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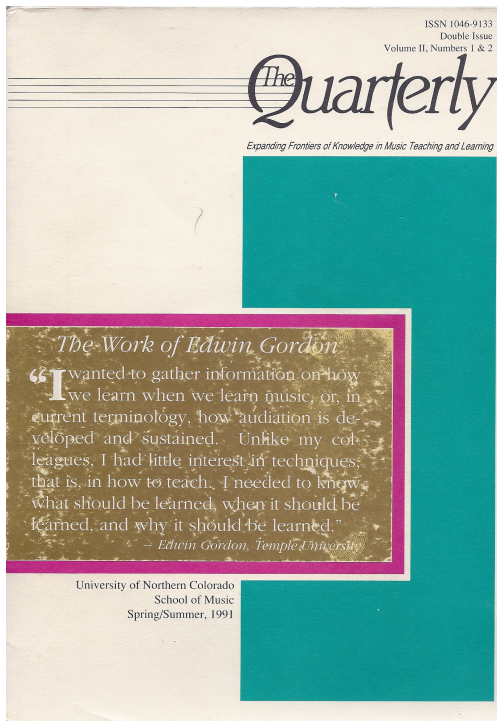
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Edwin Gordon's Music Aptitude Work

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None has had more to say about music aptitude during the last half of the twentieth century than has Edwin Gordon. The sheer volume of his work--research projects, articles, lectures, books, and measurement tools--dwarfs the output of all others. While it is reasonable to conjecture that Gordon knows more than anyone about the nature of music aptitude and how to measure it, it is important for at least two reasons that his work be reviewed and examined. First, to be prolific is to be controversial, and to be controversial is to be subject to examination. Second, the products of Gordon's music aptitude work are so widely accepted and applied that they have a profound effect upon the teaching, learning and decision-making of thousands. The purpose of this article is to provide an examination of the music aptitude work of Edwin Gordon and to address some of the questions that surround it.

The Heritage of Gordon's Work, or The First Great Controversy

According to conventional wisdom at the beginning of this century, musicians were musical because they were born to be so.^{1,2} Conversely, a person who failed to demonstrate musicality was assumed to have missed the blessing at birth. Simply put, achievement in music was taken as an indicator of one's innate potential to achieve. The possibility that conditions of life might have impeded achievement by some of the innately gifted was generally overlooked.

With the publishing of the *Seashore Measures of Musical Talents* in 1919, Carl Seashore provided the world with a tool other than observation by which to measure abilities related to music. While he championed the process of measurement, Seashore concurred with and reinforced conventional

thought that the potential for musicality was innate.³ In fact, he carried the view one step further by contending that the potential for musicality was inherited.⁴

The fast-growing music education establishment of the 1920s and 1930s, by nature of its goal to educate the masses in the discipline of music, was to a great extent a socio-educational refutation of the long-held premise that musicality is purely innate. For music educators to accept Seashore's assertion that "practice is of no avail"⁵ for the

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musically under-endowed would have been to label their own work as an exercise in futility. Consequently, the great nature/nurture controversy began to be waged in earnest relative to the issue of music aptitude. James Mursell led those opposed to the strict nature theory, stating that “it is utterly absurd to think of musical heredity as a sort of nemesis which fatally determines the level of musical achievement.”⁶

Seashore forged ahead with a 1939 revision of his measures, and other measures of music aptitude were developed as well. The most notable contrast to Seashore's measures was Herbert Wing's *Tests of Musical Ability and Appreciation*, first published in 1948. Wing's approach was as Gestaltist as Sea-

shore's was atomistic, soliciting preferences in relation to performances of standard literature. By implication, Wing's tests supported the nurture side of the nature/nurture controversy. However, throughout the course of a quarter of a century of discussion and debate, the publishing of articles and books, and the development of new music aptitude tests, the question of whether music aptitude was a product of nature or a product of nurture remained unresolved.

