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LITERATURE STUDY

PREPARING YOUNG MUSICIANS FOR PROFESSIONAL TRAINING: WHAT DOES SCIENTIFIC RESEARCH TELL US?

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CONTENTS

EXECUTIVE SUMMARY

In the framework of the ERASMUS Thematic Network for Music "Polifonia", an investigation has been conducted into the music education levels prior to the higher education level, the so-called pre-college levels. In order to be successful in future careers, musicians have to start at a very early age with music activities and instruction. With the aim to support this view, a literature study was undertaken of existing scientific research that showed such an early start was necessary. In addition, some other related research topics were formulated.

The following questions were asked in this literature study:

1. Should children start early with music lessons in order to become professional musicians?
2. Is there a certain age at which children should ideally begin with music lessons?
3. Are there any physical or psychological barriers that prevent starting with music lessons before the age of four?
4. Are there other important – external - variables that influence the level of musical expertise reached by a person?
5. Do popular musicians and classical musicians differ in their early development?
6. Is there a relation between musicality, making music (playing an instrument, composing or singing) and intelligence and/or other general developmental skills (social, emotional)?

1. As the research has shown, it is clear it is indeed desirable to start early with music lessons if one wants to reach a professional level of musical performance. The majority of the children in the different studies started before the age of nine, most of them were even younger. Brain research has also shown that starting with music education before the age of approximately seven results in plastic changes in the brain as the plasticity of the brain is largest in early childhood.
2. The second question has already been partly answered by the answer to the first question. All reviewed research suggests that it is best that children start with music lessons at the age of nine latest, but preferably around the age of seven or before.
3. To the third question, the following can be stated: In different studies (e.g. Manturzewska 1990; Bloom 1985) children started as young as three years old. In addition, in the literature there are no indications there are physical or psychological barriers to start before the age of four, as long as the musical engagement in which the child is involved is appropriate tot the development and capacity of the child (Lehmann, Sloboda and Woody 2007).
4. Related to the question on external variables that influence the level of musical expertise, research findings indicate there are indeed several such external variables. Besides the internal factors of talent and motivation, such factors are support from parents and siblings, teachers and peers, the amount of accumulated practice hours and the way of practising.
5. When addressing any differences between popular and classical musicians in their early development, it becomes evident the majority of the studies about musical development has focused on classical musicians. Nevertheless, even the limited amount of search on popular

musicians seems to indicate there are some differences. The main difference is that popular musicians mainly practise by themselves and with friends; the role of a teacher is more limited in their musical development compared to classical musicians, for which the teacher is regarded as very important. Another difference seems to be that classical musicians need to start with regular instrumental instruction much sooner than popular musicians.

6. The last question raised concerns the supposed influence of music and music education on intelligence and other general developmental skills. Studies show that music education has a positive influence on spatial-reasoning skills of children and IQ-scores. To have more certainty on the influence of music on literary skills more research is needed, because the available studies do not seem to provide a clear picture yet.

FOREWORD: WHY THIS DOCUMENT?

The ERASMUS Thematic Network for Music "Polifonia"[1], the largest European project on professional music training to date, involved 67 organisations in professional music training and the music profession from 32 European countries and 30 experts in 5 connected working groups in an intensive 3-year work programme from September 2004 – October 2007. The project, which was co-ordinated jointly by the *Malmö Academy of Music – Lund University* and the *Association Européenne des Conservatoires, Academies de Musique et Musikhochschulen (AEC)*, received support from the European Union within the framework of the ERASMUS Programme. The aims of the project were:

1. To study issues connected to the Bologna Declaration Process, such as the development of learning outcomes for 1st (Bachelor), 2nd (Master) and 3rd cycle studies through the "Tuning" methodology[2], the use of credit point systems, curriculum development, mobility of students and teachers, and quality assurance in the field of music in higher education
2. To collect information on levels in music education other than the 1st (Bachelor) and the 2nd (Master) study cycles, in particular pre-college training and 3rd cycle (Doctorate/PhD) studies in the field of music.
3. To explore international trends and changes in the music profession and their implications for professional music training.

One of the aims of Polifonia was to study the educational level in music lower than higher education, the so-called "pre-college level". It may seem unexpected to find a chapter about the pre-college level as part of a project that focuses on higher education. But there are good reasons to include pre-college education in the research on the current situation professional music training in European higher education.

Professional musicians usually start learning music at a very young age and continue being active as musicians until or even after they retire. This makes music one of the most evident examples of lifelong learning and also a subject area that distinguishes itself in this sense from many other disciplines in higher education. For professional music training institutions at the higher education level, therefore, it is essential that the pre-college level prepares students for entering the higher education level adequately. Without this preparation, students would not be able to meet the current high qualitative standards in higher music education institutions and, even more importantly, the fierce and ever-increasing competition in the music profession.

Until now, it was common knowledge among musicians and (to a certain extend) among policy makers that this preparatory phase to higher music education was important and had to be supported. This understanding, however, has become increasingly under pressure with national

[1] See for more information about "Polifonia" www.polifonia-tn.org.

[2] For more information about the "Tuning" methodology please see http://www.tuning.unideusto.org/tuningeu/index.php?option=content&task=view&id=172&Itemid=205.

governments focusing mostly on the higher educational levels in relation to professional training due to the Bologna process developments, in particular the implementation of the 3-cycle (Bachelor/ Master/3rd cycle) structure. In some European countries, where professional music training was organised as a continuum starting with training at a young age up to a first professional qualification within one continuous structure, the pre-higher education levels in music have been faced with many difficulties. In addition, it seems that the position of music in primary and secondary general education is weakening as well.

In order to assist institutions in their debates with policy makers in (higher) education and in local, regional and national governments on the necessity of a well organised pre-college system in music, the AEC decided to make pre-college training a priority in the Polifonia project. Through a Europe-wide investigation, arguments and examples of good practice were to be developed that could be helpful in discussions on music education for young people.

The investigation had the following components:

- Firstly, in order to support the fact that musicians have to start learning an instrument at a young age in order to reach a sufficient level for the music profession, a literature study was made of existing scientific research that supports the abovementioned opinion and gives insight in how young musicians learn from a music psychological, sociological, pedagogical and physical perspective.
- Secondly, a European-wide mapping exercise was undertaken to describe systems and approaches in pre-college training.
- Finally, in order to create a link with the work being done in the "Tuning" component of Polifonia, in which competences and learning outcomes were developed to act as reference points for the 1st, 2nd and 3rd cycle studies in music, the pre-college working group formulated a set of learning outcomes that can be used by pre-college music institutions for the preparation of their students for the higher education level and that are connected to the learning outcomes for the 1st cycle.

This document presents the first component, which is the literature study. It was written by Fieke Werner as a Master's thesis in musicology at Utrecht University.

INTRODUCTION TO THE LITERATURE STUDY

The literature study will identify existing research on questions concerning the development and existence of musical ability. For example, is it necessary to study many hours a day at a young age or is it necessary to start as early as possible with music instruction in order to become a professional performer? This is done by reviewing and discussing contemporary literature on music education, music psychology, musical development and musical expertise. An attempt will also be made to identify any differences in existing research between the situations of musicians in classical and in popular music. We will therefore look for answers to the following questions:

1. Should children start early with music lessons in order to become professional musicians? Is there a certain age at which children should ideally begin with music lessons?
2. Are there physical or psychological barriers that prevent starting with music lessons before the age of four?
3. Are there other important – external - variables that influence the level of musical expertise reached by a person?
4. Do popular musicians and classical musicians differ in their development?
5. Is there a relation between musicality, making music (playing an instrument, composing or singing) and intelligence and/or other general developmental skills (social, emotional)?

The first chapter focuses on grounds for teaching music and the intrinsic value of music and music education. This chapter forms the foundation of the study, by emphasizing the importance of music and music education for all children, whether they will be professional musicians or not.

In the second chapter an overview of the main literature that is used for this literature study is given.

A thorough understanding of the development of music students is needed to provide them with the best music education possible. In order to understand the development of children in general and children with an interest to become musicians in particular, developmental and music developmental theories are addressed in the third and fourth chapters.

This is followed in chapter five by a discussion on existing literature and research about important factors that contribute to the development of musical performance, including influence by parents and siblings, peers and the teacher, but also the starting age and the amount of study hours. Chapter five will start with a discussion of the role of talent in the development of musicality and musical performance.

Chapter six will review literature about the influence music making has on the human brain. The research results seem to prove that starting early with music education and making music has a long-lasting influence on the shape of the brain.

The last chapter returns to the questions formulated in this introduction.

1 WHY TEACH MUSIC?

1.1 Benefits of music education

As explained in the introduction to this document, the main question for this literature study addresses the necessity of starting young with music instruction for those wanting to become music professionals in the future. This puts this document clearly into a context related to the training for the music profession, which is the main area of study of the "Polifonia" project. However, before this main issue is discussed more in-depth in the other chapters, another issue that is vital to music in general and to professional music training as well will be explored first: why should music be taught in general? For many it is not always evident why this should be done or why music should be part of the school curriculum. This causes uncertainty for music teachers, parents and educational leaders. However, there have been several experts trying to find an answer to the question "why teach music?" In this chapter, several possible answers to this question will be discussed as an introduction to the literature study on the main topic mentioned above in Chapter 2. By doing so, this section of the document forms the foundation of the overall study, by emphasizing the importance of music and music education for all children, whether they will be professional musicians or not.

1.1.1 Why engage in music: for intrinsic values or extra-musical effects?

In his discussion of Bastian's study on the positive effects of music on the cognitive and social-emotional development (see section 1.1.2), Koopman (2005) wonders whether we should look for the extra-musical effects of music education to justify it or focus on the intrinsic value of music and music education. By stressing the extra-musical effects we make music only a means through which we gain other goals. Koopman thinks music has an intrinsic value; it is therefore not – or should not be – necessary to justify music education referring to the beneficial extra-musical effects of making music. Phillips (1993) does not agree with this opinion: he thinks that music educators and music philosophers should not be afraid of mentioning the "functional benefits" (p.17) of music in addition to the aesthetic experience. However, Phillips acknowledges the fact that most musicians became musicians because of the aesthetic experience and not because of the utilitarian aspect of music. At the same time, he does believe that defending music education – in schools – will benefit from the use of utilitarian arguments as well.

Rauscher (2002) discusses this same problem. She recognises it may be very beneficial for music education programs that extra-musical effects of musical training exist, but on the other hand she does not want music instruction to be lead by scientific goals instead of musical goals. Reimer, listening to Rauscher on a conference of the MENC[3], felt threatened by her research on the extra-musical effects of music listening and music education (e.g. Rauscher 2002). He finds the idea that music may one

[3] Music Educators´ National Conference, the National Association for Music Education in the US. See www.menc.org.

day be taught only to enhance children's cognitive abilities or their academic achievements worrying (Reimer 1999). He wonders why music has this vulnerable position in education and he finds an explanation with René Descartes (1596-1650). The French philosopher claimed that the mathematical way of thinking is the right model of reasoning and the way to achieve pure, reliable intellect. This way of thinking is free from emotions and free from unreliable information from the senses. According to Reimer, this way of thinking still influences the Western way of thinking, leading to the idea that in education there are cognitive subjects like mathematics, science and languages that are basic and regarded valuable and useful, and subjects that are rooted in the senses or emotions, like the arts, which are not considered basic and therefore not regarded as valuable. Therefore, when an unimportant subject like music is able to support one of the important subjects, this is welcomed. According to Reimer (1999) this way of thinking is common in Western education, causing a constant threat of the place of music in the school curriculum.

In the following section a short discussion will follow why it is important to engage in music and hence, why it is important to educate music. After this philosophical part, a review follows of research about extra-musical benefits of music: the so-called "Mozart-effect". Supporters of this theory claim an effect of music and music making on cognitive and social-emotional abilities and use research proving this effect to stress the importance of music education.

1.1.2 The intrinsic value of music

In his Presidents' Award Lecture 1999, the British professor of psychology John Sloboda summarizes several good reasons for engaging in music. He says: "The notion that music could be engaged in purely for personal fulfilment, for the building up of community and friendship, for the sheer joy of making beautiful sounds together, is a strange, almost reprehensible, concept in many people's minds" (Sloboda 1999, p. 455). Gembris (2003) agrees with Sloboda when he says that the main argument for music education should be the value of music (and art), although this value is not clear for all people.

According to Elliot (1991) there are different ways of looking at music education. One he calls the philosophy of "music education as aesthetic education" (p. 22). According to this philosophy, music education's main aim should be the contemplation of aesthetic objects called musical works in abstraction from their contexts of use and production. The goal of music education following from this philosophy is then teaching children to listen to music. By listening to music, children should be able to gain the knowledge musical objects offer, as musical works are symbols that offer insight to the general forms of human feelings. According to Elliot, this philosophy sees performance as an evil with the only aim to have others listening to music. It fails to acknowledge that performance can be an end in itself.
This is then the second way of looking at music education: learning to perform music because "musical performing can be a form of thinking and knowing valuable for all children" (p.23). In

musical performance knowing, thinking and acting are interwoven. Playing a piece of music requires a person to know his instrument and what to do to make music. While he plays the piece of music he is thinking about how to perform it and reacting during the performance. Every touch on – for example - the piano is based on knowledge, is done intentionally is a result of thought, and it is not possible to separate action from thought. It is a way of active knowledge. Instead of expressing verbally what he knows, the musician performs his knowledge. This knowledge is only available for performers and not for listeners, which is the reason, according to Elliot, that music education should entail learning to perform.
Still, the question remains why people want to perform. To answer this question Elliot cites Mihalyi Csikszentmihalyi: this psychologist thinks that our Self needs constructive knowledge to grow, to be fulfilled. Constructive knowledge is gained by a match between challenges and the know-how to do it. This match not only brings constructive knowledge and thus growth, but enjoyment as well. Real growth is only possible when a challenge is sought that is able to stay challenging in order to develop and grow. Music performance is such a challenge, which grows along with the individual learning to perform. In short, making music is a source of constructive knowledge and thus enjoyment and self-fulfilment, because it offers progressive levels of challenge and ways of improving one's know-how.

This way of looking at music education is also recognised by Pitts (2000). She gives an overview of a century-long discussion in the UK about the importance of music education. She discovers three arguments that have been used to plead for music education.

The first argument is music as a way of learning about the culture the child belongs to. Part of this argument is that children will appreciate their own culture more by knowing the music and, as a result, know more about the history of their culture. This is important according to the advocates of this argument, because it can prevent degeneration of the culture and of the country. This argument was mainly used before the Second World War, but in the 1990's the Chairman of the National Curriculum Council in the UK still used it. He stated that every child growing up in Britain, irrespective of their background, should be taught about key traditions and influences within the British heritage (Swanwick 1994). For children to know the music of their culture and country it was thought to be enough to listen to it. When children are taught music based on this argument, they will mainly learn to listen to music, which is a rather passive way of engaging in music. From the 1950´s, the view that classical music – the main kind of music that was taught at the time – was a self-evident part of adult life (and thus of culture) changed and caused this argument to become less important. Popular music and world musics had become more available and it was not longer sufficient to say that music had a desirable cultural influence. It became necessary to define what was meant with culture. In addition, the role of the teacher as a guide into the world of music had disappeared, as most children already listen to (their own) music before music education starts.

The second argument Pitts found is that making music is a good way of spending free time: music as leisure. According to the Board of Education[4], education must take into account the whole person and should aim its efforts at teaching students a wise use of their leisure time (Handbook of Suggestions for Teachers 1927, in Pitts 2000). The board thought that music could play a major part in this educational task. Music then becomes part of education for life; it enables children and adults to participate in music as listeners or performers. Experts using this argument thought that music was able to give children an opportunity to have fulfilling lives outside their future work as adults. Music seen in this way fulfils a role in the curriculum similar to handicraft and gardening: a subject without "real use". For some, this "uselessness" was a reason to plea for music in the curriculum, because it could give an added value to the otherwise utilitarian curriculum.
As for the first argument, the rise of popular music in the 1950's and 60's led to new challenges, because children experienced different music cultures at home and at school; teachers did not always appreciate the music children listened to at home en vice versa. The argument also lost power, as apparently children did not longer need music education at school to learn how to spend leisure time on music.

Nowadays there is reasonable agreement on the opinion that music education is relevant for all children. This is intensified by the idea that stresses the "transferable skills". These are the non- or extra-musical effects of music education that will be discussed in the paragraph 1.1.3. For many politicians these transferable skills are a good reason to keep music education in the curriculum.

The third reason to teach music discussed by Pitts - the one that resembles Elliot's argument for educating music - is music as a catalyst for emotional and personal development. The focus is here on the development of the individual child, not on the culture or on acquisition of skills. This argument is used throughout the twentieth century, but has always kept a rather isolated position. Music in this way is seen as a "guiding principle to regulate and illuminate all the activities of our existence" (Cambridgeshire Council of Music Education 1933, p.16). Pitts (2000) cites the music educator Yorke Trotter who wrote: "art is the expression of what I may call the inner nature, that nature which feels, which has aspirations and ideals, which reaches out to something beyond the material needs of this world" (p. 39). According to Yorke Trotter this vision of music and music education asks for a very high integrity and commitment from the teacher.

Koopman (2005) adds a fourth reason. From the Middle Ages till the twentieth century, a period Koopman calls the Christian era, music was meant to strengthen people's belief and devotion. Music was comprehended in a narrow way, because it involved mainly singing. The aim of music education in this period was not to learn music, but to be able to sing psalms, hymns and other religious songs. The words were important, not the music. In some religious circles, this is still the reason music is taught. Reimer (1999) describes how singing schools were established in the United States because better singing quality was needed during worship services. This is a clear example of music education

[4] The Board of Education of Great Britain co-ordinates the work of primary and secondary education. Schools that are recognized by the board are under Government inspection.

serving religion (Reimer 1999). Leonhard and House (1959) mention several other reasons music is taught, such as to advance students' health, to develop social aspects of life, to improve home life, or to develop good citizenship.

