MUSICAL ABILITY

What do we mean by musical ability?

Conceptions of musical ability

When people refer to someone as being musical this is usually because the person is involved in making music in some way. They may play an instrument, belong to a choir, be a member of a folk or pop group or be involved in any of a wide range of musical activities. Individuals are rarely referred to as musical if they listen to music, even if this constitutes an important part of their lives.

In contrast to this practically oriented concept of musicality, those who are themselves actively involved in music-making are much more discriminating in how they define ‘musical ability’. For instance, professional musicians may discuss the merits of colleagues in terms of their technical prowess, their ability to develop interpretation, their performance skills, their critical analysis of music, etc.

Instrumental music teachers when referring to children's musical ability will likewise discriminate more finely than the general public. The focus will vary depending on the age of the children and the instrument. For instance, in the early stages of playing, a child who progresses quickly in learning to read music, develops the technical skills required and performs well in public may be viewed as musical. Later, however, at higher levels of expertise, technical and cognitive skills may be taken for granted and the adolescent who is described as musical may be one who is able to convey emotion and meaning in their performances. These differing conceptions of the nature of musical ability demonstrate that the concept of musical ability is socially constructed. Society and the sub-groups within it define what is meant by the term. The more involved the individual is in musical activity, the more finely tuned are their discriminations. They may also have more strongly held views about the nature of musical ability.

Those who have particular reason to be concerned with the nature of musical ability are those involved in selection procedures when the opportunities for pursuing a career in music or learning to play an instrument are limited.

Psychologists have also had a particular interest in the nature of musical ability, both as a field of study in its own right and also because of the possibility of it contributing to our understanding of the nature of intelligence at a more general level.

As has been outlined above, the concept of musical ability can be applied to potential or attainment. The term aptitude is generally adopted to describe potential to learn, while attainment relates to what has been learned. One problem in assessing aptitude is that all aptitude tests are to some extent attainment tests. While they may reflect the initial aptitude that the individual can bring to the learning situation they also reflect what the individual has already learned. Attainment will depend on a range of factors including aptitude, the level of effort made by the student, the support they receive, the quality of the teaching and the opportunities that they have to develop expertise.

One view of aptitude is that it sets a ceiling on what can be achieved. This conceptualization sees aptitude as developing over a long period of time as learning progresses but as imposing a limit beyond which the individual cannot progress, even with further training. Some aspects of musical ability may be more susceptible to the benefits of training than others and at different points in the life span. For instance, differentiating between major and minor may be learned within a relatively short time at any age. In contrast, the development of perfect pitch, although there is evidence that it can be trained, seems to occur with the greatest facility in young children.
Most of the work on musical ability has concentrated on the perception of sound and the individual's ability to identify and contrast different pitches, rhythms and timbres. Those involved in the teaching of musical instruments will be aware that a wide range of skills are required to play an instrument and that aural abilities, while they are important, are not on their own sufficient to predict success. One alternative approach has been to consider the appreciation of music. Revesz2 adopted the term musicality to denote the 'ability to enjoy music aesthetically'. This is established by the depth to which a person can listen to and comprehend the artistic structure of a composition. While there is clearly merit in expanding the somewhat narrow view of musical ability as discrimination of pitch and rhythm, a difficulty is that to understand and describe musical structure requires considerable knowledge and extensive training.

Some believe that all human beings possess a capacity for musical competence which is similar to our capacity for language. Language skills develop naturally in all human beings except in very exceptional circumstances. Musical ability may similarly be a universal feature of humanity3. What varies are the opportunities which individuals have to develop their musical skills. In the same way that an enriched environment can promote the development of linguistic competence, a musically enriched environment may promote the development of musical skills.

The historical perspective

Early conceptions of musical ability were related to aural skills and, within the general framework operating at that time in relation to all abilities, the focus was on measurement. The development of the first tests of musical aptitude began in the 19th century. As early as 1883, the cellist Carl Stumpf had devoted considerable thought to musical ability tests. He suggested a number of simple tests which music teachers might undertake to select pupils. For instance:

- singing a note that had been played on the piano
- judging which was the higher of two notes played successively
- judging degrees of consonance for pleasantness.

These relatively simple tests were successful in discriminating between experienced musicians and fourteen self-confessed unmusical pupils. These simple beginnings heralded the development of musical ability testing.

In 1920 Revesz4 produced a more extensive battery of tests which, like Stumpf's, required individual application. Individuals were asked to imitate by clapping rhythmic patterns played on the piano or to sing the notes of chords. Relative pitch was assessed by playing eight notes between G and A in irregular order. The individual then had to find each note on the piano. Another important part of the test was the singing back of melodies. A tune of nine bars was played. The first two bars were then repeated and the individual was asked to continue the melody. These parts of the test were seen as testing the lower grades of musicality. For the higher grades there were tests of relative pitch, harmonic understanding and response, playing familiar tunes by ear and creative fantasy, which involved singing the end of a familiar, unfinished melody. The demands made by these tests were very great.

