct J. K. Randall's pithy warning: if we insist in grazing in the psychologist's pasture, we would be wise to learn enough about the terrain to be sure that we are munching on what grows there rather than on what no one has bothered to remove yet.[14] Experimental results may be very seductive in their apparent application to aural training, but we have to consider each one carefully in a realistic musical context—as the discussion below should demonstrate.

Gary Karpinski's article on melodic dictation shows a strong influence from the research literature of psychology.[15] The article is valuable on several levels. Among other things the article contains a lucid discussion of the important distinction between overt drill and testing activities and the sometimes covert skills and awareness that may be the actual goal. By way of analogy, Japan has a rich tradition in pottery that goes back many centuries. Part of that tradition is that student potters spend months—sometimes years—huddled in front of their potter's wheels, enduring monotonous and seemingly never-ending student-apprenticeships. After a year of doing nothing more creative than mixing and wedging the master's clay, a student may spend the entire next year producing 100 identical tea bowls each day, squashing them and re-wedging the clay in the evening, and producing another 100 identical bowls the next day. The ultimate goal in this process is not to produce great bowls—the potters may eventually go on to produce functional and art pottery that looks like anything but a bowl—but rather to ensure that students in an art with a strong central tradition gain solid control of the materials and techniques indigenous to that tradition: the tactile understanding of the wet clay, the sure sense that the walls of the vessel are of just the right thickness and uniformity. There is a widespread suspicion that something of the sort is supposed to happen to music students as they are formally inducted into the Western tonal tradition. For example, Karpinski questions the ultimate purpose of melodic dictation in aural training: are we really

---

[14]J. K. Randall, "Two Lectures to Scientists, I: Theories of Musical Structure as a Source for Problems in Psycho-Acoustical Research," in B. Boretz and E. T. Cone, eds., *Perspectives on Contemporary Music Theory* (New York: Norton, 1972), 118.

[15]"A Model for Music Perception."

interested only in developing brigades of facile musical stenographers, or is the objective rather to sharpen students' auditory attention, to stretch and strengthen their tonal memories? As he asks these valuable questions, Karpinski lays out clear pedagogical tactics and strategies, supporting them liberally with citations of both the cognitive and the psycho-physical strata of the music perception literature.

Even in this fine article, however, we have to be careful to not assume too much. For example, Karpinski makes much of a classic paper by George Miller, entitled "The Magical Number Seven, Plus or Minus Two: Some Limits on our Capacity for Processing Information."[16] Karpinski tells us that a typical listener ought, according to Miller's rule of thumb, to be able to comprehend 7 ± 2 (that is, from 5 to 9) notes in a single presentation:

> ... a dictation of 5-9 notes requires one playing, a dictation of 10-18 notes requires two playings, and so on. In practice, when extending beyond a single playing of 5-9 notes, an extra playing is usually necessary to account for the task of discerning the relationships between separate remembered portions of the melody. Thus, three playings are appropriate for melodies of 10-18 notes.[17]

But Miller's paper really had almost nothing to do with music. His discussion was limited to the amount of information we can reliably pick up when it is presented along a single sensory dimension such as vision (e.g., varying lengths of lines), taste (e.g., varying degrees of bitterness), and audition (e.g., varying pitch levels from low to high). Not low to high within some major- or minor-mode context anchored in some key system; not even low to high given the constraint of twelfth-octave equal temperament—or even assuming that pitches an octave apart are related perceptually. The sort of study that Miller's paper discussed might ask a listener to identify any repeated pitches in,

---

[16]*Psychological Review* 63/2 (1956): 81-97.

[17]"A Model for Music Perception," 201.

say, a series of tones with fundamental frequencies of 1349, 461.4, 94.9, 542, 1998.1, 211, 5000, and 43.7 cycles per second (or hertz). Only one of these tones happens to have a frequency matching any of the tones in the twelfth-octave equal-tempered tuning system (A=440Hz); every other tone is "in the cracks" somewhere, and one tone is well above the upper reaches of the piano keyboard. Small wonder that listeners in the study cited by Miller had a tough time recognizing many more than a handful of tones without running into problems. Listeners with strong musical backgrounds and/or absolute pitch might be able to force-fit these tones into some sort of aural mnemonic pattern (for example, the first few tones of the series might sound something like "sharp E6," "flat B♭4," and "sharp F♯2"), but listeners without that sort of musician's aural toolkit would have nothing to guide their listening.

How appropriate is Miller's famous grouping limit of 7 ± 2 in a realistic musical context? Just adding the constraints of twelfth-octave equal temperament and customary limits of register reduces the odds stacked against the listener: an infinite number of possible tones drops to 88 or fewer. Wouldn't the listener's acquaintance (perhaps informally learned and nonverbal, but powerful nonetheless) with conventions of major-minor tonality be of some help? Wouldn't repeated tones, octave similarities, and other features that favor perceptual grouping offer more help? On the other hand, students taking melodic dictation have to worry about notating rhythmic patterns within (or diverging from) metrical frameworks that Miller's subjects were not asked to describe. It may turn out that memory limitations for tonal melodies happen to resemble memory limitations for the non-musical pitch series to which Miller referred, but we have no solid evidence of that. We just do not know.