Koopman (2005), however, feels, as is clear in the introduction, that music has a value of its own, an intrinsic value and that this is the reason the teach music. This intrinsic value consists of the unique experiences music, and the other arts, provide us with. Music is a source of joy and happiness and gives humans a feeling of self-fulfilment. This is similar to the third reason discussed by Pitts. This feeling about music is also shared by Alperson: to this philosopher "music seems to be a source of genuine enrichment without which our lives would be considerable diminished" (Alperson 1991). Leonhard and House (1959) use the philosopher Dewey to say basically the same. They describe a process in which a person experiences disequilibrium in his environment and gains satisfaction in finding ways to overcome this disequilibrium. Artistic experiences are capable of helping humans with regaining equilibrium and are therefore valuable. Artistic pieces also symbolize the human struggle of loosing and regaining equilibrium. They write: "An experience is aesthetic when resistance, tension, excitement, and emotion are transformed into a movement toward fulfilment and completion" (p. 81).

As will be clear from the above-mentioned authors, there are several reasons to teach music, the most important one being the possibility of self-fulfilment and personal growth, and hence happiness and joy by making music. This is also underlined in studies on popular music by Christenson and Roberts from 1998 cited by Ter Bogt (2003). According to Christenson and Roberts young people have four reasons to listen to popular music. One of these is "mood management": listening to music improves their mood and music moves them emotionally. It makes them happier people (or less unhappy).

Leonhard and House (1959) state that art in general - and music in particular - should be taught for individuals' personal fulfilment. When only his physical and intellectual potentials are used, "he never attains his true stature as a human being" (Leonhard and House 1959, p. 99). But it still remains unclear why it is music that gives us these feelings and not – for example – gardening. According to Leonhard and House music is a symbol, the tonal motion in music symbolizes the subject's (any person composing, performing or listening to the music) conception or understanding of the ways of human feeling. They think music has importance because it is a form which has significance as a symbol of the rhythm of life experience.

According to the writers of "The Cambridgeshire Report on the teaching of Music", (1933) music is the greatest of all spiritual forces. Others say it with less high words. Hodges says music "is one of the hallmarks of what it means to be a human being" (Hodges 2000). Reimer (1999) states that some human needs can be met only through music, "that is, through the kinds of meanings and satisfactions that only musical sounds, defined and structured according to cultural expectations, traditions, and identity traits, can provide" (p. 1). According to Reimer, teaching and learning music

are meaningful, because it gives people the opportunity to develop skills with which they can gain meaningful, gratifying musical experiences. This can be done through aesthetic education in general, according to Leonhard and House, but music has unique qualities that make is the most desirable means of organized aesthetic education. The most important quality of music is that all human beings are universally sensitive to music and at some level and in some way capable of making music.

1.1.3 Other benefits of engaging in music

Despite the arguments for music education provided in the previous section, many people still look for other reasons to teach music in order to give music a more solid place in the school curriculum. Therefore, in this section an overview of studies will follow that have tried to show extra-musical effects from music education. A citation from Reimer (1999) will make clear why this is done and does not contradict the discussion in the previous section. "We are happy that it (music education, FW) has such positive effects, and as we go about fulfilling our music teaching responsibilities, we will be sensitive to and supportive of all the many positive ways in which music study and experience can enhance people's lives (p. 6)".

Influence on cognitive abilities

When writing and talking about the influence of music on cognitive abilities, one should make clear a difference exists between making music and listening to music. There are two explanations for the possible effects of listening to music on cognitive abilities. The first one is based on the "trion" model. This is a mathematical model of neuronal firing with complex spatial and temporal patterns in the brain. Because Mozart's music is ordered according to equal complex spatial and temporal structures, listening to this music prepares the brain for spatiotemporal tasks, which would cause higher scores on spatiotemporal tests. Another theory claims the effect of listening to Mozart's music is caused by the increases in arousal and mood after listening. This might have a small effect on spatiotemporal reasoning or cognition as a whole (Črnčec, Wilson and Prior (2006). This could explain why there is not only a Mozart-effect, but also an effect after listening to Schubert, a story of Stephen King of children's songs (Schumacher 2006).

There have been several studies on the effects of listening to music and according to Gembris (2003) these have all the same results: a general improvement of the intelligence after listening to music was not demonstrated. Rauscher and colleagues reported in 1993 that subjects who listened to Mozart for about ten minutes scored higher on spatial-temporal reasoning tasks immediately after the listening. This effect lasted for about ten minutes (Rauscher 2002). The popular press paid a lot of attention to these results, even exaggerating these strongly. The impression was given that all classical music (and especially Mozart) was able to improve people's general intelligence and school results, and that it is possible to make children little prodigies only by listening to classical music. The researchers or the research results, however, never suggested this. According to Costa-Giomi, a review of the literature by Schellenberg in 2001 showed that recent research not supported the Mozart Effect (Costa-Giomi 2004).

In a study in which 136 children where tested by making a paper-folding test[5] during listening to Mozart (K 448), a piece of popular music familiar to children (Zorba's dance) or in silence, Črnčec, Wilson and Prior (2006) showed that there was no effect from Mozart's music, nor from the popular music. The children's results did not differ significantly between the three testing situations. There was a significant correlation of the children's mood, arousal and increased preference. However, this did not result in better results after listening to the most preferred music. The strongest predictor of post-test folding scores appeared to be the pre-test results (Črnčec, Wilson and Prior (2006). Črnčec and colleagues (2006) conclude from this that there is no Mozart-effect in children. However, they assume that it is possible that there is such an effect in adults.

Research results may be different, however, for the effects of making music and music education. Rauscher (2002; Rauscher and Zupan 2000) performed a study to see what effect music instruction had on children in kindergarten. It was hypothesised that music instruction would positively affect their spatial-temporal abilities, but not their memory. Bilhartz, Bruhn and Olson (2000) give the following definition of spatial-temporal reasoning: "a process that requires mentally maintaining images without the assistance of a physical model and then reforming and combining these images in ways that create a meaningful whole" (p. 616). They state that this process is used to perform higher mental functions, such as playing chess and solving mathematical equations, and – according to several scholars they mention – also to perform musical tasks. Rauscher (2002) provides some evidence that there is a link between spatial-temporal tasks and mathematical ability.

For this research Rauscher studied a group of children receiving twenty-minute piano lessons twice a week for eight months and a group of children not receiving any musical instruction at all. Before the start of the music instruction, all children were tested with two spatial-temporal tasks and one memory task. After eight months the children were tested again. The results showed that the kindergarten children receiving music instruction scored higher on spatial reasoning tasks than children not receiving any music instruction. There were no differences in results on the memory task.

In first grade, some children received music instruction again and others did not. As a result, three different groups existed: one group of children receiving piano lessons in kindergarten and in first grade, one group of children receiving piano lessons in kindergarten but not in first grade, and one group of children receiving no piano lessons at all. All groups were tested again after first grade. These tests showed that the results from the children receiving music instruction only in kindergarten did not differ significantly from the results from the children not receiving music instruction at all: they did score higher but not significantly, which suggests that one year of music instruction is not enough to induce long-term effects. The scores of the children receiving music instruction since kindergarten had further improved. Again, these differences were found only for the spatial-temporal tasks.

[5] In this study (Črnčec, Wilson and Prior 2006) the children made the Fitzgerald paper-folding test. This test has demonstrated a good internal consistency and test-retest reliability. The test consists of a practice item and 20 test items and takes about 10-15 minutes to perform. Children have to visualise paper to be folded, punctured and unfolded and then pick the right answer from and multiple-choice list. The test is suited for the testing of spatio-temporal abilities, because it requires spatial imagery and then the temporal ordering of spatial components.

In second grade all children received music instruction (again piano lessons), which again resulted in three different groups of children all receiving music instruction, but over different lengths of time. The children who had received music education in kindergarten and then again in second grade did improve significantly; the children receiving music lessons for all three years did improve, but not significantly. According to Rauscher this is due to the "ceiling effect", meaning that the participant is already performing at his or her maximum capacity and therefore further improvements are not to be observed (Rauscher 2002, p. 271). The children who received music education for the first time in second grade did also improve, but not significantly. According to Rauscher, these results show that music instruction only has these beneficial effects on spatial-temporal reasoning when starting at a very young age. These findings are consistent with Hetland's (2000), who also investigated the effect of music education of spatial reasoning.

After third grade all children were tested again, but this time the researchers used another, more difficult test. The data showed that the children receiving music lessons for all four years scored thirty percent higher than children receiving music instruction in kindergarten, second and third grade, and fifty-two percent higher than children starting with music instruction in second grade only. These results not only show that music instruction has a beneficial effect on spatial-temporal reasoning, but also that these effects are found mainly when music instruction starts at a very young age (Rauscher 2002).

Additional proof for the effect of music instruction on spatial-temporal reasoning was gained by Bilhartz et al. (2000). In this study two groups of children were compared: children attending Kindermusik (a curriculum designed to develop musical listening, movement and singing skills in an age-appropriate, holistic way) and a group of control-subjects. In each of the two groups children participated from low-, middle- and high-income groups and the researchers differentiated between these groups. Bilhartz et al. found that children attending a course of Kindermusik scored higher on a test that measured abstract reasoning abilities (the Bead memory subtest from the Stanford-Binet Intelligence Scale). The effect was largest with children that had attended most of the course, but even children having attended half of the course (mostly from low-income families) scored higher than the control group. There were no significant differences between the groups on other subtests.

Eastlund Gromko and Smith Poorman (1998) performed a similar study. They divided 30 pre-schoolers from a private Montessori school in two groups: one receiving 30 minutes music education per week for seven months in which they also danced to the music, the other group having no music instruction at all. Before the music instruction started, all children's spatial-reasoning abilities were tested with the spatial-reasoning tasks from the Wechsler Preschool and Primary scale of Intelligence-Revised (WPPSI-R). It seemed no differences between the two groups existed. After the seven months instruction period, the children were tested again. The scores were different now, showing that the children in the experimental group scored significantly higher than the children in the control group. In addition, further analysis showed that the gain in IQ scores for younger children (three years) was larger than for older children (four years) and that the higher scores were only maintained when the music instruction was also continued.

Črnčec, Wilson and Prior (2006) also provided some evidence that music education enhances cognitive abilities. In their study, mentioned in paragraph 1.1.3., they tested the effect of Mozart, popular music or silence on the spatio-temporal reasoning of 136 children. Before the testing was done, the researchers asked the parents to provide information about the extra-curricular music education the children had received and about other musical experiences, followed by the Bentley Measures of Musical Ability test made by the children, which consists of four subtests (pitch, tunes, chords and rhythm). Despite the fact that the study showed no "Mozart effect" (better spatio-temporal reasoning after listening to Mozart's music), there was a small but significant contribution from the rhythm subtest to the scores of the paper-folding test.

From the discussed studies only the study by Eastlund Gromko and Smith Poorman (1998) involved dancing or moving on music. However, according to Letland (2000), who produced a meta-analysis of several studies about the effect of music instruction on spatial reasoning, music instruction with or without movement seem to have the same effect on the spatial-temporal abilities.

Both Rauscher (2002), Rauscher and Zupan (2000), Bilhartz and colleagues (2000) and Eastland Gromko and Smith Poorman (1998) showed that music education improves the scores on spatial-reasoning tasks. This is indeed confirmed by the meta-analysis performed by Letland (2000). Letland also confirms the finding of other researchers that age is an important factor for the effect of music on the spatial abilities. She concludes from the studies she analyzed, that the spatial reasoning of younger children is more enhanced by music instruction than the spatial reasoning of older children. The age of the children in the studies analysed by Letland varied from 3 to 12 years of age (kindergarten to sixth grade).

That better results are reported when music instruction is given at a very young age might be the reason that in a study by Costa-Giomi (2004) no significant differences were reported in scores on academic achievement. In her study, children from low-income families without music instruction or a piano at home before the study started, received thirty minutes of piano lessons once a week for three years. The study started when the children were in third grade and approximately nine years of age. Apart from the older age of the children, another significant difference between this study and the previous discussed studies is that the children were tested for their academic achievement with scholastic performance tests (the Canadian Achievement Test 2 and the Developing Cognitive Abilities Test) instead with tests for spatial reasoning. The school results of the children on music, French, English and math were also included in the study. As reported by Rauscher (2002), very little evidence was found that a link exists between scores on spatial-reasoning tests and mathematical – or other academic - abilities. The only improved school marks as a result of the piano lessons were - not surprisingly - the marks for music.

Orsmond and Miller (1999) tested whether music education improved children's spatial skills and verbal skills. Spatial skills were tested with three tests that all cover different aspects of spatial

reasoning. The subjects in the study participated in Suzuki classes, their age ranging from 44 months to 80 months. The control subjects did not receive music instruction at all. They were matched to the subjects by age, gender and ethnic background. The results from the study showed that the children with the Suzuki music instruction already differed on some of the tests before the study began (they scored higher on receptive vocabulary). After the study there was only a difference in scores on a visual-motor integration test (a specific spatial skill) between both groups. Orsmond and Miller suggest this might not even be a result of the music lessons improving spatial reasoning, but of music lessons improving the motor skills. As a result, they conclude music instruction improves mainly spatial skills with a motor component.

Instead of focusing on the spatial-reasoning ability of children, Schellenberg (2004) performed a study to test whether music education improves general IQ scores of young children. Whereas in other studies with the aim to prove a positive effect of music education there were usually only two groups (one receiving music education and one not), Schellenberg wanted to know whether only music education has positive effects on IQ or other extracurricular activities as well. He also wanted to know whether the kind of music instruction influences the results.
A sample of 132 children (all six years of age) was divided into four different groups: one group receiving keyboard instruction, one receiving vocal lesson with the Kodály method, one receiving drama lessons and one receiving no extra lessons. The children were pre-tested with the Wechsler Intelligence Scale for Children – Third Edition (WISC-III). Their educational achievements were also tested, with the Kaufman Test of Educational Achievement (K-TEA) to see whether changes in the IQ were accompanied by changes in educational results. A third test was done to measure social functioning. All tests were taken again after the 36-weeks period of the lessons. The lessons had been given in small classes existing of six children.
The post-tests showed that the children receiving the music instruction – either keyboard or vocal lessons – had similar increases in IQ scores (an average increase of 7.0 points). The children in the drama classes and in the no-lesson groups also had a similar increase in IQ scores (an average increase of 4.3 points). This shows that drama lessons have the same effect on intelligence as having no lessons. The increase in IQ points had influenced the educational achievements, because the children in the music groups scored higher on all five subtests of the K-TEA. The differences between the music groups and the other groups were small, but significant (Schellenberg 2004).

Bastian (2003) chaired a research team that studied the working of music on the development of children. They hypothesized that making music would positively influence cognitive, creative, aesthetic, social and psychomotor functions of children. The team studied five schools at which there was extensive attention for music and two control schools at which there was only the legally compulsory amount of music lessons. Although Bastian recognised that intelligence is only that what IQ-tests measure (and thus that there is no absolute definition of intelligence), he used the IQ-tests CFI and AID for measuring the benefit of music education on intelligence (Koopman 2005; Bastian 2003). In contrast with reports in the media, the effects of music measured by Bastian were not very evident: only a small improvement of the IQ was measured through the CFI test.

A third area in which effects of music education can be found is literacy. Douglas and Willatts (1994) found a weak significance between musical ability (rhythm discrimination and pitch discrimination) and reading and spelling. The strongest (but still rather weak) relation they found was between reading and rhythm discrimination (.306)[6]. These correlations were found in children in fourth grade at primary school. After they found these positive results, the authors were also interested to see whether music instruction had a positive influence on the literary skills of children with reading problems. They tested two groups of children with learning problems. As this was only a pilot study, the groups were rather small with six children in both groups. The children in the intervention groups joined a musical programme that lasted for six months. This programme was designed to develop the children's auditory, visual and motor skills. During the music sessions the children sang, and used tuned and un-tuned percussion instruments for playing all kinds of games. The sessions entailed a varied programme of activities in order to keep the children's interest. The children in the control group joined a non-musical programme in which they learned different discussion skills. Similar to the musical programme, the design of this programme was developed to keep the children's interest.
Before and after the six-month period, all children were tested for their reading abilities. The scores of the pre-tests had shown no differences between the two groups, as both groups consisted of children with reading problems. The test results after the six-month period showed a significant improvement of the reading abilities of the children in the intervention group had increased, whereas the scores of the control subjects had not changed.

In his meta-analysis of studies on the relation between music training and scores on reading/verbal tests, Butzlaff (2000) made a distinction between correlation studies and experimental studies. The correlation studies only tried to show a correlation between music training and reading ability without pointing a direction of this relationship, and without claiming a higher score on reading tasks was caused by the music training. The correlation studies Butzlaff analysed did this by looking at the scores at reading/verbal tests of students having and students not having music instruction previous to the tests.
In experimental studies different groups of students were tested of whom some received music instruction and others did not. The students were always tested before and after the music instruction was given in order to show the effect of the music instruction. The experimental studies in Butzlaff analysis, however, did not show any sign of the existence of a positive effect of music instruction on reading ability. In Butzlaff's meta-analysis there were a few studies that did produce positive results, but the overall picture was negative. One of the studies examined by Butzlaff was the study by Douglas and Willatts (1994) discussed earlier. Butzlaff thinks their positive results from the pilot study were due to the fact that the authors knew which subjects were in the intervention group and

[6] Correlations are expressed in a figure between 1 and -1. -1 means there is a negative relation and 1 means that there is a positive relation. 0 means that there is no relation. Any figure between -1 and 1 indicates the degree in which two things (skills in this case) are related. A correlation of .306 is not very strong: a correlation of .7 or higher is normally seen as high enough to identify a relation between A en B.

which in the control group, thus causing experimenter expectancy. In addition, Douglas and Willatts chose those students of whom they expected they could use some extra help. According to Butzlaff, other research has shown that mainly low-achieving students benefited most from the effects of teacher expectancy.
Butzlaff concluded that more research on this subject is needed, as of the (only) six experimental studies he had analysed, two studies reported positive results, three reported no or minimal results and only one produced negative results after music instruction. These differences ask for more methodological research.