Tests such as these, requiring individual application, were time consuming to administer. As such they were not the best vehicles for selecting those pupils most likely to benefit from instrumental tuition. Then, as now, resources were limited. Tuition could only be made available to some pupils. In addition, most children had limited access to music. There was no radio, television or recordings and few would have had the opportunity to attend concerts. The church, local entertainment, e.g. dances, and musical activity within the family provided the main opportunities for hearing music. Under these circumstances, where opportunities were so limited, musical ability testing was viewed as a fair way to allocate opportunity. To achieve this end it was necessary to develop tests which could be administered to groups of children. This practical consideration apart, there was no general agreement about the nature of musical ability.

Seashore5 believed that musical ability was a set of loosely related basic sensory discrimination skills. These had a genetic basis and would not change over time except for lapses of concentration, etc. He did not believe that subtest scores should be combined to obtain a single score, but
rather that a profile should be obtained which could be divided into a number of clearly defined characteristics which were unrelated to each other. These were pitch, loudness, rhythm, time, timbre and tonal memory. In contrast, Wing\(^6\), whose tests were first developed in 1948, believed in a general ability to perceive and appreciate music rather than a profile. He believed that the elements in his battery of tests should be related to each other and an overall score should be reported. Later, Gordon\(^7\) viewed musical ability as consisting of three parts: tonal imagery (melody and harmony), rhythm imagery (tempo and metre) and musical sensitivity (phrasing, balance and style). His test contrasted with earlier work in that musical ability was viewed in part as sensitivity to the prevailing musical cultural norms. For instance, the phrasing and style tests were designed to assess interpretative ability while the balance tests were designed to assess melodic and rhythmic creative ability.

What all of these tests have in common is that they assess the ability to discriminate sounds that vary in subtle ways. Aural discrimination of pitch, loudness, timbre and duration were seen as potentially fruitful for identifying those likely to benefit from instrumental tuition. Since then, as the opportunities for playing an instrument have increased and more individuals have had the opportunity to learn, we now know that aural skills are only one of the many skills necessary for the development of musical expertise. To be successful in playing a musical instrument requires a wide range of skills as well as opportunity and perseverance.

**Modern conceptions of musical ability**

While the approaches to assessing musical ability outlined above may have some predictive power in relation to who is likely to succeed in playing a musical instrument, it is now generally recognized that aural skills alone are insufficient to predict success as most musical activities require a range of skills. There has also been an increasing recognition that individual musicians have differing strengths and weaknesses. McPherson\(^8\), for instance, exploring the relationships between different types of musical performance, identified five distinct skills:

- sight reading
- performing rehearsed music
- playing from memory
- playing by ear
- improvising

When considering these in relation to groups of children of differing ages he found that the scores obtained on improvisation and performing rehearsed music were very different, tending to suggest that these rely on different sets of skills. In contrast, there were considerable similarities between, the scores obtained for playing by ear and improvising. This suggests that different musical skills are involved in these different activities. These may of course be learned. Those children who had been learning their instruments for longer showed closer scores for each activity, suggesting that all musical skills are improved through learning but that they can develop relatively independently of each other. If children are taught to play by ear and improvise, they are likely to be able to do this well. However, there will not be an automatic transfer of their ability from these skills to others, such as reading music, or performing rehearsed music. If one set of skills are taught at the expense of others then we would expect these to be better learned.

McPherson's findings concur with observations of my own, based on many years experience as both a professional musician, an instrumental music teacher and now a researcher. Learning to play a musical instrument appears to depend on the development of a wide range of different skills. Some of these may be required for all musical activities, others are applied more selectively to particular tasks. They can be broadly categorized as aural, cognitive, technical, musicianship, performance and learning skills.

**Aural skills** are required for developing:

- rhythmic accuracy and a sense of pulse
- good intonation
- the facility to know how music will sound without having to play it
- improvisational skills
Cognitive skills are required in the processes of:

- reading music
- transposition
- understanding keys
- understanding harmony
- understanding the structure of music
- the memorisation of music
- composing
- understanding different musical styles and their cultural and historic contexts

Technical skills are required for developing:

- instrument specific skills
- technical agility
- articulation
- expressive tone quality

Musicianship skills are concerned with:

- being able to play expressively
- being able to project sound
- developing control
- conveying meaning

Performance skills include:

- being able to communicate with an audience
- communicating with other performers
- being able to co-ordinate a group
- presenting to an audience

Learning skills concern being able to learn, monitor and evaluate progress independently.

Most of these skills will be readily recognized by those working in a musical environment. The least familiar will be the notion of learning skills. Learning skills are those which enable us to learn for ourselves. They reflect the ability which skilled musicians have to learn to play music that they have never seen or heard before, the ways that they can learn new techniques, develop new interpretations, plan their work and so on without receiving tuition.