Gordon's Germinal Work: The Musical Aptitude Profile

In 1965, Edwin Gordon published the *Musical Aptitude Profile* (MAP), a battery of seven subtests, as the culmination of eight years of research. At the time, the issue of music aptitude had been out of the spotlight for more than a decade, and MAP precipitated a revival of interest. Extensive studies by Gordon and others prior to and soon after publication of MAP showed the battery to possess the highest standards for reliability and validity ever obtained by the author of a music aptitude test;^{7,8,9} reliability coefficients across grades 4 through 12 ranged from .70 to .85 for subtests, from .80 to .92 for division composites, and from .90 to .96 for the total battery,¹⁰ and the concurrent validity estimates, based upon the correlation of test composite scores with teacher estimates of aptitude, ranged from .64 to .97.¹¹

The most impressive evaluative procedure applied to MAP was the three-year longitudinal study of predictive validity that began in the fall of 1963 and was completed in the spring of 1966. No music aptitude measurement tool had ever been subjected to so rigorous an examination. That longitudinal study produced a within-school intercorrelation of .77 for all validity criteria combined.¹² Most significant was the extent to which the longitudinal study demonstrated Gordon's success in factoring out the measurement of achievement, the principal challenge for any author of a test of music aptitude. The stability of MAP scores can be seen in corrected correlation coefficients of .92 and .93 after one year and two years of concentrated music instruction respectively.¹³ In that same study, other music-related factors

such as practice, parental involvement in music, and listening experiences correlated with MAP composite scores within a range of .04 to .29.¹⁴ To summarize the findings of the three-year longitudinal study, MAP is a predictor of music achievement, and MAP scores are influenced little if at all by music instruction, music practice, and other achievement-related experiences. A five-year longitudinal study administered from the fall of 1968 to the spring of 1973 produced similar results when MAP and the subsequent music instruction were administered to culturally disadvantaged students.¹⁵

It is interesting to note that some critics have cited the expected increase in MAP raw scores at each higher grade level, shown in the norms tables, as evidence that MAP measures achievement-related factors. What those critics fail to realize is that maturation is expected to produce higher scores for all students, regardless of other circumstances. The important distinction is that while raw scores increase with time due to maturation, relative standing remains constant. It is the stability of relative standing across grades four through twelve, regardless of achievement, that verifies the power and validity of MAP as a measure of music aptitude.

Results of subsequent studies produced reinforcing evidence of the power of MAP as a measure of music aptitude and as a predictor of music achievement.^{16,17,18} Years of research results, respected reviews that invoked such superlatives as "one of the most comprehensive measures of musical aptitude"¹⁹ and "the best test of its kind anywhere on the market,"²⁰ and the fact that MAP soon became the only test of its kind in print, combined to make the quality of the *Musical Aptitude Profile* unassailable as a measure of music aptitude.

Through construction of his *Musical Aptitude Profile*, Gordon supported contentions proffered by each camp in the nature/nurture controversy of previous generations. Four MAP subtests consist of objective nonpreference items that would have met with the approval of the nature camp, albeit items that are related to musical phrases and are thus less atomistic than those found in Seashore's measures. The other three MAP subtests consist of subjective preference

items that would have met with the approval of the nurture camp, albeit items that are based upon original music rather than upon familiar music such as that found in Wing's test. Through the authorship of MAP, Gordon made the statement that both nature and nurture play a part in one's music aptitude.

Examining further the construction of the *Musical Aptitude Profile*, one will note that it is based upon three other important factors. Each has been a subject of controversy, so each deserves attention here.

First, Gordon assumed that music aptitude is normally distributed. His predecessors worked on the same assumption, and even the principal detractor, Mursell, conceded that "the normal distribution is indeed the most probable when we are dealing with entirely unselected groups."²¹ The evidence that music aptitude is normally distributed is not as abundant as is the evidence that intelligence is normally distributed, simply because the measurement of intelligence has enjoyed a longer history. However, from the history of music aptitude measurement that does exist, there is no reason to believe that music aptitude is distributed among the population in proportions other than those described by the normal curve. Therefore, teachers and parents can proceed to offer musical experiences to children on the assumption that all possess some level of music aptitude and that all can learn to the level allowed by that aptitude.