Schellenberg (in: McPherson 2006) states there are four possible explanations of the effect of music education on intelligence and several scholastic skills. The first one is that schooling raises IQ, an effect demonstrated by Ceci and Williams in 1997. Although it appears the effect of music education could also have been reached by chess, math or reading lessons, Schellenberg thinks that music education is one of few scholarly out-of school activities children actually like.
A second reason for the effect of music education is that in the music lessons a wide array of (intellectual) skills are trained, such as fine motor skills, reading, learning by heart of large passages, knowledge of musical structures (including scales, chords, intervals, harmony etc). These skills are, adjusted to specific subjects, also used in school lessons, and these lessons might therefore benefit from the extra training.
A third reason Schellenberg mentions is that something specifically musical is causing the effect, namely that music is an abstraction that can be recognised in different shapes as long as the pitch and temporal relations that form its identity are intact. Learning about this abstraction in music might enhance the ability to abstract reasoning outside music as well.
The last option is that music education is comparable to learning a second language, which is also known for its non-lingual cognitive effects. However, Schellenberg warns that music education is not a simple way to enhance children's intelligence, considering the extensive efforts it takes to master a musical instrument (Schellenberg, in McPherson 2006).

Two points are yet to be made before concluding this section. The first one is an interesting finding from Letland's meta-analysis. She found that the size of the group in which the children are taught is of relevance for the effects of the music instruction. The results from her analysis show that one-to-one teaching may lead to better results than group lessons, although, as was shown before, even group lessons appear to have a positive effect.

The second point is that it is not clear how long the effects of music instruction on cognitive abilities last after the instruction has stopped. There have been no studies so far that follow students several years after their music lessons stopped to study what the long-term effects could be (Letland 2000). Besides that, there is some evidence that the improvement is not endless. The children in Rauscher's study (2002) who received music instruction for all three years did not improve significantly after the second grade. Rauscher thought this was due to the "ceiling effect" which means that the participant will not show any further improvement because he is already performing at his best.

Influence on social-emotional development

Bastian (2003) also measured whether music education has a positive influence on the social-emotional development of children. It appeared that the children in the schools with extra music lessons were less likely to reject their class mates in comparison to children in the control schools. This was, however, a measurement of children's own view of their behaviour towards children in their class instead of a measurement by others (adults) of the children's behaviour. We therefore can not be sure whether the children were really more social and less prone to rejecting class mates or that the children only thought they were. Other claims made by Bastian were rejected by Koopman (2005).

Gembris (2003) writes that although music education has almost no visible or measurable effect on the social behaviour of children - as became clear in Bastian's study –, music may play an important role in social processes. Gembris describes a project in Munich in which children from Greek, Turkish, Sinti, Kosovo-Albanian and other communities, used to fighting each other in gangs, worked together in musicals, theatre and music performances. In this context, the children learned how to work and play together instead of fighting, and how to engage in dialogue instead of aggression. Gembris claims the discrepancies between the results from Bastian and this Munich project can be attributed to the fact that standardized tests, like the one Bastian used, are unable to measure all factors playing a role in the influence of music on personality. Moreover, this positive effect of music only appears when the music is used to have this effect (for example in therapeutic situations), which is not the case in general music training on primary or secondary schools and which was the case in the mentioned project by Bastian.

Adamek describes a study that showed persons, who had learned to sing as children in their families or schools, had an enhanced capacity of regulating their emotions later in life. These persons (he calls them singers) were psychologically and physically of better health (Adamek 1997). In addition, the singers were more satisfied with their life, more balanced, had more self-confidence, their mood was better and they felt more social responsibility than the non-singers.

Other influences of music instruction

The study performed by Costa-Giomi (2004) showed that the academic achievement of the children who received music instruction did not improve after one, two and three years of the instruction. There was however another feature of the children that did improve: this was the self-esteem of the children. Children receiving piano lessons in this study had a higher self-esteem than the children in the control group. Costa-Giomi acknowledges the fact that the higher self-esteem may be a consequence of the attention from parents, peers and the piano teacher instead of the piano instruction itself. However, according to Costa-Giomi, this is in fact still a positive consequence of music instruction that will happen to all children receiving music instruction in comparison to children not receiving music lessons.

2 RESEARCH ON THE NECESSITY OF STARTING WITH MUSIC EARLY TO BECOME A PROFESSIONAL MUSICIAN

In this chapter an overview of several significant studies will be given. Please note that these studies will be mentioned more often throughout the entire document: for the convenience of the reader and in order to avoid repeating the specifications and methods of the studies, a general introduction to these studies is given here in a separate chapter, but the main results of the studies will be mentioned and discussed in chapters 4 and 5 in combination with other examples of research. These other examples of research will appear in other sections of this document as well, but they will not be discussed and reviewed as extensively as the significant studies mentioned in this chapter.

Sosniak (in Bloom 1985)

Sosniak investigated the lives of twenty-one young pianists. The pianists were all finalists of internationally renowned competitions. The study was done by interviewing the participants. The students were also asked permission to invite their parents to the study: twenty students gave permission, while the parents of sixteen of the pianists were prepared to be part of the study by giving extra information. On basis of the interviews with the pianists Sosniak found that the lives of the pianists can be divided into three stages, which will be discussed in Chapter 4.

Manturzewska (1990)

To find out more about the process of becoming an artist and about the life-long development of musicians, Manturzewska studied the lives of a group of Polish professional musicians. She was interested in the interaction between the living human organism and its socio-cultural environment, and in factors contributing to the musician's development. The purpose of the study was to collect empirical data about the life course of professional musicians and to learn about the structure of their lives.

The group of 165 musicians she investigated was composed of two sub-groups: one basic group consisting of 35 outstanding musicians, who were prize-winners in international competitions and were mentioned in the World's Who's Who in Music[7] and Who's Who in Opera[8]; and the control group consisting of 130 "ordinary" musicians resembling the basic group in age, region and musical instrument. The oldest musician was born in 1890, the youngest in 1960, at the time of the study they ranged in age from twenty-one to eighty-nine. The 165 musicians represented seven fields of musical activity: composers, conductors, pianists, violinists, woodwind and brass instrumentalists, and singers. The musicians were interviewed between 1976 and 1980 on the basis of structured questionnaires and biographical interview schedules. Some of the topics asked about in the questionnaires are:

- Early musical experiences and musical events in the childhood;
- The beginning and course of musical training and music education;

7 Kay, Ernest (Ed.) *International who's who in music and musicians directory (7th edition*). Cambridge: International Who's Who in Music, 1975.

8 Rich, Maria F. (Ed.) *Who's who in opera: an international biographical directory of singers, conductors, directors, designers, and administrators, also including profiles of 101 opera companies*. New York: Arno Press, 1976.

- Sponsors and tutors;
- Ancestors and family environment.

The interviews were tape-recorded. Besides the interviews the research used objective data such as concert diaries, photographs, reviews from newspapers, data from orchestra's or trade-unions, etc.

Sloboda and Howe (1991)

Sloboda and Howe performed a study to find out more about why some young music players become highly successful and others do not, even giving up music making. Sloboda and Howe assumed that reaching a high level of music making depends on the availability of opportunities for learning, and the family and cultural background. Especially the encouragement given by a person's family was thought to be very important in the development of musical skills.

The aim of the study was to find out what circumstances promote musical excellence in young people. Sloboda and Howe interviewed 42 children from a specialist music school. The children were quasi-randomly selected by the school. The children were divided into two ability groups, a classification made by the staff of the school. Children with outstanding or exceptional abilities by school standards were placed in group A; Children with average or unexceptional abilities by school standards in group B. Every child was further placed in a group based on first-study instrument (piano, violin, cello, wind or brass), gender (male or female), and age (thirteen years and younger or fifteen years and older). The children were interviewed alone by one of the researchers at the school and the interviews were recorded. The interviews followed a semi-structured format and concerned elements of the musical development prior to being selected as a student of the school. In addition to the children, twenty parents were also interviewed.

Ericsson, Krampe and Tesch-Römer (1991 and 1993)

Ericsson, Krampe and Tesch-Römer (1993) performed two studies about the role of "deliberate practice" in the acquisition of expert performance. In these studies their basic assumption was that "the amount of time an individual is engaged in deliberate practice activities is monotonically related to that individual's acquired performance" (Ericsson, Krampe and Tesch-Römer 1993). In their first study they investigated the practice habits of 30 young violinists. These were violinists rated by their teacher as either "best violinists" (with potential for a solo career, international competition winners or playing in an internationally renowned orchestra), "good violinists" (good violinists, but not suitable to participate in international competitions) or "music teachers" (music education students with violin as the main subject) – presuming that music teachers play the violin not as well as soloists or orchestra members due to lower admission criteria. Every group consisted of 10 persons. In addition to the young violinists, Ericsson et al. also included 10 middle-aged violinists who played in two West-Berlin symphony orchestras with international reputation.

The students were interviewed during three sessions. In the first sessions biographical information was obtained like starting age, sequence of teachers, and participation in competitions. Subsequently, the researchers presented a taxonomy of activities to the students. This taxonomy included ten everyday activities and twelve musical activities. Examples of the everyday activities were household chores,

child care, sleep or sports; examples of musical activities were practice alone, practice with others, playing for fun or solo performance. The students were asked to rate these activities according to three dimensions: (1) the relevance of the activity to improving performance, (2) the effort acquired to perform the activity and (3) how much they enjoyed the activity without taking into consideration their evaluation of the result of the activity. In this first interview the students were also asked to estimate how much time they spent during the last week on the different activities of the taxonomy.
In the second session the students were asked about their concentration and practice. They filled in a specially designed diary sheet about their day before the second interview. This diary sheet covered the twenty-four hours of a day divided into ninety-six fifteen-minute intervals. After the second interview the students kept a diary using the specially designed sheets for seven days. Before the third interview session, the students encoded everything they did according to the taxonomy and its three dimensions.
According to the diaries of the students, there were two activities judged to be highly relevant for improving their violin performance, which exceeded the duration of more than five hours a week. These activities were practice alone (average 19.3 hours a week) and sleep (average 58.2 hours a week). Practice alone was considered the most important activity for the improvement of performance. On the basis of the students' estimations of their daily practice, there was also an estimation made of the amount of past practice. The researchers expected the estimation of past practice to be rather accurate, because students careful monitored the duration of their practice. The students were asked to estimate the amount of practice they had engaged in for every year since they started with the violin.

The second study was performed to find out if the results of the "violinists-study" could be replicated. Two different groups of pianists were involved in this study: (1) piano students for whom the same selection criterion were used as for the group of good violinists in the violin study, (2) amateur pianists. Unfortunately the researchers were not able to find pianists as good as the best violinists in the violin study. The results that Ericsson et al. present in their article (1993) are based on an extended study that involved two more groups of pianists: elderly professional pianists and elderly amateur pianists.
The researchers used abbreviated versions of the interviews used in the first study. In addition to the interviews, there were several tasks for the pianists in which complex movement coordination was measured using their hands together or both hands apart. In the second session the pianists gave three successive performances of the Prelude No. 1 in C-major from The Well-Tempered Clavier, book I by J.S. Bach. Participants were given 15 minutes preparation time to think of an interpretation and were then asked to perform this interpretation three times, trying to be as consistent in their interpretation as possible. Force and onset-offset times for single keystrokes were recorded while the piece was played and a normal tape-recording of the performance was made as well. After the performance test the pianists were asked to complete two tests to measure the cognitive-motor speed. This was followed by free finger tapping tasks to measure simple motor efficiency.

Sloboda, Davidson, Howe and Moore (1996)

Sloboda et al. performed a study to investigate the emergence of specialist musical skills and the influence of environmental factors. As a lot of other studies already had shown a strong relation between practice and performance, this study mainly focuses is on other factors contributing to the development of high level performance and to the non-development of such skills. For example, the researches in this study cite Ericsson, Krampe and Tesch-Römer (1993) and Manturzewska (1990). However, they feel that these studies have two disadvantages. The first is that they lack comparisons between successful individuals and individuals who have not been successful or even stopped making music at all. The second disadvantage is that the estimates made by the subjects about the amount of accumulated practice are always made years after the practice was done, as the subjects were interviewed in (early) adult life about events in their childhood. Sloboda et al. tried to avoid these disadvantages by performing this research with children that had received tuition on at least one musical instrument and their parents.

They formulated three hypotheses:

1. "If formal effortful practice is the main precondition for skill acquisition, then we should expect lower or zero relationships between skill level and measured amounts of other forms of activity" (p. 289).
2. "Increases in the rate of achievement followed, rather than preceded, significant increases in parental or teacher involvement and increases in the amount of practice undertaken" (ibid.).
3. Older and more accomplished individuals are expected to show higher degrees of practice stability. Younger and less accomplished individuals are expected to show higher levels of practice only at times when teachers actively encourage their pupils (p. 290).

The group consisted of 257 children aged between eight and eighteen years. They were divided into five groups, matching in socio-economic status, age, gender and musical instrument. The first group consisted of 119 young musicians attending a specialist music school ("the specialists"), the second group consisted of 30 young people who were not admitted to a specialist music school ("the rejected specialists"), the third group were 23 children whose parents had asked information about attending the specialist music school ("the passive interest specialists"), the fourth group included 27 children who played a musical instrument, but only as one of many hobbies ("non-specialist instrumentalists"), and the fifth group consisted of 58 children who had given up playing an instrument at least a year prior to the interviews ("the given-up instrumentalists").

To confirm that there was a clear difference in musical competence between the different groups, data of examinations of the Associated Board and Guildhall School of Music grades were used (see Appendix I). It appeared that the "specialists" had achieved the best grades, the "given-up instrumentalists" had achieved the lowest grades and the groups in between had achieved intermediate grades, with no significant differences between them.

All the subjects were interviewed face-to-face or by telephone, and of every child at least one parent was also interviewed. In addition, the amount of daily formal practice was measured and estimated for the past years the child had received music lessons. To achieve this, the participants were asked

to fill in a specially designed grid. Because the researchers were also interested in the effect of other musical activities than formal practice, the participants were additionally asked to estimate the amount of improvisation, playing through previous learned pieces and unstructured informal activities. For these activities they only had to estimate whether the amount of time spent on it was greater than, the same as or less than the amount spent on formal practice.

A subset of the interview sample was willing to participate in a diary study. This group consisted of 5 children of group 1, none of group two (due to organisational reasons), 23 from group 3 and 26 from group 4. For every week the child received a sheet with separated entries for morning, afternoon and evening of each day of the week and separate entries for the different kind of musical activities (e.g. formal practice of prescribed pieces, formal practice of technical exercise or playing for fun). The participants were asked to estimate the time spent on each activity each day for the morning, afternoon and evening of that day.

Clawson (1999)

Clawson performed a study to find out how the early process of wanting to be a musician, learning to play an instrument, and becoming a member of a rock band are shaped by gender. She examined the musical development of male and female rock musicians who had participated in the WBCM Rumble, the best known and highest institutionalised band competition in the United States organised by the rock radio station WBCN. In this yearly competition, twenty-four bands selected by radio programmers on the basis of tapes submitted to the radio station, compete with each other. The bands' life performances are then judged by panels of journalists, radio programmers and employees from recording companies. By using the bands participating in the Rumble, Clawson could interview bands that were not yet commercially successful, but were professionally active performers in a regional music market.

The mean age of the men was 26.9 and the mean age of the women was 28.7 years. Nineteen female and twenty-four male musicians were Clawson's respondents of whom she interviewed twenty-nine by telephone and fourteen by a mail survey. All musicians were white, which is in accordance with rock's character as a mainly white pop genre. Most of the musicians had attended college for at least some years and came from middle-class backgrounds. None of the musicians earned their living as popular musicians; they had all sorts of other jobs ranging from bar-tending or cleaning to being veterinarians or architects. Despite of this situation, for most of the musicians performing was their principal work and they all shared an ambition for a long-term musical career.

Jørgensen (2001)

Jørgensen investigated the relationship between starting age with music education and performance level of conservatoire students. The main question in this research, based on the expertise theory of Ericsson (e.g. 1997), is: "Have the most accomplished performers started earlier with lesson on their main instrument than the less accomplished?" (p. 227). Based on several other studies, Jørgensen states that most international level performers - instrumentalists and singers - started around the

age of six, but he also acknowledges the fact that some have started later and still succeeded to become an expert performer.

The study was performed at a Norwegian conservatoire on students in their early twenties. The students were in a four-year undergraduate programme. The fields of music they were engaged in were instrumental (piano, strings, woodwind, brass etc), vocal, church music (church organ), and music education (same instruments as the instrumental students and jazz and pop instruments). All the students in the sample were asked what age they were when they started with formal lessons on their main instrument. "With "formal lessons" is meant lessons from an instrumental teacher outside the general music lessons in school and outside instruction from a conductor or choir or brass-band" (p. 66). The formal lessons must have prevailed for at least six month to be included in the study. Subsequently, the performance level of the students was measured. The students in Jørgensen's study were divided into three sub-groups: the excellent students, the very good students and the good students. This division was based on the students' final examination year at the end of the fourth year. A one-hour concert by the student was judged by a three-person committee of conservatoire teachers. The grades for this examination were based on a five-point scale: excellent, very good, good, accepted and failed. Overall, only the three highest levels were distributed. For the music education students there were only a "pass" or "fail" grade, so they were excluded from the results for the relationship between starting age and performance level.