Historically, much school learning has developed a dependency culture, where it is expected that the teacher will convey a body of knowledge to pupils which they will then learn. There has been little attempt to facilitate learning skills or to encourage learners to learn for themselves. This is gradually changing and modern theories of intelligence stress the importance of the development of such skills. For instance, Perkins’ acknowledges the importance of neural intelligence (the computational power of the brain), experiential intelligence (the practical knowledge which one acquires in the world) and changeable, learnable or reflective intelligence. He suggests that teachers should create a curriculum centred on reflection that helps pupils to think about their own thinking and about their own learning. In instrumental music teaching this means encouraging pupils to learn music on their own and giving them the necessary skills to do so.

In order to become successful musicians, individuals also need to develop what we might describe as life skills. These include:

- social skills (being able to work with other musicians, promoters, the public)
- planning and organizational skills (planning practice schedules, programmes, travel arrangements)
- time management (being punctual, meeting deadlines)

Learning and performing on a musical instrument tends to encourage the development of these skills. In order to play in orchestras, bands and ensembles musicians have to learn to work co-operatively. Performing in concerts develops skills of communication and encourages planning and organizational skills and working to deadlines. By encouraging participation in musical groups, teachers can encourage the development of these skills.

Given that all these skills are necessary for playing an instrument, can we legitimately describe them as musical skills? Many of them are necessary for developing a range of expert activities, not only musical ones. Is there perhaps a way of thinking about musical ability which is distinctive from these other skills, which nevertheless recognizes that the other skills are important in playing a musical instrument?
argues that the end states of intelligence which we observe in society – in the
case of music, performers, composers, etc. – draw on combinations of several
intelligences. Each individual has their own profile of intelligences. So how
might Gardner’s intelligences combine to lead to different end states in
music?

As we have seen, spatial intelligence is claimed by Gardner to be relevant in
the compositional process and also in the structural analysis of music. Verbal
intelligence appears to be linked to labelling skills in relation to notation,
identifying the names and styles of music and understanding the historical
and cultural frameworks within which music was written and will be
performed. There has been a close relationship between mathematics and
music since the time of Pythagoras. In medieval times, and in some non-
Western cultures, the study of music shared many features with the study of
mathematics, including an interest in proportions, ratios and recurring
patterns. Until the time of Palestrina and Lasso in the 16th century the
mathematical aspects of music were central. In the early 20th century, with
the advent of twelve tone music, and now with computer composition, the
relationships between the two have become even closer. The performance of
music, in particular in relation to rhythm, also has close links with
mathematics. Bodily-kinaesthetic intelligence is involved in the learning and
performance of technical skills and intrapersonal skills play an important part
in the emotional aspects of performance, in enabling the performer or
composer to be self-aware, providing a rich source of emotional material on
which to draw in the development of ideas for composition or interpretation.
Interpersonal intelligence is also important for communicating with an
audience and also where musicians need to work together in preparing for
performance. Table 2b indicates how each intelligence might be implicated at
the professional level.

Is musical ability inherited or learned?

Whatever other intelligences musicians may draw upon, they all require
musical intelligence. One of the questions that has concerned researchers
over many years is whether musical intelligence is learned or inherited.
This question can be interpreted in two ways. One relates to whether the
human species as a whole has the capacity for music, the other concerns
individual diversity in musical intelligence. As has been outlined earlier in
the chapter, it is likely that the human species is pre-programmed for
musical activity, although why this should be is not so clear. Whether
some individuals are then born with a greater capacity for musical activity
than others is still an unresolved question. What is clear, as Parnsworth20
wrote in 1969, is ‘that neither nature nor nurture can alone make a
musician. Both must be present before musical and other abilities can
emerge.’ Despite this, the debate has continued as to which, nature or
nurture, might be the most important.
Table 2b  Gardner's intelligences applied to music

<table>
<thead>
<tr>
<th></th>
<th>Ways that the separate intelligences might be utilized by expert musicians</th>
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<tbody>
<tr>
<td>logical-mathematical</td>
<td>Performance of rhythm, sight reading of rhythm, analysis of music, composition</td>
</tr>
<tr>
<td>spatial</td>
<td>Reading of notation, identifying and understanding the structure of works</td>
</tr>
<tr>
<td>bodily-kinaesthetic</td>
<td>Technical skills, movement involved in the communication of interpretation</td>
</tr>
<tr>
<td>intrapersonal</td>
<td>Understanding emotions, composing, developing interpretation</td>
</tr>
<tr>
<td>interpersonal</td>
<td>Communication with an audience, teaching, working with other musicians</td>
</tr>
<tr>
<td>linguistic</td>
<td>Reading music, critical analysis of music and performance, understanding the historical and cultural contexts of music</td>
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If one considers those who have pursued successful careers in music it is clear that some children of exceptional musical abilities are born into families of musicians, while others are born into families of amateur musicians, and others into families with no history of interest in music. Conversely, some highly musical parents produce offspring with no interest or apparent talent in music. Those working in the field of genetics study the patterns of ability within families and, using mathematical techniques, apportion ability to genetic or environmental contributions. Research has been undertaken through pedigree studies, and examination of twins and family relationships.

**Pedigree studies** Some of the earliest work was by Galton, who undertook a study of what were described as ‘illustrious’ men. Of these, 120 were musicians. Twenty-six of them had relatives who were also eminent in the musical field but these belonged to only fourteen families. The remainder came from a range of partially musical or non-musical families.