Karpinski's discussion is limited to length of melodic dictation examples, but many other factors could affect the difficulty level of the tune: for example, bigger skips are usually tougher for students to recognize than steps and smaller skips; descending skips are usually tougher than ascending skips; chromatic tones are always tougher than diatonic ones, but some types of chromaticism (e.g., passing-tone and neighboring-tone microtonicizations) seem easier for students to make

aural sense of than other types (e.g., Neapolitans, skips to any altered tone). We can propose a home-made difficulty index that certainly is not based on solid evidence produced by carefully designed and executed experimental studies, but it has the good characteristics that it can be applied systematically and quickly:

(1) add up the total number of notes in the melody, assigning one point per note;
(2) add one point for each ascending skip (>M3), two points for each descending skip (>m3);
(3) for chromatic alterations other than scale-degree 5 and scale-degree 6 in minor mode, add two points for each chromatic PT or NT; add three points for each skip to a chromatically altered note;
(4) subtract two points for each tonal sequence; subtract four points for a parallel antecedent-consequent phrase structure.

At the beginning of the freshman year, melodies might have a difficulty index level of 8 to 12 or so, depending on what the high schools have sent you. By the end of the year, the melodies might progress to 25 or thereabouts. At the outset of the sophomore year, facing classes full of students suffering summer amnesia, you might begin with melodies at a difficulty index no higher than 20. By the end of the sophomore year, melodies might average around 40-50+. Does this grading system work? It is a rough measure at best; there are many ways one might sharpen it. Temporal aspects (rhythmic process, meter) are the most obvious missing components, but many refinements could be added to account for other important pitch relationships as well. For example, we often observe that even skips the same direction and the same size can be very different in difficulty, depending on the scale degrees involved: for example, the ascending perfect fourth from scale degree 5 to scale degree 1 seems much easier for students to sing and to recognize than the ascending perfect fourth from scale degree 1 to scale degree 4. But there is a trade-off between the comprehensiveness and sophistication of the difficulty index on the one hand, and its ease of use on the other. Even the rudimentary system described above seems to measure something real in our own aural

training sequence, because we find that as the difficulty index goes up, errors on students' papers increase and the students' complaints get shriller. If our trust were based entirely on validation of the difficulty index by carefully controlled experimental studies, we might have to wait for years while testing each of the factors listed in the four steps of the tallying process: comparing error rates for longer and shorter melodies containing the same proportion of steps vs. small skips; steps vs. small skips ascending/small skips descending; steps vs. small skips ascending/large skips ascending, and on and on. How do we prepare for our classes in the meantime? A sensible first step is to think a bit about the purpose of aural training.

Kate Covington identifies four obstacles to success in aural training.[18] Among these is the need for explicit methodology for teaching aural skills. This assessment appears accurate as reflected by discussions in the literature on aural training and at professional conferences. Most textbooks for sight-singing and dictation do seem to reflect some agreement on goals for aural training: that students should have the ability to look at a musical score and create an aural image of the music in their minds (to "audiate" or "auralize" the sounds). Though this objective may assume that musical understanding is taking place with the aural imagery, this is an unsafe assumption. Benward and Kolosick are among the few to openly state in a textbook the need for intellectual understanding of the music as part of the goal for aural training.[19] Timothy Smith, in an article comparing solmization methods, goes on to assert that the purpose of aural training is broader than the development of good musical readers for performance, and must include students' abilities to understand and analyze music with "utmost intelligence and skill."[20] We will go on to argue that aural skills must

---

[18]K. Covington, "An Alternative Approach to Aural Training," *Journal of Music Theory Pedagogy* 6 (1992): 5-18.

[19]B. Benward and T. J. Kolosick, *Ear Training: A Technique for Listening,* 4th ed. (Dubuque: Wm. C. Brown, 1990).

[20]T. Smith, "A Comparison of Pedagogical Resources in Solmization Systems," *Journal of Music Theory Pedagogy* 5 (1991): 2.

be more than the ability to detect performance errors during band or choral rehearsals. Reaching a goal of good error detection is a minimal skill included within the scope of understanding and skills discussed by Smith and by Benward and Kolosick. If we can agree on these ideas, then we, as instructors, can begin asking intelligent questions about how to better foster these skills in our students in effective and relevant ways.

The picture that seems to be emerging is that the field of aural training is benefiting a little—but only a little—from all the prodigious research activity in the area of music cognition. It seems quite likely that one reason for the limited amount of information transfer boils down to the dilemma posed by a fundamental incompatibility between two eminently desirable goals: experimental rigor on the one hand, and musical validity on the other. Lord and Covington summarized this situation aptly with the observation that innovative programs in aural training—i.e., the programs likeliest to be based on findings of empirical studies—are moving away from the tradition of drilling on isolated intervals and other sub-musical patterns, and adopting a more holistic approach to music.[21] In so doing, they have less and less in common with experimental studies that use musically impoverished stimuli (consisting of, say, a half-dozen tones or fewer), and that often force the listener to respond in musically unconventional ways.