Green (2003)

Green interviewed fourteen popular musicians aiming to know more about "the nature of popular musicians' informal learning practices, attitudes and values" (p. 7). Green also wanted to know whether the experiences of the musicians in formal education changed during the past forty years and whether the musicians' learning practices changed during this period. The musicians she interviewed were aged between fifteen and fifty years and lived all in or around London. Most of them Green interviewed five or six times until no more new topics were discussed.

Six of the musicians, aged twenty-seven to fifty at the time of the study (1998-1999), were in secondary education before popular music was taught in formal music education. Two of the interviewees, aged twenty-one and twenty-three, were in secondary education during a tumultuous period in British music education when there was a transition period in the music curriculum. The youngest six musicians, aged fifteen to nineteen, experienced the changes that had occurred after popular music and world music were officially recognised as part of the curriculum.

The criteria Green used for selecting the musicians in her study were that the musicians 1) were not friends or personally acquaintances of the researcher prior to the study, 2) should have attended school in England, 3) should be professional or semi-professional musicians (the older persons), or should play in a band or be at the point to start a band (the younger persons), and 4) were involved in "Anglo-American guitar-based pop and rock music" (p. 9). Concerning the fourth criterion, the evidence showed that most musicians played more than one particular popular music style, with

one of the subjects also being active in classical music. The instruments played by the subjects were mainly electric guitar, bass guitar and drums. Some also played keyboards, one sang and one played the saxophone.

The group of popular musicians consisted of twelve men and two women, and they were all white. They came from different backgrounds, their parents ranging from professionals with higher education degrees to scrap yard merchants and factory workers. Their own occupation also varied broadly: some had worked in unskilled jobs or had been unemployed for many years, some had worked in semi-skilled jobs, and one person worked as a higher education lecturer in popular music. The youngest musicians were still in school. Green found the musicians by asking around in her circle of friends, family and acquaintances. The interviews lasted between an hour and an hour-and-a half and all the interviews were tape-recorded and transcribed. The question concerned the nature of the musicians' skill and knowledge, their development as musicians, what attitudes and values they attached to acquiring musicianship, their experiences in formal music education, their opinions regarding the place of popular music in music education and their possible experiences as teachers.

As mentioned in the introduction to this chapter, the actual results of these studies will be mentioned in chapters 4 and 5.

3 CHILDHOOD DEVELOPMENTAL THEORIES

In order to put the existing research on specific musical development reviewed in Chapter 4 into a larger framework, some generally accepted theories of children's development will be discussed in this chapter. These theories originate from the Swiss biologist Jean Piaget and the Russian Lev Vygotsky. The reason Piaget is discussed here is because his theory has had an enormous impact on the way psychologists think about development and education, including on thinking about musical development. The reason Vygotsky is discussed is also because of his influence on thinking about development and learning. Especially his emphasis on the social interactions in learning is very important. Interesting is the difference between these psychologists: Piaget believed that development is a rather autonomous process without influence from the child's environment or culture, whereas Vygotsky claimed an important role for the interactions between the child and its culture, being represented by parents, teachers and other important persons in the child's environment (Vygotsky 1978).

3.1 LEV VYGOTSKY

Lev Vygotsky was a Russian psychologist (1896-1934), whose theory the social interactions between the child and representatives of his/her culture (like a parent or a teacher) were given a very prominent place. Vygotsky claimed that the higher mental functions grew out of these interactions. By looking at effective ways parents, teachers or other significant persons solve problems or think, a child internalises these ways of doing and thinking that is common in his culture. The way a child internalises these cultural mores depends of his age and developmental stage. Significant in Vygotsky's theory is that the child learns by participating in the culture. With his participation the child sometimes causes a change in his development, a next step, but most of the times the child needs the help or guidance from another person for this to happen.

A very important term in this theory is the "zone of proximal development". This is the distance between the actual development of child determined by the level of tasks it can solve by itself and the potential development determined by the level of tasks it can solve with the help of adults or more capable peers. According to Vygotsky the ability to solve a problem or task with the help of someone else (a more developed person) is telling us much more about the potential mental development than what a child can do on its own (Vygotsky 1978). By guiding a child to solve a problem it learns and it will be able to grow to a next stage in his development. This makes the human learning an especially social process. Vygotsky proposes that educating children is done well when the teacher is "in" the zone of proximal development of his pupil, because this advances the development.

In addition to being part of a culture in which higher mental processes such as abstract thinking, self-awareness and problem solving take place, the child learns these processes also in conversations and dialogues with himself. These internal conversations are the basis for internal processes like thinking (Seifert and Hoffnung 1994).

3.2 JEAN PIAGET

The Swiss biologist, philosopher and psychologist Jean Piaget (1896-1980) developed a theory about children's cognitive development. He believed that the thinking of children develops is a series of complex stages, which revise and incorporate the preceding stages. From birth to adulthood, Piaget thought, every child goes through four stages: the sensorimotor, the preoperational, the concrete operational and the formal operational stage (Seifert and Hoffnung 1994). The development from one stage to the next depends on several processes: adaptation, social transmission and physical maturation.

In the process of adaptation two other processes are working, assimilation and accommodation. When these two are in balance, adaptation occurs. To understand the process of assimilation, another Piagetian term needs further explanation: the term "scheme". "A scheme is a cognitive structure of actions, behaviours, thought and problem-solving strategies; in short a structure to which a class of similar action sequences belongs" (Flavell 1963, p. 53). Such a class provides a framework of how to respond to a given intellectual challenge or situation. The action sequences in a scheme are tightly bound together, and the behavioural elements are strongly interrelated. Piaget believed that children are born with a few schemes and that these schemes are adjusted, extended and changed through assimilation and accommodation. The innate schemes are made of simple patterns of unlearned reflexes, such as sucking, looking and grasping.

Assimilation is the cognitive encounter of an environmental object or situation that is new for the child, there is not yet a scheme telling how to respond to the object of situation, and the interpretation and response to the object or situation based on existing schemes. The core of the assimilation process is responding to the present in terms of the past.

When a child is confronted with a new object or situation in which existing schemes do not work, a new scheme will develop. This is called accommodation. The interplay between assimilation and accommodation is called adaptation. It is the process of deepening and broadening existing schemes when possible (assimilation) and of modifying when necessary (accommodation) (Seifert and Hoffnung 1994).

The second way the transfer from one stage to the next is made is through social transmission. This is the process through which a child is influenced by and adopts information and ideas from the surrounding culture and society. This is a major influence on a child, because it determines largely which objects and situations a child encounters. Social transmission works through imitation and modelling.

The third and last explanation Piaget used for the change from one stage to the best is physical maturation. A child has to reach a certain physical age to be able to do certain things, for example to name objects.

As stated before, Piaget divided the child development in four stages. The first stage is the sensorimotor stage lasting from birth to two years (all age indications are approximate and average). During this stage the innate schemes are adapted through assimilation and accommodation. The only "ideas" a child has about the world is via the senses (sensory experiences) and direct contact with the world (motor experiences). This means that a child has no idea about an object unless he can touch it or through another sensory experience. Gradually schemes develop for all sorts of objects and experiences the child has. These are important because they form the basis of more complex schemes that will develop later in life. Between eight and twelve months the child will achieve object permanence. This means that the understanding that people and things do exist even though you can not see, taste, feel, smell or hear them.

From two to seven years of age the child is in the preoperational stage. In this stage there is a shift from the action-oriented schemes from stage one to language- and other symbol-oriented schemes. During this stage the child slowly starts mastering certain logical rules and becomes capable of solving problems with words or actions. Children in this stage experiment with symbols that represent the world in different ways. Children do this with deferred imitation and dramatic play (for example playing house). The most obvious sign of children's ability of understanding and representing the world by using symbols is the development of language. This begins with the use of single words and ends with complete –mostly grammatically correct - sentences. When the child starts talking it only refers to objects of situations that are present, but later the child is also capable of talking (and thinking) about things that have been of will be.

The third stage, the concrete operational stage, lasts from the seventh till the eleventh year. This stage begins when children are capable of making representations and learn how to co-ordinate those logically. Piaget defined operations as logical relationships among concepts or schemes. In the concrete operational stage children become capable of using logical relationships for the first time, but this skill is still limited to objects and events that are concrete and real. A consequence of this development is existence of conservation. This is the belief that the quantity or content of something remains the same despite a change of the form of the object.

The last stage, from eleven through adulthood, is the formal operational stage. In this stage, children (adolescents now) become capable of thinking abstractly, logically and hypothetically. Entering this stage also makes individuals able of thinking about their own thinking and of abstract and complex matters such as moral, religion and politics. By doing this the adult identity is formed (Seifert and Hoffnung 1994).

It should be acknowledged here that many psychologists do not really believe the stages Piaget described really exist (Hargreaves 1996). The first reason for this is that the theory does not take into account any cultural or environmental differences that may cause different developments. Piaget saw the environment as the raw material for the cognitive development, but not as actually taking part in shaping the course of thinking, which is the current dominant view. The second reason is that Piaget thought that for all tasks or domains of tasks the development would have the same speed or course (functional coherence). This, however, appears now not to be the case.

4 MUSICAL DEVELOPMENT THEORIES

In the following chapter several theories concerning musical development will be discussed and a connection will be made with the developmental theories in the previous chapter. Overall, two types of musical developmental theories exist: theories about musical development in general and theories about the development of expert musicians.

4.1 Musical development in general

In this section, two theories of musical development will be reviewed. The first is developed by Keith Swanwick, a British musician and emeritus professor of music education. The second is by David Hargreaves, a musician and professor of child psychology, whose main research and teaching interests lie in developmental psychology and art education.

4.1.1 Keith Swanwick

Swanwick (1994) studied how children aged three to eleven compose. Despite the fact that this study concerned composition, Swanwick feels that "the implications of this study go beyond the specific activity" (p. 85). Through studying compositions Swanwick was able to get an insight of how people think musically. This way of studying musical development may be more effective than asking children to express in words what they think, feel and understand about certain parts of music or musical parameters, because it could well be that they understand more than they can express. It should be noted that composing was defined very broadly in this study. It included even the briefest spontaneous musical utterance as well as more elaborated works consciously created by the children. Also spontaneous invented, but not notated music was considered as a composition. From a small sample from the collected and recorded compositions, each composition was listened to by three independent teachers, who were asked to estimate the age of the child who made the work. The teachers' judgements agreed with each other on a positive statistical level and with the ages of the children.

Swanwick distinguishes four fields of musical knowledge that are mastered in the following order: materials, expression, form and value (see figure 1). The gaining of this knowledge takes place through two processes, assimilation (an intuitive process) and accommodation (an analytical process). The left-side of Swanwick's model is the intuitive and playful side, starting with the exploring of the sensory qualities of music, which is then transformed into personal expressiveness, structural (or "formal") speculation and ends with a personal commitment to the values of music. These intuitive characteristics are extended by the imitative and analytical aspects of musical development: skill mastery (manipulating the materials), knowing the conventions of the musical vernacular and after that idiomatic authenticity. It ends with the systematic extension of musical possibilities. Swanwick presents musical development this way because he sees it as a dialectical process. Every step taken

in this process is qualitatively different from the previous step, not quantitatively.
The four fields of musical knowledge are described in Figure 1, based on Swanwick (1994). Each field has two levels, one from the intuitive side of the model and one from the analytical side.

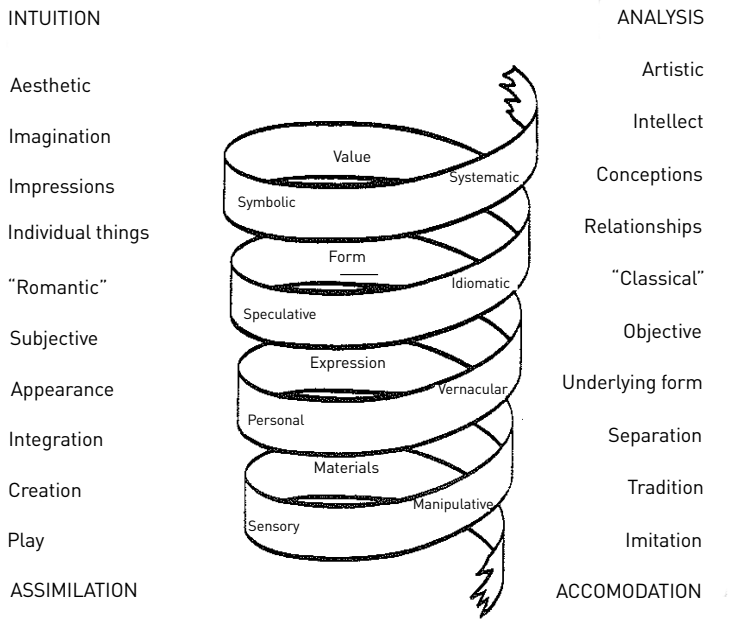

Figure 1: Swanwick's model of musical development (Swanwick 1994, p. 87).

"Note: the terms "Romantic" and "Classical" are here still being used in the special sense developed by Robert Pirsig, as are those provocative words "subjective" and "objective"" (ibid).

Materials

Level 1 (sensory): The child finds pleasure in music, especially timbre and volume. It plays occasionally with instruments, but the organization is spontaneous, the pulse is unsteady and tone and rhythm do not seem to have expressive value.
Level 2 (manipulative): The manipulation of instruments becomes more controlled and a regular pulse is possible. The child is able to use the physical structure of the instrument to produce specific sounds, such a glissandi or intervallic patterns. When the child makes up a composition it tends to be rather long and repetitive.

Expression

Level 3 (personal expressiveness): Expressiveness becomes clear by changes in speed and volume, and by communicating drama and atmosphere through the music, sometimes referring to an extra-musical idea. Despite the fact that phrases are beginning to develop, there is little structural control or development of ideas.

Level 4 (the vernacular): The child is able to produce and repeat melodic and rhythmic patterns. The pieces are short and are mainly established in general conventions and hence rather predictable. The phrases are two, four or eight bars long.

Form

Level 5 (the speculative): Compositions become more elaborative and less conventional. The child is able to explore structural possibilities, contrasting and varying musical ideas.
Level 6 (the idiomatic): Technical, expressive and structural control is shown in longer compositions which have a recognizable style. Patterns like answering phrases, call and answer and variation through elaboration and contrasting sections are likely to occur.

Value

Level 7 (the symbolic): Original and coherent musical statements are made through a combination of formal relationships and expressive character. The individual is able to give his composition a strong personal sense and is able to develop particular groups of timbres and harmonic progressions.
Level 8 (The systematic): The individual composes musical works based on newly generated musical materials, like scales, novel harmonic systems or electronic sounds.

In general, individuals go through the stages in this order, but when one phase has been reached, it is still possible to compose or make music in the manner of a previous stage. In addition, when a next stage has not really has been reached yet, it is possible to lightly touch it. A level is really reached when the compositions show the characteristics of that level in a consistent way.

According to Swanwick, the crossing from the left part from the model to the right happens naturally when children develop, but it has to be supported by music education, because just intuitive experimenting and being expressive will not cause any further musical development. Children will need teachers to teach them about musical parameters and their conventions.

When crossing the border to a new field of musical knowledge, according to Swanwick, a mental shift takes place which he links to Piaget's theory. In the first layer of the model assimilation and accommodation generate sensory-motor intelligence through sensory and motor experiences, which bound the possibilities of levels one and two. In order to be able to see music as able to mean something metaphorical, more than just a direct imitation of sensory phenomena a qualitative mental shift is necessary. This is the shift to "representational imitation", or the representation of an absent object. According to Swanwick (1994) this lies at the heart of music making: for producing music with an expressive character, it is necessary to abstract feelings or thoughts from real life and transform then into musical gestures. Children become able of representing things that are not present (object permanence) at a younger age, but in music this quality comes only when a child is capable of representing that absent object in music. When this is possible the child will make the step to the expressive stage. It begins intuitive, but soon it will be more analytical. Then the child is capable of using vernacular patterns and musical conventions.

Subsequently, a second qualitative mental shift occurs that Swanwick calls constructional play. By this shift the child is able to form musical structures, such as sequences or contrapuntal motives. This constructional play can also be seen in performing music, for example when contrasting phrases or pointing up differences of similarities between phrases or passages. Again, this phase starts intuitively; the effectiveness of a musical form is measured by its capacity to surprise or express. After this constructional play takes it place in the conventional rules or frameworks of set musical styles (Swanwick 1994).

Swanwick does not mention a third shift to move to the fourth field of knowledge, value, because he sees this as a rather different issue, as it is developed through the development of other fields of knowledge. It goes beyond sensory and expressive enjoyment or capabilities, but it is about becoming consciously aware of the importance of music as a major benefaction to human beings and to society (Swanwick 1994).

4.1.2 David Hargreaves

Hargreaves (1996) built a model of musical development based on Piaget's theory on the one hand and on children's developments in other field of arts (drawing, writing and aesthetic perception) on the other. Instead of using the word "stage" for the progression he uses the word "phase". He does this for two reasons: the first is in order to avoid the impression that the stages (or phases) do posses some sort of functional coherence. The second reason for using the word phase is that Piaget's theory is mainly about logical-scientific thinking, which may be rather inappropriate in the arts.

Hargreaves distinguishes five phases: the sensorimotor phase, the figural phase, the schematic phase, the rule systems phase and the professional phase. For every phase Hargreaves describes the skills a child probably will obtain in singing, composing, melodic perception and graphic representation.