**Family and twin studies** The most common method of investigating the role of genetics in behaviour has been through twin studies. Identical twins have identical genes so by examining identical twins who have been brought up in different environments it is possible to calculate the extent to which genetic and environmental factors have contributed to whatever is being measured. If genetics has played an important part in the development of the ability then the scores of the identical twins will be very similar even though they have been reared apart. If they are not, the environment will have played an important part.

There are very few studies of musical ability in identical twins who have been reared apart. One case study of a single pair of twins reported that one twin
showed a definite aptitude for music, taking up the violin at the age of nine, which he was later forced to give up because of financial constraints. The second twin took up the trumpet at the age of fourteen and played in amateur dance bands. Their scores on musical ability tests revealed quite different patterns which suggested no genetic basis to their musical talents. Another study followed five pairs of twins. Two sets had similar scores on musical aptitude tests, both having been brought up in rather similar musical environments. The scores of the other three pairs showed a greater discrepancy. In one case the higher scoring twin had enjoyed a much superior musical background, had been given piano lessons and conducted an amateur choir. In another case one had become a piano teacher, while her twin had had only two years of piano lessons and much experience of listening to music. In the final case the twin with the greater experience of listening to music produced the lower score.

Alongside these studies are those examining the relative measured musical ability of relatives, fraternal twins, ordinary siblings, adoptive parents, and children who share no genes. Such studies have found relatively low relationships, suggesting that while there may be a role for genetics in relation to measured musical ability, the environment is very important.

Recent work concerned with the development of a variety of intelligences suggests that hereditary factors also shape the environment. A home where there are a lot of opportunities for listening to music and playing instruments may reflect parental musical ability. In addition, parents tend to respond to genetically influenced variables in their children. So if a child exhibits an interest in music this may be encouraged and supported. Environmental influences may not be necessarily purely environmental but may reflect genetic influences as well. This clearly complicates the issue.

It is also likely that there are complex interactions involved in the development of musical ability. We know, for instance, that young rats bred in stimulating environments develop larger brains with more connections between synapses which are also better insulated. This means that they know more, have made more connections between what they know and can also access their knowledge more quickly. In humans this is likely to mean that the environment in the early years of life will determine what and how much knowledge is acquired, and how quickly it can be accessed and used. If the environment is lacking in stimulation then the child is unlikely to develop knowledge and skills in any domain. If the environment includes stimulation in one domain, e.g. music, then musical knowledge will be acquired which will then provide a framework for the acquisition of further musical knowledge. Prerequisite to this is that the child has adequate aural sensory perception. If their hearing is not acute then they may not be in a position to acquire musical knowledge. It is also possible that other auditory stimulation may facilitate the development of musical skills, e.g. interaction with adult caregivers through nursery rhyme games, etc., while some stimulation may be detrimental, e.g. living with constant noise from traffic or machinery.
Effects of learning on performance on musical ability tests

If musical ability is acquired we might also expect that specific coaching will have an effect on performance in ability tests. Generally the evidence from short term attempts to improve pitch discrimination shows that it can be improved by practice. Programmed learning techniques can help, as can gaining greater control of the voice. There is also research which indicates that absolute pitch can be trained\textsuperscript{22}. Having music lessons can improve test performance\textsuperscript{19} but does not always do so.

Overall, the evidence for an important role for genetics in determining music ability is not strong. The environment clearly has a vital role to play. It is likely that the individual’s unique pattern of intelligences interacts with the environment to determine which intelligences develop and how. This interaction will continue over time and in extreme circumstances, where the environment is almost exclusively devoted to music, as in the case of Harriet described earlier, may lead to outstanding abilities in music, perhaps at the expense of others. There is nevertheless the prerequisite that the individual concerned must be able to perceive and process the incoming information. This would tend to suggest that all individuals can develop musical ability if given appropriate learning environments. It may therefore be more appropriate to think of musical ability as depending on prior learning and knowledge in music, this knowledge being particularly related to aural skills. Given the evidence that music ability is not unduly dependent on genetic factors, to what extent are aspects of musical ability prerequisites for achievement on a musical instrument? Is it possible to learn to play an instrument with relatively poor aural skills?

How important is musical ability for musical achievement?

As we shall see in chapter 6, many factors are important in determining the level of attainment that an individual can achieve in playing a musical instrument. These include level of prior knowledge or ability, the motivation of the pupil, the level of support he or she receives from the family, the environment within which they are learning and their individual characteristics. These will be dealt with in subsequent chapters. There is also the question of the role of practice. Can individuals compensate for lack of ability or prior knowledge by practising?

Practising

No individual can become an expert musician without practice. It is simply impossible to acquire the necessary skills without spending time working on them. The question which has been of crucial interest to researchers has been
the extent to which practice is important. For instance, is the amount of practice that an individual has undertaken sufficient, on its own, to determine what the individual will achieve? If an individual practises ten times as much as somebody else, will this automatically mean that they attain a level of expertise ten times greater?