Second, Gordon discovered that music aptitude is multidimensional, encompassing at least 20 different aptitudes.²² The seven MAP subtests are designed to measure the seven music aptitudes that he identified as most important and most reliably measurable. Gordon has found variability among the seven music aptitudes within individuals.²³ The fact of that variability, along with the efficacy of MAP in quantifying it, makes MAP the first relatively sophisticated tool for diagnosing musical strengths and weaknesses within individuals. The multidimensional nature of music aptitude as evidenced by the length of the test—three 50-minute sessions are needed to administer the complete battery—contributes to what is sometimes offered as a criticism of MAP. Gordon

defends the length as necessary to the validity and diagnostic value of the battery, a contention that is supported by Gordon's research and by a study by Brown.²⁴

Third, Gordon found the basis of music aptitude to be a characteristic that he refers to as "audiation," a term that he coined in 1976. Others long before him spoke of the same factor at a seminal level under the terms "musical imagery" and "aural imagery."^{25,26,27} While some haggle over the term audiation today, it is difficult to deny that musicality is fundamentally dependent upon one's ability to hear, understand, and give meaning to specific sounds in recall and prediction at times when the actual sound is not present. The extent to which that ability is available to a person without instruction is, according to Gordon, music aptitude.

Gordon often finds himself needing to defend the validity of MAP results for populations other than mainstream, middle-class Americans. His claims are supported by research. There is evidence that MAP is a valid measure for culturally disadvantaged black students,²⁸ for German students,²⁹ for handicapped students,³⁰ and for gifted students.³¹ There is evidence as well to support Gordon's often-heard assertion that music aptitude is not highly correlated with intelligence or academic achievement.^{32,33,34,35}

The Concept of Developmental Music Aptitude, or The Second Great Controversy

Gordon and all the authors of music aptitude measures who preceded him had one experience in common. All wrestled with the confounding phenomenon of unreliability when their measures were administered to primary-aged children. Speaking late in his career of the "sensory capacities" called upon by his measures, Seashore observed that "we can measure these capacities reliably by the age of 10 in the normal child."³⁶ Wing published norms for children as young as 8 in a later edition of his measures, even though reliability was questionable.³⁷ Others diagnosed the problem to be one of process validity and altered directions, answer sheets, and other materials accordingly.³⁸ Some consistency of MAP scores for nonpreference subtests was

achieved among children in grades two and three by Harrington,³⁹ but the statistics were not as robust as for older children.

Gordon obtained an apparently reliable measure of aptitude from students as young as kindergarten age by the use of MAP, but only by taking extraordinary measures.⁴⁰ First, he selected only those children whose musical achievement had been observed to be exemplary, and then he enlisted the help of parents, one per child, to function as interpreters of what each child was hearing and to mark the answer sheet. Administration time was quadrupled. When such Herculean efforts produced only adequate results, Gordon concluded that more needed to be learned about the nature and measurement of music aptitude among children of such a young age.

In thinking of possible explanations for incongruities encountered in working with young children, Gordon theorized that the process by which they perceive and understand music may be similar to the process by which they perceive and understand language. Specifically, he conjectured that tonal patterns and rhythm patterns might represent musical sound vocabularies that children apply to the understanding of the two principal dimensions of music, much as words represent a lingual vocabulary that children apply to literature. Using the work of linguists such as Vygotsky⁴¹ and Smith,⁴² and gleaning information from other music researchers who had inquired into the nature of the acquisition of tonal and rhythmic sensibilities,^{43,44,45,46,47,48} Gordon initiated a series of research projects that culminated in the development of a taxonomy of tonal patterns and a taxonomy of rhythm patterns, organized by audiatonal difficulty.^{49,50,51}

Gordon's 1974-1978 research involved more than 10,000 young subjects. During the course of that extensive research, he drew a series of conclusions about the nature of children's innate relationship to music and their mode of processing musical sound.