Sensorimotor phase (0-2 years)
In this phase, as in Piaget's sensorimotor stage, development mainly involves the practice and development of physical skills and integration of sensory information. Obviously children this age do not really sing yet, but a start is already present in children's babbling and rhythmic dancing. Non-musical babbling first appears in the infant's first year and after this musical babbling appears. Whereas non-musical babbling does not seem to be a response to the environment, musical babbling seems a reaction to musical sounds in the child's environment (Hargreaves 1985). The "songs" these young children produce consist of sounds of varied pitch. They are sung on one vowel or a few syllables. Rhythmically these "songs" are amorphous. A part of the singing development of infants is the rhythmic dancing that parallels their singing (of course after they are able to do so physically). Hargreaves (1996) cites Moog (1976) who performed a study on five hundred preschool children. Moog found that children from the age of six months move rhythmically to music and the co-ordination between movement and music appeared to increase with age.

The actions infants perform with instruments Hargreaves calls composition and also in this musical

domain the sensorimotor aspect is present. Composition in this phase mainly involves mastering the mains of producing sounds with instruments and physically controlling them.

Regarding melodic perception, research has been done using measurement of changes in heart rate and head turning as measure of discrimination. These studies, for example by Chang and Trehub (1977), show that infants can distinguish between melodic differences, especially when the contour of a melody changes, and are able to recognise rhythmic sequences as well. The graphic representation of music in this phase is scribbling; this means that children scribble what they are doing or hearing, for example they draw rhythmic patterns. However, these patterns do not have much resemblance with the music it is based on.

Figural phase (2-5 years)

Important in this phase is that children have acquired the ability to symbolize or represent things that are not present (object permanence). One thing that becomes possible after a child acquires object permanence is graphic representation. Graphic representation in this phase is figural. Regarding musical notation this means that the notation or drawing conveys the figure or shape of the sequence, which was seen by Bamberger[9] as an appreciation of musical expressiveness. In this phase the metrical representation is not completely developed and therefore likely to be flawed.

After the ´babbling songs´ from the sensorimotor phase, children are in this phase capable of producing articulate and recognisable songs. Spontaneous songs invented by children often borrow aspects from existing songs. Davidson (1994) studied the songs of 69 children and concluded that three-year old children rely on the words of a song to sing it. They can sing distinct pitches, but there is no interval stability yet nor tonal coherence. The children have acquired tonality within phrases, but in complete songs they have not. The individual relationships between the pitches are not yet articulated. A year later the child still relies on words, but the melodic contour is produced more accurately. However, it still does not convey complete tonal coherence. At the end of the figural phase children are capable of singing melodic contours and intervals correctly, but a coherent whole composed of all parts of song is not organised before the child is in the schematic phase. Regarding melodic perception children appear to discriminate pitches and the contour of a song. Their compositions show that in this phase children are assimilating the music common in their environment or culture.

[9] Jeanne Bamberger is Professor Emerita of Music at the Massachusetts Institute of Technology where she taught music theory and cognition. Among other things she studied musical development and learning, in particular aspects of representations among both children and adults (http://web.mit.edu/jbamb/www/). In her work she described the earliest stages of music cognition: what children have learned about music, rhythm patterns en tune building through their own discovery, and how they graphically represent what they hear in order to find out how musical development occurs. (http://www-classes.usc.edu/engr/ise/599muscog/2003/week14/ paper.html).

Schematic phase (5-8 years)

By the age of five, when the schematic phase starts, children have a good picture of adult conventions and probably have invented some of their own inventions. For the arts this means that children are beginning to develop artistic conventions, but these are not integrated in a complete sense of style. In composing this leads to using vernacular conventions, such as the use of melodic or rhythmic ostinati, but not yet a coherent style.

Children from the age of five sing "first draft song", a term used by Davidson (1994). This means that the songs are very recognisable models of the songs of the child's culture, but they are still not accurate. Research from Davidson, McKernon and Gardner (1981, cited by Hargreaves 1985) showed that five-year old children achieve songs in four phases: first the words of a song and then all phrases and the order of the phrases. Then the underlying pulse of the song becomes present and a constant speed is established, this is called the phase of topology. The next phases are rhythmic surface, pitch contour and key stability.

The graphic representation of music also develops further in this phase. Children were only able to represent one element of a melody in the figural phase, but are now capable of representing more dimensions. For example, at the age of seven children are able to understand the different durations of the notes and can also include the shape and contour of a phrase. They can relate the different "systems" working in the music. The same is seen for the perception of music: children discriminate different pitches, but also intervals and tonality. As a result of this, children show a growing preference for western tonality and harmony from the age of five years.

Rule systems phase (8-15 years)

In this phase the adult conventions are mastered. This is shown in the perception of music as well as in its production. In singing this means, for example, that children are capable of singing songs in one key, instead of "falling" to another key after every phrase. This key stability is also present in their music perception, as is the children's analytical recognition of intervals.

The graphic representation becomes formal-metric. This means that the drawings convey all aspects of the music in a formal, conventional way. When composing, children in this phase are capable of using idiomatic conventions, which means that they can correctly use the idiom of several different styles. However, the small body of research on style sensitivity in music has not produced clear and definite results yet.

In the rule systems phase the aesthetic experience of works of art becomes more important. Before the age of eight, children are mainly focused on the concrete properties of works of art and on the means to produce them, but in the rule systems phase children develop style sensitivity and this becomes an important aspect of their judgements of musical works (or other works of art).

Professional phase (15 years and older)

Having entered this phase means that an individual is capable of producing works of art that show independence from the conventions and common styles and of making his own rules. Another characteristic of persons in this phase is that they are capable of self-reflection in relation to conventional styles and (their own) works of art. Hargreaves (1996) thinks that this level is only achieved by professional artists. It acknowledges the fact that there are no absolute standards in art and that rules may exist to be broken. An important aspect of performance in this phase is that individuals are capable of adapting to the demands of a situation, as they are able to reflect on this situation.

4.2 The development of expert musical performance

The following section will address several theories on the development of expert (musical) performance. The first model is developed by Maria Manturzewska (1990), while the second model is based on research by Bloom (1985), later adjusted by Ericsson et al. (1993; 1995).

4.2.1 Manturzewska's model

Manturzewska (1990) made an overview of stages in the life-span development of classical musicians. She based this scheme of musical development on the lives of 165 professional Polish musicians[10]. To distinguish between the stages, Manturzewska used five criteria:

1. changes in musical behaviour and form of musical expression specific and typical for a particular stage;
2. changes in motivation and interest in music;
3. changes in musical achievement and activity;
4. changes in style and form of musical learning and musical experience;
5. forms and content of use of individual potential (self-realisation).

Manturzewska learned from the research interviews with the musicians that every stage "seems to be a "critical period" for learning specific skills, particular sensitivity, and readiness to develop and accumulate specific experiences which are important for the musician" (p. 131). She states that the different stages have different durations in the lives of different musicians; the stages are therefore not fixed at certain ages and are overlapping, although Manturzewska gave some rough age indications.

Manturzewska found some interesting differences between singers and instrumentalists, but this seems to have influenced only stages 3 and 5; in stage 3 because most singers start later (see also Jørgensen) and in stage 5 because they usually stop earlier than instrumentalists.

[10] See chapter 2 for more information about this research.

Stage 1: development of sensory-emotional sensitivity and spontaneous musical expression and activity

This stage covers the first six years of life and it ends when systematic music lessons begin. As we will later see, this generally happens at six years. When a child starts before six with music instruction, stage 1 ends at that age. Because of the enormous development a child has in his or her first six years, stage 1 is divided in three sub-stages:

1. the formation and development of sensory-emotional sensitivity to sounds and music (0 – fifteen months);
2. the development of cognitive sensitivity to acoustic and musical stimuli and the development of categorical perception of pitch (sixteen – thirty-six months);
3. the development of musical memory and imagination and spontaneous vocal and instrumental activity (three – five years of age) (Manturzewska 1990, p.133).

Stage 2: intentional, guided musical development

At this stage, that usually starts around six years of age, basic technical and performance capacities and musical knowledge are gained. Manturzewska draws the somewhat idealistic picture of children demanding music lessons because of their need to learn to play on an instrument, even in families without musical traditions. Between the age of ten and fourteen the greatest progress in performance ability develops. According to Manturzewska stage 2 is essential for the development of technical performance. When efficiency in technical performance does not exist in this stage, it is very unlikely to develop later in life. Therefore, misuse of this critical function, starting music lessons after the age of nine, inadequate instruction or too many teacher changes will probably lead to difficulties with reaching a professional level. This stage ends with the transition from primary to secondary school[11].

Stage 3: formation and development of the artistic development

At this stage the young musician reflects on philosophies and develops a personal view on musical performance and interpretation. Usually this stage reaches its peak at 18-20 years. The development of singers, conductors and composers can be different from the development of instrumentalists: singers have their first systematic education in this stage after years of successful amateur singing and composers and conductors have their first non-professional achievements. These first artistic achievements in the lives of singers, composers and conductors seem to be necessary in their musical and professional development. It could be compared to the successful and playful performances of future expert instrumentalists in their pre-school years.

In this stage the relationship with the teacher seems of great importance. Manturzewska draws two possible developmental lines. On the one hand young musician may have a very good and intense relationship with a teacher; on the other hand the young musicians develop within the environment

[11] The age of children at the transition from primary to secondary school differs per country; typically, children are between 12 and 14 years.

and sub-culture of their peers. Although the latter development being normal – and healthy - for young people, Manturzewska explicitly states that for the development of an international career in music it is important to have a good relationship with a teacher or master[12].

Stage 3 ends with the graduation from a conservatoire[13]. In the study of Manturzewska this usually happens at the age of twenty-three or twenty-four. After graduation – sometimes even before graduation - the young musician has to find a place in the professional community for himself. It is likely for the musician to join different ensembles and orchestras. Manturzewska stresses the need for a teacher or manager here, because without one, the musician is more likely not to find the right path for himself. The teacher can help the young musician with setting up contact with other musicians or managers. This depends on the network of the teacher, as is also shown by Sosniak's study (1985).

Stage 4: first professional stabilisation

At this stage, which usually lasts from thirty to fifty years, the musician has found professional employment. The performance activity reaches its peak, as does the geographical span of journeys. In this stage the musician has the highest artistic output (annual number of concerts, recordings and new pieces on the repertoire). Again the importance of a guide (in this stage this could be a manager) is stressed. Without one, the musician may tend to work to hard without rest, which may lead to a period of great physical and psychological fatigue between the age of forty-five and fifty-five. In this "critical period" the musician starts finding new ways of being active as a musician and his interest in pedagogical and philosophical matters increases. In this way, the musician slowly goes into stage 5.

Stage 5: teaching phase

At this stage the musician is more capable of interest in and identifying with others, such as students. The musician has a greater sense of social responsibilities and there is more readiness to become involved in general issues. The amount of concerts will decrease. (Solo-) Singers and violinists usually give their last concert at around the age of sixty. Members of ensembles and orchestras and some pianists continue giving concerts for a longer period of time and therefore stay in this stage longer.

Stage 6: slow but systematic retreat from professional activity

At this last stage the musician gradually retreats from any professional activity. Teachers as well as performers retire, but some keep playing in an orchestra less frequent than before. Some exceptional musicians may switch to representative functions, such as being a member of jury of musical contests or participate in honorary committees.

4.2.2 Bloom and Ericsson's model

Ericsson made a model of expert musical development that is based on interviews held by Sosniak

[12] Please note more information about the relationship between teacher and student, respectively between musicians and their peers can be found in paragraphs 5.3 and 5.4.

[13] With the term "conservatoire" an institution for professional music training is meant here.

(1985) with international-level performers and their parents and teachers. These international performers were active in music, sculpting, athletics, mathematics and neurology – fields that demand long periods of preparation and development. Bloom's study started with interviewing pianists after which the researchers recognised several developmental stages. After the developmental theory was made, it appeared to be applicable to other fields of expertise as well. According to Bloom the development consists of three stages.

Stage 1

The first stage contains the playful actions an individual has in the domain of music at a young age. It ends, as with Manturzewska's model, when instruction and deliberate practice start, when the child has become more interested and shows some potential. In the study by Bloom et al. (Sosniak 1990; Bloom 1985), most of the talented individuals were introduced to their future domain in their families. Their parents were not likely to be professionals themselves, but the field in which their child would become an expert played a major role in the family. The musicians, for example, listened to music almost from the day they were born. Sosniak's description of the first phase implies that the motivation needed to pursue a musical career is based on the joyful interactions with music in these years. She writes: "The effect of the early years of playful, almost romantic involvement with a field seemed to be to get the learner involved, captivated, "hooked"- motivated to pursue the matter further" (Sosniak 1990).

Stage 2

In the second stage the parents help their child to establish regular practice and give support and encouragement when the child improves. As opposed to the first phase in which there is no concern for "correctness", in this phase there is more attention for detail and technical skill. With the performance of the child increasing and improving, better-qualified teachers are engaged and the amount of daily practice increases. There is a greater need of rational instruction instead of the informal and personal way of tuition in the first phase. During this phase the students devote a large part of their time to practice and give up other activities to make this possible. This stage ends with the musician's commitment to pursue activities in the music domain on a full-time basis. According to Sosniak (1990), making this commitment is very difficult for most students. They will have to picture themselves as potential professionals and have to dedicate all their time to their domain. This moment was, for most of the individuals who were interviewed, the first time they made a conscious commitment to the pursuit of excellence. Usually, according to Bloom's study this happened in the musicians' mid-teens.

Stage 3

The third stage consists of the full-time commitment to improving the performance and the young musician making a great effort in reaching the top level of their domain. Usually this involves a search for a master teacher and optimal training conditions. Sometimes, the family of the musician moves to another region to make this possible. In all cases Bloom studied (artists, athletes and

mathematicians and neurologists), the master teacher is someone who himself reached the top level in his field or someone who taught other pupils who reached the top level (Ericsson 1996). The relationship with the teacher was no longer based on a close personal bond, but entirely on the dedication of both the teacher and the student to the field. In this phase the student becomes more independent; he develops personal concerns and ways of working, and solves his own problems. The working is done more for personal satisfaction than to satisfy the teacher. This stage ends when the musician can make a living of his musical activities or when the musician ends his full-time engagement in music.

Ericsson, Krampe and Tesch-Römer (1993) suggest that it is possible to recognise a fourth stage in the development of professional elite performers. This stage is based on research Ericsson et al. performed on violinists and pianists. After more research, Krampe and Ericsson even added a fifth stage to this developmental model (Rink 1995). This way, the model describes the whole life of a musician and not just the learning period. Ericsson et al. (1993) emphasise that musicians need support from important others, such as parents and teachers in all stages.

Stage 4

In this stage, called the stage of innovation, the musician has learned almost everything his teacher is able to teach him. The musician now starts seeking for ways to innovate or improve his domain. Doing so will provide the musician with great public recognition. In The practice of performance edited by John Rink (1995), Krampe and Ericsson give a slightly other description of the fourth stage. In this stage, the musician has to earn a living from public performances, working in ensembles or teaching. According to Rink, Krampe and Ericsonn, when the musician has a solo career this usually promotes his/her development further, whereas teaching or playing in an orchestra need time for deliberate practice. This may mean that the teaching musician or the orchestral musician may have fewer opportunities to further increase his level of musical performance. Krampe and Ericsson acknowledge the fact that hardly any musician will be able to earn a living by solo performing only and will have to teach or play in an orchestra as well. As in Manturzewska's development description, the highest degree of musical success for instrumentalists is in this phase.

Stage 5

This phase denotes the last years before retirement. Most experts will maintain "deliberate practice" in order to be able to perform on a professional level, but it depends on the career of the individual musician. If a musician succeeds in a solo career he will have more freedom and independence than those playing in an orchestra. Some expert musicians had already in this phase given up performing because of problems such as the limited freedom to choose repertoire, difficulties in making practical arrangements, or bad reviews in the media. Some musicians in this stage pursued in teaching.

5 FACTORS INFLUENCING MUSICAL DEVELOPMENT

In this chapter the main factors influencing the musical development of children will be discussed. Manturzewska's research showed that there are several factors contributing to the level of performance the musicians eventually reach. These are starting age, the way of practising, the accumulated amount of study hours, the influence of parents and other relatives and the influence of the teacher. Other researchers have also studied the lives of musicians, but for shorter periods than Manturzewska. For example, Ericsson, Krampe and Tesch-Römer (1993) investigated the amount of hours music students had studied, and Sloboda, Davidson, Howe and Moore (1996) investigated the role of practice in the development of performing musicians. Sloboda (2000) mentioned that there is not much known yet about the musical development of popular musicians, because musical cultures other than classical musical - such as pop, jazz and folk – have received almost no serious scientific attention, which is confirmed by Ter Bogt (2003) and by Green (2003), who writes that "detailed investigations by music education researchers into the specific nature of popular music learning practices or their relationship with formal music education have been relatively small" (p. 6). With the role of types of music other than classical music becoming increasingly important and visible in today's musical practice, it would not be right to ignore the situation of musicians in these genres. Therefore, attention to these types of musicians is also given in this chapter, despite the fact that little research exists.

This chapter will start with a short overview of literature about - the existence of - talent, an area in which heated debates have taken place for years in relation to musical expert performance (e.g. Gagne 1999; Sloboda and Howe 1999).

5.1 IS MAKING MUSIC ONLY FOR THE TALENTED?

There is an on-going debate in music about the origin of expert performance (O'Neill 1997). Some people believe that only individuals with so-called inborn gifts are able to receive an expert level of music performance (e.g. Gagné 1999). On the other end of the spectrum, there are people who think every individual is - in theory - capable of expert performance and that there are other factors contributing to musical expertise. Between these extremes, there are many psychologists and educators - and others - who think that, although inborn talent plays a certain role, a lot of personal and environmental factors are important as well. They assume that the observed behaviour is the result of an interaction between the individual's genes and environmental factors.