There is a lot of evidence that to become a professional musician requires a great deal of time. Typically, 16 years of practice are required to achieve excellence in the playing of an instrument, the individual usually beginning to play at a very early age, with 25 hours of practice being undertaken weekly by adolescence, subsequently increasing to as much as 50 hours. However, there is considerable individual variation. Some individuals practise for much longer than others to achieve the same level of attainment. Whether this is necessary or not is not clear. They may be practising over and above what is actually required for them to achieve their aim. Or it may be necessary for them to undertake that much practice. A number of factors may affect what is required in the way of practice:

◆ their own strengths and weaknesses
◆ the quality of their practice and whether it is effective or not
◆ the quality of the teaching they are receiving, which may directly affect their level of attainment regardless of the quantity of practice
◆ the nature of the instrument they are learning
◆ the nature of the repertoire for the instrument
◆ whether they are involved in playing in groups, which may improve some aspects of playing without individual practice.

One way of considering the problem is to suggest that there may be a trade off between ‘ability’ factors and time required for learning. If you have considerable ability you will need to spend less time practising. Some research of my own explored this question in relation to instrumental tuition. 109 violin and viola pupils aged 6–16 years took part in the study. Measures were made of:

◆ the length of time spent learning to play an instrument
◆ how much time was spent practising
◆ personal motivation to practise
◆ the support for practising received from parents, teachers and friends
◆ measured aural ability
◆ musical potential as assessed by the teacher
◆ verbal ability
◆ logical reasoning ability
◆ the teacher’s assessment of their ability to understand instructions
◆ level of attainment (level of examination taken)
◆ the quality of attainment (mark obtained in examination).

The best predictors of level of attainment were the length of time the individuals had been playing the instrument, a cumulative measure of the
amount of practice they had undertaken, their class teacher’s rating of their ability to understand instructions and their own attitude towards practising.

When the quality of their playing was considered, the significant predictors were their teacher’s rating of their musical ability, the overall attitude and influence of their parents, their own personal intention to practise and the extent to which they were not influenced by the attitudes of their friends.

In none of the analyses did musical ability as measured by aural tests feature in the predictions. The only aspect of musical ability which seemed relevant was that assessed by the instrumental teacher, who would clearly have knowledge about the child beyond that which could be obtained in a test of aural ability.

The environment

As has been discussed earlier in the chapter, the environment may be more or less conducive to developing musical ability. Some research has focused on the home environment and this will be discussed fully in chapter 4. However, the child functions in other environments apart from home which will also provide possibilities for musical stimulation. Young children may attend nursery, be looked after by a child minder, spend considerable amounts of time with other relatives, e.g. grandparents, be involved in religious activities which include music, or have friends who are involved in music. All of these may provide opportunities for providing musical stimulation.

What research has not addressed is what kind of musical stimulation might be required to begin to develop the appropriate aural skills that can provide the basis for the future development of musical expertise. Some questions that we might consider are outlined below:

- Does the music have to be ‘live’, e.g. sung by a carer, or will recorded music provide sufficient stimulation?
- Does the music have to be of a particular type, e.g. children’s songs, classical music, or will any music develop the appropriate skills?
- Does the child have to be actively involved in some way or is passive listening sufficient?
- Does music heard in other contexts, e.g. on TV, in shops, provide a suitable basis for the development of aural skills?

At the moment we do not have answers to these questions. Music is more widely available than ever before and plays an important part in everybody’s life through the media. Most children in the Western world will have been exposed to a considerable amount of music by the time they attend school. This should mean that their aural skills will be more highly developed than those of previous generations.
Motivation

Motivation to play and to continue to play a musical instrument will be discussed fully in chapter 5. Motivational factors may be influenced by the extent to which a child is exposed to musical influences, which may in turn facilitate the development of aural skills. A child may be surrounded by a stimulating musical environment, with a range of opportunities to play, sing and listen to music, but they may not be motivated to become involved. Two children may be bought identical xylophones for Christmas, one may spend hours trying to pick out familiar tunes whereas another may virtually ignore it in preference for another gift. Why should this be? The child who plays with the xylophone is clearly finding it rewarding whereas the other child is not. There may be a range of reasons for this, both internal and external. The sounds made may themselves be perceived as pleasant; the child may find it interesting and absorbing to try and play particular tunes either by ear or from materials provided with the xylophone; if the child succeeds in playing a tune it may be rewarding to have mastered the task; mastery of one tune may lead to a desire for the challenge of learning other tunes; external rewards may come in the form of encouragement from parents, siblings and other relatives. To be successful in learning to play melodies, the child may also require other skills which are not essentially musical, e.g. concentration, persistence, physical co-ordination. The child’s degree of expertise in these skills will also contribute to whether interest and motivation are sustained. It is the complex interactions between these various elements which are likely to develop the motivation to engage with music in any form.