First, music aptitude for children younger than age 9 appears to be developmental. That is, the instability of music aptitude scores for young children experienced by many researchers over the previous 50 years may be attributable to the fact that those

scores simply would not "stand still" for measurement. Environmental variables exercise a push and pull upon younger children's innate potential at rates that vary among children. Consequently, young children are constantly changing their relative positions in terms of music aptitude, depending upon the kind of "nurture" that is interacting with their "nature."

Second, children younger than age 9 make the most reliable decisions about what they are hearing when the tonal element and the rhythm element are presented to them in isolation from one another. That necessarily means that material from only two of the four MAP nonpreference subtests is usable for measuring the aptitude of young children, and then only in the form of pure tonal patterns and pure rhythm patterns.

Third, young children are incapable of giving reliable responses to items related to preference. Therefore, none of the material from the three preference subtests of MAP is useable for measuring the aptitude of young children.

The Development of the PMMA

The culmination of Gordon's extensive inquiry into the nature of the young child's music aptitude was the development of the *Primary Measures of Music Audiation* (PMMA) in 1979. The title was meant to imply that aptitude, in the stabilized form by which it is generally understood, was not solidified for primary-aged children. PMMA is specifically a measure of the developmental tonal and rhythm aptitudes of children in kindergarten through grade three. Its design includes an answer sheet with pictures so that literacy skills are not required. Split halves reliabilities across the four grades range from .72 to .89 for subtests and from .90 to .92 for the composite.⁵² The correlations between PMMA and MAP, corrected for attenuation, are .71 for tonal and .68 for rhythm.⁵³ Subsequent studies have produced evidence that music aptitude is unstable during the primary years,⁵⁴ that PMMA scores predict achievement in young children,⁵⁵ that developmental aptitude as measured by PMMA is sensitive to instruction, particularly in cases where the level of aptitude is low,⁵⁶ and that PMMA is a valid measure for use

with developmental comparisons, even if it were familiar to the child.⁵⁷

When teachers of young children began to base instruction upon information learned from PMMA scores, students so instructed soon needed a more discriminating measure. Thus, Gordon has responded by developing the *Intermediate Measures of Music Audiation* (IMMA) in 1982. The design and format of IMMA is identical to that of PMMA. The fundamental difference is that IMMA items are more difficult and more highly discriminating, and that the intended age range for the administration of IMMA is grades one through four. Split halves reliabilities across the four grades range from .70 to .78 for subtests and from .80 to .82 for the composite. Test-retest reliability ranges are about .10 higher.⁵⁸ The composite correlations between IMMA and MAP, corrected for attenuation, are .58 for tonal and .63 for rhythm.⁵⁹ IMMA appears to function as a measure of stabilized aptitude for fourth grade students, serving as a predictor of music achievement,⁶⁰ but it lacks the detailed diagnostic capabilities of MAP.

Aptitude or Achievement?

Interwoven among the studies and the impressive statistics related to Gordon's measures of developmental music aptitude is the controversy about whether or not there is such a factor as developmental music aptitude. Some maintain that the sensitivity of PMMA and IMMA scores to practice, compared with the stability of MAP scores, confirms that PMMA and IMMA measure not aptitude, but achievement.

Gordon, however, has constructed the measures with painstaking care to eliminate to the greatest extent possible any advantages that might accrue from prior learning. The content is unfamiliar, and it is presented in the atypical format of rhythm patterns expunged of tonal characteristics and tonal patterns expunged of rhythm characteristics. Furthermore, PMMA patterns are delivered to children with no preparatory information having been given about tonality, meter, or tempo, and the time allowed between the first and second of each pair of patterns is too short to allow a complete re-hearing of

When the issue of developmental and stabilized music aptitude is examined from a neurological viewpoint, a process known as myelination appears to offer evidence in support of Gordon's findings. Nerve fiber systems in the brain undergo a transformation from a thin state to a thickened state as a result of a gradual accumulation of a fatty material called myelin.⁶¹ The myelination of most nerve fibers occurs during the fetal period and the first 12 postnatal months, as shown in Figure 1. However, a few systems myelinate later and over a longer period of time. A variety of traits that correspond with those nerve fibers are unstable, and in fact undergo development during the period of myelination. At the end of the myelination process, those traits achieve a mature, stabilized state that remains characteristic.