On the other hand, conditions are not ideal for mounting rigorous experimental studies of aural training methodology in the most realistic situation, which is when actual aural training classes are used in the study. One obvious reason for this is that our guinea pigs are actually real, live human beings, and aspiring musicians, to boot: control groups cannot be allowed to languish for long periods while test groups receive some sort of training. A recent study by Lorek et al. gives an excellent illustration of this problem: the test group was given continuous training with solfege syllables while the control group sang exercises on a neutral syllable, and then it was found that the two groups performed at an equivalent level of mastery on sight-singing tests

[21]Private communication, 1993.

administered during and after the training period.[22] Although the report of the study indicates that dictation tests were administered as well, the report does not give an account of the results of those tests; informal indications are that the test and control groups performed at essentially the same mastery level on dictation tests.[23] An intrinsic problem with this strategy is that students in both groups practiced their dictation skills steadily throughout the training period. Although students in the test group obviously were able to draw on their knowledge of pitch relations enriched (we assume) by months of drill with solfege syllables, that does not mean that students in the control group were prevented from coming up with their own problem-solving tactics—some substitute for solfege syllables. Lorek and her colleagues might have avoided this uncontrolled learning within the control group by not giving students in either group any dictation practice throughout the training period, but it would have been educationally irresponsible for them to do that.

Conclusion

Must there be an unavoidable trade-off between experimental rigor on the one hand, and musical realism and educational responsibility on the other? If we decide that the only knowledge that we can trust is based on experimental evidence, the answer is probably yes—although as musicians we will likely agree that we would settle for somewhat looser experimental methodology, rather than conducting elegant studies that give reliable evidence about musical trivia. As Serafine put it, "a fuzzy view of the whole elephant is preferable to a

---

[22]M. Lorek, H. L. Riggins, R. Pembrook, K. Lidge, and L. New, "The Effect of Three Syllable Systems—Fixed *do,* Movable *do,* and "la"—on the Sightsinging Performance of Freshman Music Majors," unpublished paper, Conservatory of Music at the University of Missouri at Kansas City, n.d.

[23]Private communication with the first author, 1993.

clear view of the trunk.''[24] Experimental research is not the only route. In the last decade, a lot of attention has turned toward qualitative—rather than quantitative—research methods: case studies, ethnographic studies, autobiographical protocols. These sorts of studies can run the gamut from sloppy to precise in their design and execution, from dead-brained to brilliant in concept, just as experimental studies can.

But before we discuss the strong points of this method versus that, are we agreed on the sorts of questions we want to ask? Are solfege and dictation going to continue to be the staples in our students' aural training regimen? Why or why not? What could augment or replace them? Why? We seem to agree, don't we, that the primary purpose of solfege is to instill in our students a strong and clear sense of tonal relationships, right? Do these ''tonal relationships'' amount to something beyond a sense of scale-step? What about the other rationales for solfege drill, such as sight-reading practice, exposure to the performance literature, development of musical phrasing and articulation habits and the like? How does the importance of these objectives rank in comparison to the importance of a strong sense of scale-step?

We also seem to agree, don't we, that dictation's ultimate purposes go beyond accurate musical stenography? If one of those purposes is to develop the student's memory, are we talking about so-called ''short-term'' memory, which lasts from a few seconds to a few minutes (according to most descriptions)? Or ''long-term'' memory, which may last for days, weeks, even years? There is some evidence that listeners—at least those without absolute pitch—cannot reliably identify the original tonic by the time an average-length symphonic movement nears its midpoint, and this may either show the need for aural training that effectively develops students' short-term memories—or it may instead demonstrate the limits of most humans'

[24]*Music as Cognition,* 107.

tonal memory.[25] Long-term memory comes into the picture if we decide that it is important that solfege and dictation drills should always be taken from the performance literature so that our students become more musically literate. Is there any hard evidence that students really learn a sizable hunk of the performance literature this way? We cannot find any evidence of it, and in fact have heard from at least one respected colleague that students seldom if ever recognize the same dictation melody when it is played only two weeks later in the same course.[26] Before we become absorbed with borrowing the tools of the cognitive scientists, perhaps we would do well to make sure that we are reasonably agreed on what we define music cognition to be—that we have reached some level of consensus on the kinds of musical perceiving, musical production, and musical knowing over which our students should gain control.

---

[25]N. Cook, "The Perception of Large-Scale Tonal Closure," *Music Perception* 5 (1987): 197-206; Benward, "The Unbearable Lightness of Perception." Although Cook's publication antedates Benward's, Cook's experiment demonstrated formally what Benward's informal study had demonstrated some two decades earlier.

[26]Private communication with Richard Ashley, School of Music, Northwestern University, 1993.