Interactions between the environment and the individual

The environment and the individual interact with each other. Where the characteristics of the individual fit well with the environment then the individual’s progress towards expertise in the field will be great. Formal education in music is not essential to this process. Louis Armstrong, for instance, had no formal tuition. In New Orleans in the 1900s there was great interest in music and it was easily accessible. As a child, to earn money, Armstrong formed and sang in a street corner choir. He began to learn the trumpet by sitting in on jazz sessions, borrowing the instruments of other musicians. He did not own his own instrument until he was sixteen. These communal jazz activities gave him opportunities to experiment and learn without fear of making mistakes. His professional status was achieved with only a few tips and hints from King Oliver in the later years of his teens. If Armstrong had been born into a different environment, at a different time, he might not have had the opportunity to develop his musical talent to the extent he did. This illustrates the importance of the interactions between the individual and his/her environment. S. J. Ceci has developed a theory of intelligence which attempts to take account of the nature of these complexities.
Ceci’s theory of intelligence

Ceci’s theory\textsuperscript{25} is similar to Gardner’s in that it suggests multiple potentials for intelligence which have a biological basis. But Ceci goes on to suggest that the environment and the knowledge that the individual acquires become interwoven. Knowledge is seen as playing a key role in understanding the differences between individuals. Ceci believes that the mental processing that goes on in any domain does not just enable the acquisition of greater knowledge but that the processing itself is affected by what is already known and has been experienced.

Let us consider this in relation to music. Musical knowledge consists of information, rules, beliefs, attitudes towards music. These are acquired through learning. As knowledge is acquired it is stored in structures in our long term memory that vary in the extent to which they are interrelated and elaborated. So, for instance, as we begin to learn to read music we recognize and respond to single notes. Over time patterns of notes which occur frequently, e.g. scales, may come to be stored together in structures so that instead of dealing with each note separately we perceive and react to them as a group. As we store knowledge about musical terms we will elaborate and make links between them, e.g. $p$ is soft, $pp$ is very soft. In this way our store of knowledge develops and is structured in ever more interrelated and elaborate ways. As the knowledge becomes more interlinked it enables our searches through it to become more efficient. We become quicker at sight reading, recognizing musical terms, etc. The more we learn, the easier it becomes to learn new things and the quicker and more efficient we become until some processes require no conscious thought and are carried out automatically. Over time the processes involved in playing music and the knowledge base which is required to play music become intertwined. This explains why we can function at an expert level in one area of our lives while not being able to do so in another area. We do not have the necessary knowledge structures. Building up these structures takes time, which is why practice is required.

Ceci believes that the context of learning is all important. If children are given tasks to do which are in contexts which they understand, e.g. video games, they learn much more quickly than when the setting is unfamiliar even though the requirements are identical. So, for musicians, the ability to think in musical ways is tied to a rich knowledge base. This is acquired by being actively involved in music. Ceci believes that those individuals who are described as intelligent in a domain are those who have sufficient knowledge in the domain to let them think in complex ways. They do not have superior intellect. In other words, having ability alone is insufficient: it requires the right environment to develop. Working in a domain over a significant period of time allows one’s knowledge base to grow and become better organized. This effort over time leads to intelligent performance in that domain.

Adopting Ceci’s ideas and applying them within the musical domain explains why performance on musical ability tests improves if one has music lessons.
It also provides an explanation for the importance of the environment in the development of musical expertise and explains why musicians may be expert in music without having extensive skills in other domains.

Like Gardner, Ceci believes that there are many cognitive potentials, that they are biologically based and that they constrain mental processes, such as the ability to remember and retrieve information. He suggests that these biological potentials are inextricably linked to the environmental challenges and opportunities in which they develop. In other words, the environment and genetic contributions cannot be analysed separately. The two are in a state of constant interaction. To support his case in the field of general intelligence, he reports studies undertaken in the 1920s and 30s in the UK on the children of gypsies and canal boat pilots, who spent most of their time travelling. As the children became older their measured intelligence became lower. The pre-school children had measured intelligence of about 90 while the adolescents averaged measured intelligence of about 60. He suggests that schooling provides the right environment for the development of measured intelligence and if children are unable to attend then their measured intelligence will appear to fall in comparison to other children. If we apply this principle to music, we would expect that children exposed to musical environments will develop ways of processing music which will then enable them to learn music better in the future. Ceci also believes that social class and job opportunities influence achievement. Re-examining a study of pupils with high measured intelligence, he established that those who came from upper income families were more successful in their careers. Few of the high IQ children from poor homes went on to become famous. In addition those who were of high IQ in the Great Depression turned out to be less successful than those who came later. The Great Depression reduced job opportunities for all.

**Crystallizing experiences**

Ceci and Gardner would agree that an individual may have an uneven profile of intelligences with strong potential in one domain but only moderate potential in others. Because of the environment the individual may have little opportunity to develop his area of strength and the stimulation s/he receives may relate to the intelligences where s/he is relatively weak. S/he may with the right support attain significant skills in these areas, or without support may lose motivation and give up. But, if through chance, s/he comes across materials that activate the talents of his or her strongest intelligence s/he may have a ‘crystallizing’ experience. A crystallizing experience occurs when an individual reacts to some quality or feature of a domain which yields an immediate but also a long term change in that individual’s concept of the domain, his or her performance in it and his or her view of him or herself.