Both standpoints have social and educational implications. For example, when assumed that a child does not have any talent for music, it is often denied access to music education. Reactions of parents or teachers to musical utterances of a child may be very sceptical, which in turn makes sure that the child has negative feelings about music making and will not pursue it any further (Howe, Davidson and Sloboda 1998). Kemp and Mills (2003) describe the case when "something has been spotted in

the child that destines him or her for greatness as some kind of musician or at least indicates that it is worth giving the child opportunities that may be denied to other children, for example, lessons on a musical instrument" (Kemp and Mills 2002, p.3). It may have consequences for the motivation and the self-image of the child as well when it is believed to be talented. The idea of a child of being a talented or gifted child can give it the strength to persevere (Howe and Sloboda 1991a).

As there may be differences of opinion about the content and meaning of the word talent, it is useful to have a definition. Howe, Davidson and Sloboda (1998) give a definition of talent that will be used here. Their definition consists of five properties they ascribed to talent recognisable for scientists as well as for outsiders.
The first property is its - partly - inheritable character through genetically transmitted structures. The second property is the presence of early indications that a certain person is talented allowing a trained person to recognise the gift even before the exceptional performance has been shown. The third property is that these early indications make it possible to predict who is to excel later in life and who is not. The fourth property of talent is that only a minority of the people is talented. The last property is that talents are relatively domain-specific.
However, this last property is not acknowledged by everyone. There are psychologists who think highly gifted children or adults have talents for more than one domain, but that the domain chosen is directed by circumstances (e.g. Freemann 1991). Freeman suggests general artistic ability comes from the same broad source, but why a certain field is chosen may, for example, depend on the interests of the family. Ericsson (1997) describes a development in music (and other arts) regarding this subject. In previous times musicians were expected to play several instruments, conduct choirs and orchestras and compose as well, making talent less domain-specific. Nowadays, musicians are highly specialized and their training is focused on one particular specialization. The consequence is that they excel in only one domain.

There are, however, other possible definitions of talent. Gagné (1999) defines (musical) talent as follows: "the demonstration of systematically developed abilities in the playing of a musical instrument at a level which places the individual among the top 10% of peers having similar training" (p.39). This indicates there is quite a difference between this definition and the first one of Howe et al. Howe, Davidson and Sloboda believe that talent is shown by early indications (the second property – see above), but that it is not necessarily a "demonstration of systematically developed abilities". According to them, the systematic development of abilities is what happens after the talent is recognised; it is not the talent itself. What Gagné describes as "musical giftedness" is closer to what Howe et al. call talent: he writes "the term musical giftedness designates the possession and use of natural abilities (or aptitudes) in domains that influence the development of musical talent" (p.39).

In their article Howe, Davidson and Sloboda (1998) give several reasons why people could believe in the talent account. However, they also give some comments on these reasons that make it hard not to search for other important factors that influence the musical development. One argument in

favour of the talent account is the fact many reports exist of very young children already capable of impressive skills. Howe, Davidson and Sloboda's comment on this argument is that these stories are usually reporting from many years back. They are not observed by researchers, but - for example - by parents and, more importantly, many prodigies received from an early age intensive, supervised training and guidance. Kemp and Mills (2002) think that an early sign of musical potential is actually a sign of musical achievement: some children did have learning experiences (formal or informal) other children did not. Because of these learning experiences those children seem to be more talented than other children lacking these experiences. These experiences can be rather simple, like singing children's songs by the parents, but when a child lacks such an experience it will not be likely for the child to sing any children's songs.

Sosniak (1990) writes about the study by Bloom et al. that most of the individuals they studied did not show any sign of precocity in early childhood and early achievement, nor did they demonstrate early commitment and single-minded pursuit of the domain. The acknowledgement of their abilities came only in their teens. Another argument favouring the idea of inherited talent is the fact that relatively rare capacities, which are seen as a part or prove of musicality - e.g. perfect pitch -, seem to appear in some children spontaneously. Howe et al. react to this by stating that a) a perfect pitch is not necessarily a utility to or prove of musical expertise and b) that perfect pitch can be learned. Howe et al. use research by Takeuchi and Hulse to show it is not difficult to train children for perfect pitch before the age of five and that it can be learned even by adults. Takeuchi and Hulse (1993), however, are not as certain about this last statement as Howe, Davidson and Sloboda (1998). They describe several studies that showed an improvement of pitch identification after training, but the adult subjects did not reach the level of an absolute pitch possessor. Cohen and Baird (1990) describe an investigation of absolute pitch acquisition by children aged two to four and adults. It appeared to be difficult to obtain absolute pitch for the children as well as the adults. Cohen et al. assume that it may be necessary for children in order to obtain absolute pitch to have piano (or instrumental) lessons as well as absolute pitch training instead of absolute pitch training only, because in a Japanese study children trained this way did obtain absolute pitch. As a result, according to Howe et al. there is no evidence that absolute pitch appears spontaneously in children, but always after specific practice or training. This is supported by a small study by Plantinga and Trainor, who found that six-month old infants did not possess absolute pitch (2004).

A third argument seemingly in support of the talent account is the reported appearance of biological correlations of certain skills and abilities. An example of this is the bigger left hemisphere of musicians' brains as reported by Schlaug (1995b). It is, however, not certain whether these biological correlations are a cause of the difference in skills or a consequence of the different experiences individuals had[14].

[14] See chapter 6 about the music and the brain for a further discussion of this subject.

A last argument favouring the talent account is the existence of autistic children and so-called "idiot-savants". They seem to be able to perform a specific skill without the development of other - cognitive - skills. According to Howe and Davidson we must keep in mind, however, that the expert performances of these children are accompanied by obsessive interest in this particular skill and high degrees of practice, which makes it more likely to be a consequence of practice than of talent. Krampe and Ericsson add to this argument that a lot of these idiot-savants are blind; therefore their aural skills may be so well developed – partly - to compensate for their lack of sight.

After refuting these arguments in favour of the existence of inherited talent, Howe and Davidson refer to different research findings that contradict the talent account. The first of these is the lack of reports of early signs of musical ability without above-average degrees of parental support or practice. When considering reports of prodigies and early signs of musical talent, those children always were very much supported by their parents, often had a living-in teacher and were (due to these factors) stimulated to practice intensively. There are, according to Howe et al. persons who think of an early interest in music as a sign of musical talent. When thinking of an early interest in music (which is not the same as the skill to perform) as a sign of talent or giftedness, we should be aware, according to Howe, Davidson and Sloboda, that the interests of children are manipulated by the reactions of their parents and important others. Therefore, when a child reacts spontaneously to music in a way the parents like, they will reinforce this behaviour by praising the child or giving it otherwise positive attention. This will make it more likely for the child to act like this the next time it hears music.

Another study Howe, Davidson and Sloboda use to reject the talent account is a study performed by Sloboda, Davidson, Howe and Moore (1996). Sloboda et al. investigated how many hours children needed to practice to be able to enter the next grade in the British musical board examination. They found that there were no significant differences in the amount of practice time needed to reach a certain level between highly successful children and other children and that, according to the researchers, talent had nothing to do with the fact that the successful children entered the next level sooner. The successful children just practiced more. This research suggests that there is a more or less "fixed" amount of hours needed to be able to proceed to the next level. The difference between successful children and others is thus that the most successful children practice more and consequently transfer to the next level sooner. Other research showed that successful musicians need at least ten (Ericsson, Krampe & Tesch-Römer 1993) to sixteen (Manturzewska 1990) years of study to reach a professional level[15]. Simonton (1991) thinks ten years of preparation is an underestimation. Based on his study of 120 famous classical composers he states that most of them started with music lessons at age nine, started composing at age 17 and made their first composition with which they gained a place in the classical repertoire at the age of 26 to 31. However, he acknowledges the fact that there are some "great" composers who start composing at a younger age. He thinks this might be a result of a higher cognitive speed.

[15] Please note in paragraph 5.5 about practice this subject will be further discussed.

A third area of research Howe and Davidson use to refute the talent account is about achieving exceptional levels of achievement in normal people. It appears that after intensive training on specific skills adults were able to perform those skills on a high level. Howe, Davidson and Sloboda reviewed several studies on this subject by Ceci et al. (1988), Chase and Ericsson (1981) and Ericsson and Faivre (1988).

Conflicting evidence from a study performed by Sloboda and Howe (1991) seems to suggest that the amount of practice is not that important. They investigated the musical lives of students from a special music school for musically gifted children. From this study it appeared that the best achieving students had not accumulated the largest amount of study hours. This was the case for their main instrument as well as for all the instruments played by one individual. The best students did spend more hours on their other instruments than the average students, but overall the best achieving students spend less time practising than the average students. The best achieving students also did not spend the most hours playing for fun. Another contradicting outcome from this study is that the best students started later with music lessons than the average students, although this was not a significant difference. From these results the authors conclude that it is not the sheer amount of practice on one instrument that is important, but the distribution of effort across different instruments that accounts for the above average achievement of these students. Krampe and Ericsson (1995) attribute the results of this study to the fact that the practice intensity of these students was much lower than in other investigation on this subject (Ericsson, Krampe and Tesch-Römer 1993) and that only a fraction of the students of the school was working towards a career as professional musicians. Consequently, the differences in outcomes may also be attributed to the selection of the samples.

A third reason for the surprising results from this study is that there were no questions asked about the way the students practised. As will be clear from the next sections, this is an important factor. Sloboda and Howe (1999) give another explanation: the students were selected on the basis of the subjective opinions of their teachers as communicated to them by a single member of the staff, instead of using the English music council board examinations. It was, therefore, rather difficult for the researchers to tell whether these students really differed in their achievements.

It seems as a contradiction to the overwhelming evidence Howe, Davidson and Sloboda offer in their article, but in the end the researchers acknowledge the existence of talent in a strict definition. They select two of the abovementioned five defining attributes of talent: "1) Individual differences in some special abilities may indeed have partly genetic origins, and 4) there do exist some attributes that are possessed by only a minority of individuals" (1998, p.407). In their words: "In this very restricted sense, talent may be said to exist" (p. 407). Kemp and Mills (2002) also acknowledge that not everyone has the same innate possibilities for developing musical skills, they write: "musical potential is something all children have, although arguably some may have more of it than others" (p.4).

It appears therefore that Howe, Davidson and Sloboda (1998) attribute at least a part of the musical performance to talent. Manturzewska (1990) seems to do the same. She mentions that children should start with music lessons before the age of nine, because children will not be able to reach a professional level when starting later – this is clearly not an innate factor. However, Manturzewska keeps mentioning that there are specially gifted children, which implies that she contributes a certain musical level not only to factors outside the child (such as starting age and length of practice), but to talent as well.

Acknowledging some kind of innate potential does, however, not mean that the environment is not important in the development of this musical potential. Gembris and Davidson (2002) explain that many nowadays think that musical ability is a special gift that develops without any environmental influence, because of the notion of the genius that emerged in the nineteenth century. Gembris and Davidson show that genetic factors influence the general – and musical – development in three ways: maturational development, physical capacity, and mental capacity. An example of a genetic, physical factor contributing positively to the musical development is the size of an individual's hands. Persons with bigger hands have an advantage when playing certain music and certain musical instruments. The same goes for mental capacity. A well-developed capacity of problem-solving – which is at least partly inherited as part of the general intelligence - may help people to identify a musical pattern quicker, which makes it easier to perform aural discrimination tasks.

These examples clearly show that innate components are important in musical ability. But, as most researchers now agree (Howe and Sloboda as well as Gagné), to develop an individual's musical potential, environmental influences are of great importance. Especially the interaction between the innate capacities and the environment determine the level of musical performance. Gagné (1999) designed a model that clearly states it is exactly the interaction between personal, environmental and innate factors, which determines one's skills and performance level. His model – the Differentiated Model of Giftedness and Talent (DMGT) - exists of four fields of factors: (1) intrapersonal catalysts (e.g. motivation, health), (2) giftedness (e.g. intellectual of creative giftedness), (3) environmental catalysts (e.g. influence of the social surroundings, influence of persons), and this results in (4) talents (e.g. in academics or the arts). It is important to mention that Gagné adds a fifth element to his model, the developmental process which exists of learning, training and practising.

We could therefore carefully suggest that Sloboda, Davidson, Howe and Gagné both acknowledge the existence of innate talent and the importance of practice and environmental factors. It is the way they stress the different factors contributing to expert performance that differs: Howe, Davidson and Sloboda stressing mainly the environmental or "non-innate" factors such as amount of practice, and Gagné stressing the importance of innate gifts.

Therefore, in the next section several factors that contribute to the development of musical potential will be reviewed: first, some environmental factors such as the influence of relatives and the teacher,

the influence of practice mode, and the influence of starting age and amount of practice will be discussed. The chapter will then end with some considerations about personal characteristics.

5.2 The influence of relatives

5.2.1 Parents

In her study on the life-span development of professional musicians, Manturzewska (1990) asked the musicians about their musical and social family background. She found that most students came from families with a certain degree of musical tradition: fifty percent had fathers and twenty-five percent mothers in the music profession. Only five percent of the musicians originated from a family where there was no musical tradition at all, but it was interesting to note that two of the outstanding musicians came from such a family. Manturzewska thinks therefore that it not essential that a child lives in a musical family, although it is a factor of considerable importance. Green (2003) agrees that for popular musicians the role of parents is also very important and that it is even more likely the musicians come from families in which music plays an important role. In the learning of popular musicians, "enculturation", which is the acquisition of musical skills and knowledge through the involvement in the music and musical practices of a person's society, seems to play a more important role than with regards to classical musicians.

In Sloboda and Howe's study of young musicians at a specialist music school the parents also appeared to be very important for the children. Most parents were involved in music, but this varied from just listening to music at home to professional engagement. Most parents were also involved in their child's practising, for example by praising the child when a piece sounds nice, or by stimulating the child to practice every day. These factors did, however, not differ for the two differentiated ability groups (exceptional and average). This could mean, according to Gagné (1999) that the influence of the parents is not that relevant. However, on the other hand, this result could also be attributed to the fact that the classification of the students in the two ability groups was not correct (Sloboda and Howe 1999; see also section 5.1). In their 1996 study, Sloboda et al. tried to correct this fact. They found several differences between the five groups used in this research[16]: groups 1 and 2 were characterized by high parental involvement in the child's practice, whereas groups 3 and 4 showed intermediate levels of parental involvement and group 5 showed low levels (Davidson, Howe, Moore and Sloboda 1996). There was also a difference in the involvement of the parents in music listening and music playing. The mothers in group 1 were more involved in listening to and playing music than the mothers in any other groups, the fathers in groups 1 and 2 were more involved in music than the fathers in groups 3 and 5. There was no difference between the fathers in group 4 and the other groups. Another interesting result of the study was that by twenty and forty percent of the parents in groups 1, 2 and 3 a change was reported in their musical behaviour and involvement after their child's lessons

[16] See for more information about this study Chapter 2, p. 24 and further.

started, while only 3 percent of the parents in groups 4 and 5 reported such change. By combining several interview questions, Davidson et al. conclude that the parents of groups 1 and 2 children were already interested in music, and became more interested in music after their child had started with music lessons. The parents in group 3 were not really involved or interested in music before their child had started, but after that their involvement grew. The involvement of parents in groups 4 and 5 was minimal before the lessons started and this did not change afterwards.

O'Neill (1997) investigated the influence of several factors contributing to the performance level of young children. She interviewed the children before entering formal music education and one year afterwards. One of the factors she thought may influence the performance level of the children was the involvement of parents in the child's lessons. She found that parents of high and medium achieving children were significantly more involved than parents of low achieving children. But, as O'Neill remarked, it is not clear whether this difference is caused by the progress of the better achieving children or the actual cause of the improved achievements. It could be possible that parents are motivated to become more involved in their child's lessons because the child makes such good progress. O'Neill suggests, however, that because this study concerned the first year of music lessons, the parental involvement preceded the success in instrumental learning. This conclusion differs from the conclusion by Davidson et al. (1996): they stated that parents who follow rather than lead their child's growing sense of musicianship may assist the learning process most.

MacMillan (2004) investigated the involvement of parents with their child's music lessons and practice, and the way teachers encourage parents to be involved. She found that some teachers think it best when there is no parent involvement, because it is the child's domain or practice is the child's own responsibility. Other teachers, however, encourage the parents to be involved. From her research she found that it was of no importance whether the parent was capable of playing a musical instrument; what was important was whether the parent had a sense of being helpful during practice. In contrast to other research (e.g. Davidson, Howe, Moore and Sloboda 1996) MacMillan found no correlation between parental involvement and child achievement or enjoyment. She found, however, that children receiving parental support enjoy it. She thinks the contrasting results are due to the small sample and the differing qualities of the teachers in the study.

Hallam (1998) also investigated the influence of several factors on the musical achievement of children and the reasons for dropping out on musical education. She studied 109 children ranging in age from 6.6 to 16.3 years who were playing their instrument between 3.3 and 9.75 years. All the children received their lessons in small groups from the same music teacher. She found that the influence of parents is mainly on the practice of the children and less on motivation or learning outcome. Parents influenced the amount of practice more than teachers or peers. Howe and Sloboda (1991a) write about the interviews they had with parents of young music students: "The unspoken theme that runs through nearly all the observations is one of quiet and dogged perseverance in the undramatic process of helping the child get the work done" (Howe and Sloboda 1991a, p. 51).

Green (2003) describes that for most of the young people she studied the parents were very important. They gave the children verbal encouragement, but also organizational and monetary support. Some of the parents also taught some of their own knowledge to their children, for example showing chords on the piano or the guitar. One of the boys Green interviewed had received support from his parents when he was young, but when he wanted to become a professional popular musician, he and his parents started to have serious conflicts. This seems to contradict a conclusion from Bennett and Finnegan who are cited by Clawson, who writes that both authors stress one of the central characteristics of rock music is its relative autonomy from direct adult imitation, instruction and supervision (Clawson 1999).