The great cerebral commissures, which entail the corpus colosum, are among the late-myelinating systems, with myelination extending up to age 9. As can be seen in Figure 1, the myelination of the great cerebral commissures begins at about the third postnatal month, occurs at a gentle rate to about the second year, occurs at a greater rate between the second and seventh years, and is completed at some point between ages 7 and 9, the exact point of complete myelination depending upon individual variables. Martha Denckla, a developmental behavioral neurologist at Johns Hopkins University's Kennedy Institute, has stated that there is ample reason to speculate about a relationship between the myelination of the great cerebral commissures and an observed stabilization of music aptitude.⁶²

The facts before us concerning developmental music aptitude are as follows. Gordon has conducted the most extensive research into issues of music aptitude of anyone to date. Having completed MAP, Gordon conducted research that involved 10,000 primary-aged children. Combining the information from that research with the results of other research into the issues of language development and music perception, Gordon concluded that music aptitude is developmental prior to about age 9. He then

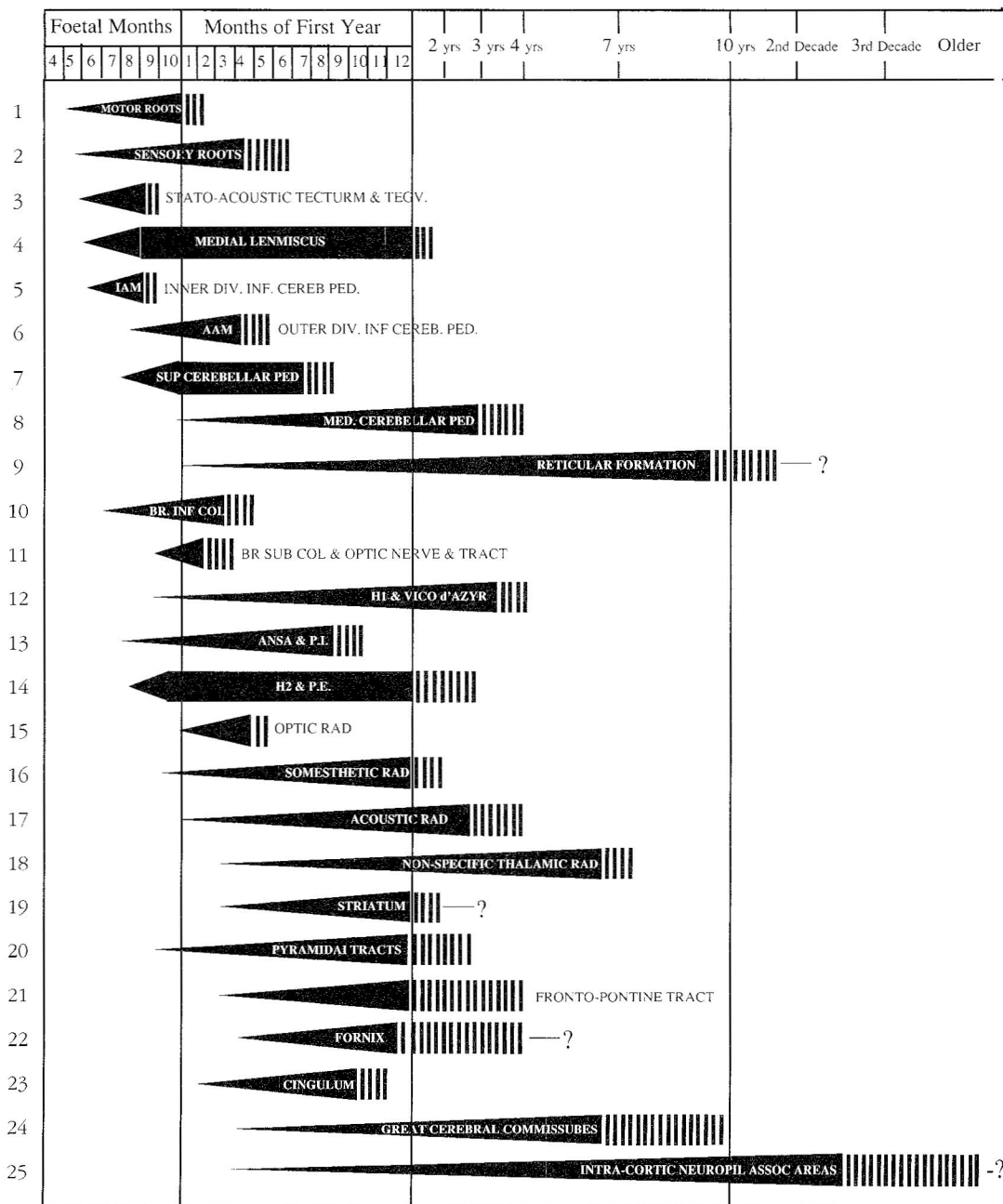


Figure 1. Cycles of Myelination. The width and length of graph indicate progression in the intensity of staining and density of myelinated fibre. The vertical stripes at the end of graph indicate approximate age-range of termination of myelination estimated from comparison of the foetal and postnatal material with the material from adults in the third and later decades of life. *Reprinted with permission from Blackwell Scientific Publications LTD., Paul I. Yakovlev and Andre-Roch Lecours, "The Myelogenetic Cycles of Regional Maturation of the Brain," in Alexandre Minkowski Regional Development of the Brain in Early Life (Philadelphia: F.A. Davis Co., 1967), 3-70.*

developed means of measuring developmental music aptitude, and the use of those measures has only reinforced his position. Furthermore, there exists neurological information from which the existence of a developmental factor can be inferred. All totaled, there is a preponderance of evidence that music aptitude undergoes a period of development of approximately nine years.