Crystallizing experiences are of two kinds. Initial crystallizing experiences occur early in life. Refining crystallizing experiences occur well after an
individual has undergone an initial attraction to a domain. Initial crystallizing experiences may reveal a raw talent. For instance, Stravinsky, who attended the theatre weekly, was greatly moved on hearing the sound of Glinka's orchestra and the music of Tchaikovsky. Menuhin was taken to hear the San Francisco Symphony Orchestra when he was three years old. On hearing Louis Persinger's violin he asked for a violin for his fourth birthday and Louis Persinger to play it. Rubenstein, who came from a non-musical family, had what might have been called a crystallizing experience when he was three. The family bought a piano and he played games teaching himself the names of the sounds and the notes. He then persuaded his family to test him. His talent was then recognized and arrangements were made for him to have music lessons with an expert.

Others have a crystallizing experience later in their development when they are already attuned to the area of music. This crystallizing experience seems to guide the individual to that area of the domain in which their strongest talents lie. For instance, Debussy began his formal study of the piano at the Paris Conservatory at the age of nine. He had won the piano prize by the age of fourteen but showed no interest in composition until he was introduced to the music of Wagner, in particular the overture to Tannhäuser.

**Issues of ability testing in music education**

The first tests of musical ability were developed to select children to play an instrument in formal educational settings. The reasons for selection were essentially pragmatic and were based on the assumption that:

◆ musical ability was innate or at least determined at an early age
◆ resources were limited
◆ the best way to ensure that resources were well used was to select children on the basis of ability.

The tests focused on aural abilities and most included subtests of pitch and rhythm. Some of the later tests attempted to assess musicality by asking individuals to discriminate between different examples of phrasing or expression and state their own preferences. There is considerable evidence that learning to play a musical instrument enables people to perform better on these tests, although this has a stronger effect on some tests than others.

**Limitations on expectations**

The testing of musical ability can have an effect through the way that it can impose limitations on the expectations of those involved, parents, teachers and learners. The crucial effects of teacher expectations on pupil attainment have been demonstrated in the classroom in what is known as the self-fulfilling prophecy. Research has shown that labelling pupils as
being of high or low ability leads teachers to have certain expectations which are then fulfilled. In the original study the researchers supplied teachers with false information about which children in their class were likely to do well. By the end of the year those designated as potentially successful had indeed been so. In fact all the children had been selected at random. There was no reason why those designated as likely to have been successful should have actually been successful. What this study demonstrated is that the expectations we have of people affects the way we respond to them and they respond to us.

◆ teachers acquire different expectations about their pupils
◆ teachers behave towards pupils in accordance with their expectations
◆ pupils recognize what teachers are expecting of them from the ways in which they are treated
◆ unless the pupil resists or is determined to prove the teacher wrong, such interactions, over time, will convince the pupil to behave in keeping with the communicated expectation, e.g. a non-answerer of questions, a clown, a poor pupil
◆ the teacher’s expectations are consequently confirmed and reinforced. Pupils usually conform to them.

Teachers can ensure that high expectations are communicated by:

◆ setting high goals for everyone
◆ giving praise rather than criticism
◆ ensuring an equitable quality of teaching for everyone and that pupils are stretched at every opportunity.

Parents are also influenced by teacher expectations. Pupils who believe that they are of low ability tend to make less effort. Similarly parents who believe that their child has little or no ability will provide less encouragement and support than those who believe that their child is able.

**Formative and summative assessment**

Recently, there have been new approaches to assessment which have moved away from a narrow concern with selection. They are known as formative and summative assessment. Formative assessment provides feedback to the learner and the teacher and is used during the process of teaching and learning. Summative assessment indicates how well material has been learned after teaching has been completed.

Musical ability tests can be used formatively or summatively. They can be used as part of the process of learning, to indicate to the teacher where the pupil has weaknesses in aural skills and where more work needs to be undertaken, or they can be used, as they more often have been, to assess current learning to date or the pupil’s potential.
Traditional musical tests

There are many tests of musical ability. Those which have been most often used are briefly described below.

The Seashore Measures of Musical Ability\(^5\) are the oldest standardized tests available. They originally appeared in 1919 and were a landmark work in their time. Seashore believed that musical ability was a set of loosely related basic sensory discrimination skills. Because of this a profile is obtained rather than an overall score. The battery contains six sections:

- pitch (whether the second of two pitches is higher or lower)
- loudness (whether a sound is louder or softer)
- rhythm (whether a rhythm is the same or different)
- time (whether the second of two tones is shorter or longer)
- timbre (whether two tones are the same or different)
- tonal memory (this is distinctive because it is multiple choice. A tonal sequence is presented which acts as the model. The same sequence is presented with one note changed. The listener has to decide which note has been changed).

The scores for each subtest are presented separately, giving a pattern of musical ability.