Gembris and Davidson mention several ways parents influence their child's musical development. The first thing that seems to support the musical development is music-related activities in the family. These activities are mainly singing and making music together, but attending concerts, discussing music together and practising in the parents' presence also contribute to the musical development. Gembris and Davidson mention outcomes from Manturzewska's study of Polish musicians (see also Manturzewska 1990). One parent characteristic she found is the child-centred attitude of the parents with an emphasis on the musical education of the child. This means that it is important for the parent to support the child's musical activities. Other characteristics Gembris and Davidson mention are:

- Deliberate organization and channelling of child's interests, time, and activities
- At least one person in the family believing in the potential of the future musician and encouraging the child
- Music being a genuine value in family life
- Emphasis not being placed on a musical career but on enjoying making music
- Praise and rewards even for smaller successes
- A positive emotional atmosphere for musical activity
- Careful selection of teachers and monitoring of musical development
- Conscious and active organisation of a supportive and understanding network for the child, including personal contacts to professional musicians and music teachers
- Willingness to invest considerable time and effort in musical activities (Manturzewska 1995 in Gembris and Davidson 2002).

Some of these are also mentioned by Howe and Sloboda (1991) when they write "[T]ime, transport, money, organisation and motivation are vital elements which nearly all of these parents provided" (Howe and Sloboda 1991a, p. 51).

Stollery and McPhee investigated what factors contributed to the development of engagement in music for music teachers and music psychologists. They called these factors "crystallising" experiences. The two most mentioned experiences were "motivation through praise and enhancement of self-esteem" and "parental encouragement and support in various forms" (Stollery and McPhee 2002, p. 93). Therefore, musically educated people, like music teachers, indicate that the influence of the parents on their musical development is very important.

The influence of the parents can already be important in early childhood. The intensive, quasi-musical communication, including holding, rocking and singing to the child, between the child and its parents or other caretakers, connects the love and care of the parents to the experience of music. This gives the child a positive feeling listening to and making music, which is important in becoming motivated and hence has a lifelong influence (Gembris and Davidson 2002).

5.2.2 Siblings

There is not much known yet about the influence of siblings, but from the literature on developmental psychology it is known that siblings can influence each other. For example, from various studies cited by Davidson, Howe en Sloboda (1997), it is clear that older siblings act like a sort of teacher for their younger siblings. Not only in the musical area older siblings act like a sort of parent to their younger brothers or sisters, this happens throughout life, mainly because the older siblings imitate the parents when they interact with their younger brother or sister (Seifert and Hoffnung 1994).

Davidson et al. (1997) asked the subjects whether their siblings had any influence, and, if so, what influence this had been. It appeared that most subjects had experienced a neutral or positive influence from their brothers or sisters. The influence existed either of inspiration by the sibling or of imitating the sibling, mostly because the sibling already played a musical instrument. The older sibling is then a role model for the younger child (Seifert and Hoffnung 1994). Sloboda and Howe (1991) also found this kind of influence in their study of high achieving and average students of a specialist music school. Ten subjects reported being bullied by their sibling(s), but for six of these subjects this had a positive effect.

In an earlier study Howe and Sloboda (1991a) investigated the role of family influences on 42 children at a specialist music school. They found that almost half of the children had been influenced by older children, mainly siblings. The sibling playing an instrument caused awareness of music at the child or the possibility to play an instrument. It also provided a model for the child it could copy and created an atmosphere in which music playing and practising was seen as normal. In some cases the sibling had a more negative role. Some children started playing an instrument because of jealousy. There was, however, no difference between high and average achieving children. Another negative influence of siblings could be the sibling also plays an instrument, but does this much better than the other child. This is likely to cause some jealousy (Seifert and Hoffnung 1994). Other influence from siblings may come from the sibling imitating the parents in being interested in the musical child. This way, the sibling provides external motivation to the musically educated child (Davidson 1997). From the already mentioned study by Stollery and McPhee (2002) it became clear that motivation provided by siblings and other members of the family was a very important "crystallising" experience for music teachers, which were questioned about important factors contributing to their musical engagement.

5.3 The influence of the teacher

Manturzewska mentioned in her study on the life span of professional Polish musicians (1990) the importance of the teacher. She puts it very clearly: "What is, however, of paramount importance here is the presence of specifically musical motivation (drive toward music) and the personality, musical competence, and socio-professional prestige of the teacher, who becomes a "master" for the aspiring musician" (Manturzewska 1990, p. 125). Gembris and Davidson agree with her and say it even shorter: "Teachers are perhaps the most important early influence besides the parents" (Gembris and Davidson 2002, p.23). They explain this is because teachers "transmit musical abilities but also because they more or less influence musical tastes and values and are role models and hold a key position with regard to motivation – for good or for bad" (ibid.). Stollery and McPhee (2002) also have some evidence from their study on "crystallising" experiences for music teachers, that the inspiration from a gifted teacher is a very important factor in the musical development. The music teachers, music specialists and educationalists they questioned expressed the opinion that the influence of a gifted teacher was one of the three most important factors influencing their musical career.

However, the influence of the teacher may be declining. Gembris and Davidson cite several studies about music listening behaviour of young people. American research performed in 1986 showed that 12-to-14-year-old Americans listen to music more than seven hours a day on average. A German study showed that 93% of the children aged six to nine hear music in their leisure time and 98% of the 10-to-13-year-olds. It is therefore clear that children hear more music outside than during their music lessons. This may reduce the influence the teacher has on musical taste and values of the student and also results in the child having more musical role models than just the teacher. The exact influence of this is, according to Gembris and Davidson (2002), not clear yet due to methodological differences in the performed studies. They think, however, that musical development cannot be explained without taking these influences into consideration.

Despite the above, the master is important because the – excellent - student develops and grows in the relationship with the teacher. A good master, according to Manturzewska, not just concentrates on the technical side of the musical development, but also helps developing the entire personality. The teacher accompanies the student to auditions or concerts, shows him what books to read or what music to play and introduces the student into professional circles. From the research done by Bloom et al. (Sosniak 1990; Bloom 1985), this appears to be true. The teachers of the young people studied by Bloom and colleagues encouraged their students to take part in public performances, arranged meetings with peers with the same interest or with professionals in the field of the students. The teachers also taught the students important historical facts about their domain by recommending books or recordings.

Manturzewska's research showed that students without a master grow up and develop themselves within the environment and the sub-culture of peer groups. According to Manturzewska this is a

disadvantage. Because all the outstanding musicians in the study did have a master, it seems that having a (good relationship with a) master is a prerequisite for a career as a soloist. The musicians who found employment in orchestras or ensembles did develop in peer groups. According to Manturzewska, however, the period of finding employment as a professional musician was longer and more erratic than for those who had a master or manager.

Other studies also stressed the importance of the teacher. Jørgensen studied the age at which children started with music education related to their level of performance at the conservatoire to find an answer to the question whether it is necessary to start early in order to reach a high level of performance. It appeared that the starting age is a very important factor, but Jørgensen found four other important factors. One of these is the "careful and appropriate guidance from a teacher" (p.236). Krampe and Ericsson (1995) state that "the earlier musicians find appropriate coaching, the more considerable the benefits for their development" (p. 86). Obviously, this begs the following question: what is appropriate teaching? This question will be considered in paragraph 5.5.

About the personality of the teacher Kemp and Mills (2002) state that in the first few months a child has music lessons, it is important for a teacher to be warm, nurturing and to be able to provide a playful climate. Afterwards the teacher will modify its behaviour according to the personality of the child. This is in accordance with findings of several researchers in the general field of education, who all acknowledge the importance of certain characteristics of the teacher. Skinner and Belmont (1993), for example, found that a high involvement of the teacher is very important to the children's experiences. Deci and Chandler (1986) found that a friendly and warm teacher is important for student motivation. Howe and Sloboda also confirmed this in their study on young music students (Howe and Sloboda 1991b). They conclude from their research that, at the earliest stage of musical training, it is far more important for a teacher to be effective at motivating and encouraging the child than to be a highly skilled performer. The concert pianists in Sosniak's study (1985) confirm this finding. Almost all of them had a warm and friendly teacher when they started. Most of those teachers were not very famous or special musicians, but just "the teacher in the street".

When a child becomes older, the character of the teacher becomes less important, and the professional qualities of the teacher become more relevant. Gembris and Davidson (2002) studied differences in their judgement of their teachers between good students and children who stop with music lessons. Because the good students in this study became more self-motivated, the professional qualities of the teacher gained relevance compared to the personal characteristics, whereas the children who stopped did not make this distinction between personality and professional qualities. A study by Lepper and Woolverton showed that in expert teacher behaviour there is a balance in focusing on affective and cognitive factors (Lepper and Woolverton 2002).

Besides the warmth and friendliness of the teacher, there appears to be another aspect of the teacher's character important for the relationship with the pupil (Sloboda and Howe 1991). This was

described as the amount of autonomy a teacher gives to his students. Most students liked it when the teacher challenged them and made them practice, and disliked when the teacher was too much laid back. However, very strict teachers were also not liked by their students. This is in accordance with literature about expert teachers. Skinner and Belmont showed that the amount of autonomy given to the students is crucial for students' motivation (1993). Kemp and Mills (2002) also stress it is often the approach of the teacher that will lead to a lack of recognition of a child's musical potential or motivation. This could be caused by a "misfit" between the teacher and the pupil.

Another aspect of the influence of the teacher is the relationship between the teacher and the child's parents and the way the parents are in contact with the teacher. The more contact there is between the parents and the teacher, the better it seems to be for the musical development of the child.

A last distinctive factor in effective training concerning the teacher is whether a person is trained individually or in a group. A study by Bloom (1984, in Lepper and Woolverton 2002) showed that pupils taught by a tutor did significantly better than pupils taught in a group. In most teaching situations in music, the teacher or tutor is not around every day or the entire day. Therefore the teacher designs practice activities for the pupil that maximise his improvement (Lepper and Woolverton 2002). These practice activities are meant to be used by the pupil during the time in between two meetings with the teacher. A study by Davidson, Howe, Sloboda and Moore (Sloboda, Davidson, Howe and Moore 1996, and Davidson, Howe and Sloboda 1997) showed that the three most successful groups of subjects (see page 22) received individual instruction; the other children received group instruction only. According to Davidson et al. this means that if a child wants to reach a high level of performance, it is likely to benefit most from one-to-one tuition. Advantages from one-to-one teaching are the individualized character of the tutoring which enables the teacher to direct all his attention to one pupil and thus eliciting more effort and on-task attention from the pupil. Another advantage from this method is immediacy: feedback or results are known to the student as soon as he has performed it, or only shortly after it. This is positive, as it is more effective and likely to be better understood. A last advantage is that there is more interaction between teacher and pupil. The teacher is able to react more to the needs and previous knowledge of the student and the student can show his personal preferences (Lepper and Woolverton 2002).

In contrast to the classical music student, teachers seem to play a less relevant role in the development of popular musicians (Green 2002; Clawson 1999; Bennett 1980). In Clawson's study most musicians were primarily self-taught. Organisational matters done by teachers for classical music students, such as contact with peers or information about music or competitions, are accomplished by the young popular musicians themselves. This does not mean, however, that popular musicians or children wanting to become a popular musician never have a music teacher. From the fourteen musicians in Green's study thirteen had received music lessons; five of them had also received theoretical lessons. However, no accounts were made about the special or crucial influence of this teacher on their musical careers.

5.4 The influence of peers

The influence of peers is discussed only by Green (2002) in her study on popular musicians and shortly by Manturzewska (1990), Clawson (1999) and Bennett (1980). For Manturzewska the influence does not seem a positive one, when she writes that young musicians influenced by their peers instead of their teacher have a bigger chance of not finding the right path for themselves.

The influence of peers is estimated much more positive and more significant by Green, Clawson and Bennett. According to Green, the solitary activity of listening and copying recordings or live music (see section 5.5.1.) is accompanied by other practice activities that are equally important. These practices involve friends, siblings and other peers. Starting rock bands acquire their members from their peer groups, they emanate from friendship in which socialising and music making are closely linked (Clawson 1999). Green distinguishes two kinds of peer-involved activities. The first is peer-related learning. This entails the teaching of one or more person(s) by a peer. The second is group learning, which is less hierarchic: the learning occurs as a result of peer interaction and there is no "teacher" involved. Both activities can happen between only two people, but also in larger groups; they can occur in organized meetings but also in casual encounters; they can happen during or apart from music-making sessions. Most of this peer-involved learning occurs in bands, which results in a difference between boys and girls, as boys tend to start a band at a younger age than girls.

Clawson also describes that peers are very important in popular music. Especially in starting bands, the members are peers both in age and musical level. But she implies that learning is more limited than Green assumes, because "a highly skilled musician would be playing in a more highly skilled band" (Clawson 1999, p. 104), thus implying that beginning musicians do not meet more skilled colleagues. But she acknowledges the fact that for the musicians' development joining a group or band is essential. This also is noted by Sloboda (1990) who concluded that several factors seem relevant for untutored development of jazz skills. One of these factors is the "opportunity to take part in communal jazz activities where "mistakes" are tolerated and where one can choose the level of risk and difficulty of one's own performance" (p. 174). Therefore, not only in the field of pop music, but also in jazz taking part in a band or other communal activities seem to be important. An example of this way of learning is provided by Collier who described the musical development of Louis Armstrong (summarized in Sloboda 1991). Armstrong learned to sing and received thorough ear training in a vocal quartet he formed with boys in his neighbourhood. After having done this for a few years, he joined a band in which he learned to play the tambourine, drums, alto horn and bugle without a teacher. Not until he was nineteen and already an established professional musician (Sloboda 1990), Armstrong met a person who functioned as a sponsor and teacher and started learning musical notation.

Two other activities related to the influence of peers that Green mentions are learning from peers by watching each other and talking with peers about scales, harmonies, metres, styles, music history,

chords instruments etc. However, this talking happens not only between peers but also with older, more experienced musicians. This kind of peer-learning is also recognised by Bennett (1980): by talking with and watching each other, young rock musicians and starting bands gain their initial expertise as rock performers. A final point about the influence of peers in the learning of popular musicians is that friendship between the musicians is highly important and has an enormous effect on their learning experiences. Possibly this could be compared to the importance of a friendly and warm teacher for starting classical music students.

5.5 Practice

In this paragraph, the following aspects of practice will be discussed: the way of practising, the starting age and the amount of practice.

5.5.1 Why practice and how

Many believe that maximal performance is reached by merely engaging in a practice activity in a sufficient amount. However, already in 1897 Bryan and Harter showed in a study of Morse code operators, that with mere repetition the performance of a certain skill does not improve to the maximum level. If further improvement was to be reached, the practice of the skill needed to be thoroughly reorganized (Bryan and Harter 1897; Ericsson, Krampe and Tesch-Römer 1993). Bryan and Harter (1897) write: "it is intense effort which educates" (p.50). They describe that the level of Morse coding usually stays at the same level for years unless an individual is forced to improve himself in order to secure a certain job position. Ericsson (1988) provides evidence that practice also improves the memory skill. He describes the case of a student improving his skill to memorise digit-spans from seven when starting the experiment to almost eighty, two years later.

There is evidence present day performers in sports and music are far more capable in comparison to their colleagues fifty years or a century ago. World records in sport have improved, sometimes a few times a year, and music pieces once thought of as too difficult to be played, belong now to the standard repertory. Ericsson (1996) cites Ericsson and Lehmann, who in 1994 studied the recommended sequence of piano instruction at music institutions and music curricula. They found that modern techniques (for example polyrhythm) are estimated to be more difficult than older techniques and hence are placed later in the study programme. In addition, they found an increase in difficulty of piano sonatas from 1750 (Haydn) to 1825 (Schubert) based on published difficulty ratings. This explains why musicians' abilities have improved: it is only possible to improve a skill if you know what you would like to be capable of. The (musical) culture in which an individual lives and which demands certain skills from this individual is an important factor (Lehmann, Sloboda, Woody 2007). If music of a certain level has not yet been composed, it is impossible for a musician to reach that level, because he is as good as the most difficult piece he has played. This is illustrated by an anecdote described by Ericsson, Krampe and Tesch-Römer (1993). "When Tchaikovsky asked the greatest violinists of his day to play his violin concerto, they refused. Today elite violinists consider this concerto part of the standard repertoire" (p. 366).

Lehmann (in: Altenmüller, Wiesendanger and Kesselring 2006) mentions some other causes that explain why musicians are more capable than in earlier times. In the past, many instrumentalists used to play more or less by sight-reading, using their improvising skills more than their technical abilities. Related to this issue is the fact that modern audiences expect a near-to-perfect performance, which also does not vary too much from earlier or future performances or from CD-recordings from a particular musician or musical work. Musicians have to practice more and longer to be able to meet these expectations and consequently become better musicians than their colleagues in the past.
Other reasons Lehmann mentions are that the instruments have become better and more suited for changes in dynamics and for playing technically difficult passages, and that today's musicians are usually specialised in one instrument where it was common for past musicians to play more instruments, compose and teach younger musicians. Training plays, according to Lehmann (2006), an important role in the better achievements of modern musicians as well, because there are more and better educated teachers available who use specially designed training programmes.
A last reason Lehmann lists is that musicians (similar to for example sportsmen) want to become better than other musicians in competitions and therefore are motivated for the years of practice.