Current Work

Gordon has written two other measures of music aptitude that are late-1989 publications.⁶³ Together, they represent a bi-directional extension of the age range for the measurement of music aptitude. *Audie* is designed to measure the tonal and rhythm aptitude of children ages 3 and 4, and the *Advanced Measures of Music Audiation* (AMMA) is designed to measure the music aptitude of college-age students.

To accommodate the problems inherent in testing very young children, Gordon designed *Audie* to be administered one-on-one by a parent or other person close to the child. *Audie* necessarily calls for a short administration time, less than 10 minutes per dimension, compared with the measure for the next oldest age level, *Primary Measures of Music Audiation*.

In writing AMMA, Gordon needed to surpass MAP's levels of difficulty and discrimination sufficiently to detect differences in music aptitude among college-age students. To accomplish that, he combined tonal discrimination tasks and rhythm discrimination tasks within each item, requiring subjects to make multiple discriminations. Because tonal and rhythm judgments are combined in AMMA, and because AMMA consists of only nonpreference items, the measure calls for very short administration time, about 20 minutes, compared with the measure for the next youngest age level, *Musical Aptitude Profile*.

Perspective

Gordon states that the principal end he would like to see served by his measures of music aptitude is the improvement of music instruction. He has developed his music learning theory on that basis, but that is a subject unto itself. It will suffice to conclude

this article by noting that acting out of knowing can be expected to produce consistently better results than acting out of not knowing. Gordon's many measures of music aptitude allow us to know, and consequently to act more responsibly as teachers, parents, and counselors than we would be able to if we were without their information that his measures provide.

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