Wing’s standardized tests of musical ability\(^6\) are very different to the Seashore battery. Wing, a British researcher, believed that there was a general factor of musical ability. The test is considered by some to be more musical than Seashore’s because the stimuli are piano tones and short melodies or chords. There are seven subtests. The first three tests consider aptitude through analysis of chords, pitch discrimination and memory for pitch. The remainder are concerned with preferences, rhythmic accent, harmony, intensity (loudness) and phrasing. These tests assess familiarity with conventional modes of musical expression.

The Bentley Test of Musical Abilities\(^28\) has been the most widely used test in the UK in recent years. It contains tests of pitch discrimination, tonal memory, chord analysis, and rhythmic memory. It is relatively short, is easy to use and covers a wide age range from seven to fourteen. It is suitable for use with classes of children and has been widely used to select children for instrumental tuition.

One of the most comprehensive measures of musical aptitude is Gordon’s Musical Aptitude Profile\(^7\). This has three major sections: tonal imagery, rhythm imagery and musical sensitivity. All the items on the test include a forced choice decision – either same or different or a decision as to which one is better than the other. There is also a possible ‘don’t know’ response. The test is very long and thorough. Each section requires 50 minutes to administer.

In the test of tonal imagery there are two subtests labelled melody and harmony. In the melody test a musical statement is played on the violin, followed by a musical answer which always contains more notes than the
musical statement. The task is to compare the answer with the statement and
to decide whether the answer is a melodic variation of the statement or not
(same/different). The harmony test is the same except that two instruments
(violin and cello) perform the musical selections and the variations are
harmonic ones performed in the lower part by the cello. In the test of rhythm
imagery there are also two subtests, tempo and metre. After a musical
statement in the tempo test, the ending of the musical answer is either played
faster, slower or at the same tempo. The judgement has to be made
same/different. The judgement to be made on the metre test is whether the two
phrases have the same or different metres.

The third section of the test is concerned with musical sensitivity. This
contains three musical preference tests: phrasing, balance and style. The
musical material for the phrasing test is performed on the violin and cello;
the other tests are performed on the violin. For the phrasing test the listener
has to decide which phrase has better musical expression. In the balance test
each item has different endings and the task is to decide which ending is
better. In the style test the musical variable is tempo and the task is to decide
which rendition of the phrase has the more appropriate tempo. The responses
for these tests are made in relation to which performance makes the better
musical sense. There is the opportunity to indicate an ‘in doubt’ response if
there is no preference for either the first or the second performance.

These tests have clear elements in common. They all assess pitch, rhythm
and musical memory. They vary in the extent to which they require listeners
to assess musical expression. Although they have in the past been used for
selection purposes, musical ability testing is not widely adopted in the UK at
the moment. Their length and complexity may also make them unattractive
for instrumental teachers to use although the ideas underlying the tests could
be adopted for use with individual pupils.

Developing your own diagnostic checklist

Using psychometric musical tests to assess progress or even diagnose problems
in individual children learning music may be rather like using a sledgehammer
to crack a nut. The tests essentially measure aural discrimination of pitch,
rhythm, harmony and cultural norms of expressivity. It is very easy for teachers
to develop similar tests that can be played on an available instrument or be sung,
which can be used periodically in lessons to check the development of aural
skills. The chart on page 48 provides an example of such a checklist. You may
photocopy it to write in the things that you wish to monitor.

For instance in a beginner you might monitor progress in:

- discrimination of two pitches as higher or lower
- discrimination of two simple rhythms as the same or different
- discrimination of the number of notes in a chord
- discrimination of two melodic phrases as the same or different.
For a more advanced pupil you may wish to monitor progress in:

- recognition of different intervals
- being able to repeat a short melody by singing or playing
- being able to repeat a short rhythm.
- being able to recognize chords as major or minor.

With advanced pupils you might progress to chord recognition, asking them to compose their own accompaniments, asking them to create their own answering phrases, etc. These more open ended activities will also promote their improvisation and composition skills.

You can adapt the tests to suit the individual needs of pupils. If they find something particularly difficult they will need to spend more time working on it. It is also useful to try to link their aural work with what they are learning on their instrument; pitch and rhythm can be explored in relation to the melodies they are learning; harmony can be explored through accompaniments where the instrument is not a keyboard instrument.

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**CHAPTER SUMMARY**

**Musical ability**

- What constitutes musical ability is socially defined.
- Different groups within society define it in different ways.
- Historically, within education it has been seen as an individual's aural ability.
- Modern conceptions of musical ability tend to take a wider perspective.
- To become an expert instrumentalist requires the development of a wide range of skills.
- The evidence does not support a hereditary view of musical ability; development of ability appears to depend largely on the opportunity to experience and actively participate in music.
- Aural ability, historically, has been assessed by psychometric tests, which have largely been used for selection purposes.
- The use of psychometric tests for selection and assessment purposes limits the expectations of teachers and parents of what an individual can achieve and reduces the emphasis on effort and motivation.
- Teachers can develop simple tests of their own to assess their pupils' strengths, weaknesses and progress. These can be adapted to take account of the age of the pupil and their prior experience with music.