The above mentioned facts already reveal some goals of practice, mainly practice to master a (new) piece and practice to improve. Barry and Hallam (2002) mention several purposes of practice. Musicians practise to "acquire, develop and maintain aspects of technique, learn new music, memorize music for performance, develop interpretation and prepare for performance" (p. 155). The main purpose of practice is to enable musicians to perform physical, cognitive and musical skills fluently and with as little conscious control as possible in order to free cognitive processing capacity for higher mental processes such as the communication of an interpretation. In developing a motor skill three stages are recognised. The first is the cognitive-verbal-motor stage in which learning and performing is under conscious control, takes effort and may be accompanied by words. In the second, associate stage, the learner becomes more able of putting the sequence of responses together that are needed for the desired outcome. In the third stage, called the autonomous stage, the skill becomes automated and without conscious effort (Barry and Hallam 2002).

According to Ericsson, Krampe and Tesch-Römer (1993), it is possible, after thousand years of education, to name four conditions for optimal learning and skill improvement. They reviewed several studies for this purpose (Bower and Hilgard 1981; Gagné 1970).
The first condition is motivation. Without the individual's motivation to attend to the task and persist in trying to improve their skills, it would not be possible to improve one's performance, because of the great effort and amount of time it takes. Because deliberate practice is not enjoyable and requires effort, individuals are usually only motivated to do so, because they want to improve their skills. This is even strengthened, as deliberate practice generates no immediate monetary rewards and generates costs (such as access to teachers and training environments). An individual engaged in deliberate practice will therefore have an understanding of the long-term consequences of his practice and will have a clear end in view. According to Ericsson, Krampe and Tesch-Römer (1993) the only reason that individuals are motivated to engage in deliberate practice is that the practice improves their performance[17].

[17] For a discussion on motivation, see also paragraph 5.6.

The second condition is that the design of the task should take into consideration any pre-existing knowledge and abilities. This is to ensure that the task is well understood after a short period of instruction in order to prevent the task being too difficult for the student. This condition is important, as it is discouraging for most people when they are underestimated (Deci and Chandler 1986).
Giving immediate informative feedback and knowledge of results of his performance to the learner is the third condition for performance improvement and optimal learning. Without this, efficient learning is impossible and improvement minimal.
The last condition is the repeated performance of the same or similar tasks by the learner, given that he other condition are satisfied. Ericsson, Krampe and Tesch-Römer (1993) summarise the conditions as follows: "To assure effective learning, subjects ideally should be given explicit instructions about the best method and be supervised by a teacher to allow individualised diagnosis of errors, informative feedback, and remedial part training. The instructor has to organise the sequence of appropriate training tasks and monitor improvement to decide when transitions to more complex and challenging tasks are appropriate" (Ericsson, Krampe and Tesch-Römer 1993, p. 367).

Davidson, Howe and Sloboda (1997) also acknowledge the fact that sheer amount of practice is not enough to improve one's performance. They cite studies by Gruson (1988) and Miklaszewski (1989), stating that the structure of the practice is an important factor. Miklaszewski's study of an expert pianist showed that this pianist studied a piece of music in fragments. The lengths of the fragments became longer as the practice progressed and the fragments improved. The pianist used the structure of the piece to divide it into fragments, but for the most difficult passages he used smaller fragments. Other practice techniques used by the pianist were visually examining the piece during practice, changing between fast and slow tempi and writing comments or fingerings in the score. In a study of a cellist preparing for a concert, the researchers found similarities to the abovementioned approaches. The cellist started the practice by playing the piece sight-reading. In the sessions after that she practised the piece in parts. When she made errors, the cellist stopped and played the same fragment another time (Lisboa, Chaffin, Schiaroli and Barrera 2004). During the practice period, the segments without interruptions become longer.

Gruson compared young instrumental learners and more experienced musicians. She found that the experienced musicians paid more attention to structural units in the music – for example a theme - and, as in Miklaszewski´s study, studied those structural units apart from the rest of the piece instead of repeating the whole piece again and again. The beginners tended to play the whole piece several times instead of playing only those fragments that are not played well. Other practice behaviours that increase as the musical level is increasing are self-guiding speech, total verbalizations, and playing hands separately (Gruson 1988). Gruson also investigated whether the practice behaviours changed during a sequence of practice sessions of the same pieces. This appeared not to be so; hence the differences between the separate performance levels remained the same during ten practice sessions. From this Gruson concludes "it appears to be many hours of practising a wide variety of music pieces that influences practising behaviours" (Gruson 1988, p. 104).

Ericsson, Krampe and Tesch-Römer (1993) call the above-discussed practice activities "deliberate practice". They distinguish these from other activities such as playful interaction, paid work (such as a public performance), and the observation of others. They summarize the activities of deliberate practice as follows: "The most effective learning requires a well-defined task with an appropriate difficulty level for the particular individual, informative feedback, and opportunities for repetition and corrections of errors. When all these elements are present, the term deliberate practice can be used to characterize training activities" (Ericsson 1996, p. 20-21).

When musicians study too much time every day they may fall to exhaustion. Several studies quoted by Ericsson et al. indicate the following findings. There is no benefit from practice duration exceeding more than four hours per day and reduced benefits from practice exceeding two hours per day. Studies of the acquisition of typing skill and other perceptual skills show that the best amount of deliberate practice per day is probably closer to one hour. However, the studies Ericsson et al. use here are rather old, dating from the 1930s to the 1980s. The reason that students are able to engage in deliberate practice for only such a short time per practice session is that it takes so much effort. In order to be effective, the practising individual should be fully attentive to his playing so that errors can be improved. It is not possible to do that for a long period every day without risking exhaustion. But, Ericsson, Krampe and Tesch-Römer (1993) have some evidence that it may be possible to slowly extend the amount of practice an individual is capable of each day. This is only possible, however, when a person takes the time to recover from his practice. It is probably possible then to extend the daily amount of deliberate practice to four hours per day. This is the daily amount the best and good violinists and the professional pianists in the study by Ericsson, Krampe and Tesch-Römer studied alone. The authors think four hours deliberate practice per day is the maximum amount that can be sustained without exhaustion. This does not mean, however, musicians can be involved in music only four hours per day: they engage in other musical activities as well, such as practice with others, playing for fun or taking lessons (Ericsson, Krampe and Tesch-Römer 1993). Barry and Hallam (2002) confirm this, based on Oxendine (1984). They write that short practice sessions are usually more effective than long practice sessions, but at the same time, that longer and more complex tasks sometimes require longer practice sessions. They also state that group practice sessions may take longer than individual sessions, because a person involved in a group activity is probably not playing the entire time, which is of course the case in an individual session. This probably explains why the musicians in Ericsson's et al. study (1993) are able to practise for about four hours individually and in addition practise with others or in different ways during other moments of the day.

In their study of the role of practice in the development of performing musicians, Sloboda et al. found a weak relationship between informal practice and level of performance (Sloboda, Davidson, Howe and Moore 1996). The lowest achieving individuals did the least of this kind of practice, but the best achieving individuals did not spend the greatest proportion of their total practice time to informal practice but to deliberate practice. However, because the best achieving individuals spend so much time on practice (formal and informal), it is still possible that they spend more hours on informal practice than the lowest achieving individuals.

An interesting feature of high level performers' practice found by Sloboda et al. (1996) and Ericsson et al. (1993) is that the best achieving musicians spend the greatest part of their deliberate practice in the morning. According to Sloboda, Davidson, Howe and Moore (1996) the hardest and less rewarding practice - of scales - was done significantly more often in the morning by the best achieving individuals than in other parts of the day. For the other groups there was no significant difference in time of day. They found no difference in time of day for the practice of repertoire between the different groups they studied.

The violin study of Ericsson, Krampe and Tesch-Römer (1993) showed that the two best groups of violinists preferred to practice alone before lunchtime while the third group (the music education students) did not have such a preference. The best and good students also studied in the afternoon, the amount of study hours per day accumulated up to eight hours (Krampe and Ericsson 1995). The expert pianist studied by Lehmann and Ericsson (1998) during her preparation for a public performance also preferred to practice the most difficult pieces in the morning.

Green's study on popular musicians (2002) suggests that their learning is rather different from what is mentioned above. The main difference is that popular musicians "often take the informal route of music learning" (p. 5) and that when they have formal education as well, the share of informal learning in their musical development is much larger than the share of formal education. Except one, all musicians in her study had received some formal music education, nine of them even classical, but for most of them this formal education lasted for only a few months or years. From her research Green learned that the most occurring informal learning practice of her subjects was hearing and copying recordings. For most of them this was a more or less unconscious learning process, part of their "enculturation". Green distinguishes three kinds of listening. The first is "purposive listening", with the purpose to learn something and to put that to use afterwards. This type of listening is part of informal and formal learning. The second type of learning is "attentive listening". This requires the same level of attention as purposive listening, but it has not the aim to learn something. The last type is "distracted listening": the only purpose is enjoyment or entertainment. These three kinds of listening can vary easily, even within one song or piece of music. Green states that for all musicians listening is important in their development and is part of formal and informal education, but for developing popular musicians it forms a central part of their learning process.

Practising by listening was combined with the use of notation by six of the musicians and all of them used of had used books or magazines about playing techniques. Bennett (1980) and Clawson (1999) also describe this kind of learning from listening to recordings. Green, Bennett and Clawson mention playing together in a band as another very important way of practising for popular musicians, as has already been discussed in paragraph 5.4.

5.5.2 The importance of the starting age or "the-ten-years-rule"

There are many famous stories about children able to perform professionally at a very young age, the so-called "musical prodigies". This phenomenon seems to contradict the presupposition in this literature study that an early start and large amounts of practice are more important for developing high levels of musical performance than the possession of innate talent. As mentioned, Howe en Davidson (1998) showed that there are several reasons not to attribute the performance of the prodigy to sheer talent. In the following section several studies will be reviewed that have focussed on the importance of an early start with musical instruction and practice for reaching a high level of performance.

The study performed by Manturzewska (1990) showed that there are several factors contributing to eventual success. An important finding of Manturzewska was that most of the musicians in the study started their music lessons between five and six years, although there were some musicians who stared as late as 26. Manturzewska believes this is related to the year of birth of the musicians and hence other educational systems: the late starting age was only found in the groups of the oldest musicians, those born between 1890 and 1925. Further analysis of the data suggests, according to Manturzewska, that "the age at which a person starts his/her music education is essential for the future career" (p.124). "The hypothesis can be formulated here that if musical training starts after nine, the career, particularly in the cases of virtuoso-type pianists and violinists, will not lead up to the mastery regardless of the musical abilities and degree of motivation" (Manturzewska 1990). Of the musicians in the study starting late with music education, only the ones active in conducting and composing were able to reach the international level of musical activity. The mean age at which the outstanding musicians started music lessons was 6.9 and age of first music lessons ranged from four to eighteen – those starting at age eighteen being a member of the oldest cohorts (born between 1890 en 1925). The mean starting age of the total sample was 8.97, which is considerably older than the outstanding musicians, the age of first music lessons for the whole group ranged from four to twenty-six– again those starting at age twenty-six being a member of the older cohorts (born between 1890 en 1925).

The study of Jørgensen (2001) shows a difference between singers and instrumentalists (except church musicians) concerning the starting age. The mean age at which the singers started (14.4) differed significantly from the mean age at which instrumental players started (11.3). The minimum age at which the vocal students started was nine years; the minimum age at which the instrumental students started was five years.

Jørgensen tried to answer the question whether the excellent students started having music lessons earlier than the good or very good students. The results showed that the students with the highest grades (the excellent students) started earlier with music lessons than those with lower grades. The mean age at which the sub-groups started is 11.3 for excellent students, 12.5 for very good students and

14.8 for good students. When these results are divided into separate study programs (instrumental, vocal, and church music), the results show that for the instrumental students the mean age at which they started music lessons differs not significantly for the three level sub-groups. The mean starting ages of excellent, very good and good instrumental students is respectively 11.4, 11.5 and 11.0.

For the vocal students a significant difference was found. Both minimum age and mean age are lowest for the excellent students (min. age 9, mean age 9.5) and highest for the good students (min. age 16, mean age 18.0). For the church students the difference between the level sub-groups is in the expected direction (lowest starting age for excellent students, highest starting age for good students), but the difference is not significant.
From these results Jørgensen draws the following conclusion: "For the whole student population, the conclusion is that those with the highest grades started earlier with lessons on their main instrument than those with lower grades" (2001, p.237). It is clear, however, that this conclusion will not stand for the separate specializations, for which Jørgensen gives several reasons. The first reason is the amount of practice an individual has already studied in his life at the time of the study (Ericsson, Krampe, Tesch-Römer 1993), which is likely to differ per student. Two other factors, already mentioned are the quality of the teacher (section 5.3) and the quality of the practice (section 5.5.1). Jørgensen adds a fourth factor: a combination of influences that together account for some of the variance between students. Among these are, for example, the influence on the performance level of wind instrumentalists from band experiences; the influence of students playing on their own for several years before having any lessons; the influence of playing the recorder before starting with another wind instrument, or the piano before starting with organ. These are not factors that were addressed in this study, but may have considerable influence on the performing level of the students. "Nevertheless", Jørgensen states, "this study shows, above all, that there is a positive relationship between starting age with lessons and later levels of performance" (2001, p.238).

In the study by Ericsson et al. (1993) with pianists, the expert pianists all had more than 14 years of experience, while for the amateurs the range was from five to twenty years of experience. The experts started significantly earlier (5.8 years of age) with their lessons than the amateurs (9.9 years of age). On average the expert pianists received 19.1 years of formal instruction, significantly more than the amateurs, who received 9.9 years of formal instruction.
From the results of their studies on violinists and pianists, Ericsson, Krampe and Tesch-Römer (1993) conclude the following about the relation between starting age and performance. The expert pianists started reliably earlier than the amateur pianists. However, for the violinists there was no difference in starting age (the mean starting age was 7.9 years), but it must be pointed out that the violinists were all professionals or trained to be professionals and amateur violinists were not involved. In another study of pianists, Krampe and Ericsson (1996) again found that expert pianists started reliably earlier than amateur pianists: the mean age at which the professionals started music lesson was 6.75 years and the mean age at which the amateurs started was 9.33 years. For both older and younger pianists this difference in starting age was noticed. In this study there was also a significant difference found in years of formal instruction, the expert pianists having reliably more years of formal music lessons than the amateur pianists.

As was already shown in the study of Jørgensen (2001), there also seems to be a difference in starting age for different instruments. The study of Ericsson et al. showed that the violinists were older when starting with music education than the pianists, but there are other studies in which the violinists started earlier than the pianists (Krampe and Ericsson 1995).

When an individual starts earlier he has more time to accumulate a certain amount of practice hours than an individual starting later, hence the early starter is likely to have acquired a higher level of performance at a certain age. Ericsson, Krampe and Tesch-Römer (1993) state it appears necessary for professional musicians to start earlier than most of the amateurs in the same domain. In The Practice of Performance (1995) Krampe and Ericsson write: "Our proposition that the amount of deliberate practice determines one's degree of success at each stage of development implies that the age at which practice starts plays a crucial role" (p.99). This is based on one more study of virtuoso violinists and pianists. The violinists started at 5.0 years of age and the pianists at 5.8 years. But they did not only start earlier with music education, they also found their master teacher earlier than the expert musicians and as a result did not have to find new teachers later in life to have optimal instruction (Krampe and Ericsson 1995).

As already mentioned before, in the Manturzewska's study all expert musicians playing an instrument started before the age of nine. This was also the case in Sosniak's study of twenty-four concert pianists (1985): they all started with formal music instruction between the ages of three and nine. Also in other domains (for example chess playing), elite performers are exposed earlier to their domain and start earlier with deliberate practice. According to Ericsson, Krampe and Tesch-Römer "it is generally found [in music and ballet] that elite performers have started well before the age when most children first gain access to training" (1993, p.389).

For popular musicians starting age seems less relevant than for classical musicians. From Clawson's study (1999) it appears that the male musicians started playing a rock instrument at an average age of 12.9 years, and the female musicians were even older, their mean age was 18.0 years. The amount of years between starting playing an instrument and joining or starting a band was rather small, the boys the average length was 2.7 years and for the young women it was 3.3 years. However, it is possible that the musicians in this study already played an instrument before they started playing a rock instrument and thus already had some musical experience.

In Green's study (2002) the starting ages of the musicians are not clearly described. Throughout the book several age indications are given. For example, it seems that most of the musicians who took classical lessons did start after the age of ten. However, this does not mean that they did not start their informal practising before. One of them, for example, taught himself from the age of six, but only took lessons aged eleven or twelve (the subject did not remember exactly what age he had at the time). In spite of the fact that the United Kingdom has a rather elaborate system of music education in schools, most subjects in Green's study had not received music lessons in primary school or could

not remember having such lessons. Where music lessons were given in primary schools, this was mainly done by general teachers instead of specialist music teachers.

In the previous section it was already mentioned shortly that there appears to be a minimum of ten years training required to become a professional. This is not only the case for musicians, but also for other artists, athletes and scientists (Ericsson 1997). The violinists in the study by Ericsson et al. (1993) had all spend more than ten years practising their instrument by the age of twenty-three and the pianists all more than fourteen years. Simonton proved the claim of a minimum of ten years practice to be true for composers. He studied the lives of one-hundred-twenty classical composers and found that lessons usually started around the age of nine, composition around the age of seventeen and that the first successful composition appeared somewhere between the age of twenty-six and thirty-one. Simonton concludes from his research that the average amount of musical preparation is between seventeen and twenty-two years, and the average amount of compositional preparation is between ten and fourteen years.

Manturzewska asked in her interviews also about the length of the musical study. It appeared that there are considerable differences between the musicians, the years of musical training ranging from four to twenty-five years. There are different ranges for the different age cohorts. The length of musical training of the eldest musicians ranged from four to twenty-two years, and of the youngest musicians (born between 1937 en 1960) ranged from twelve to twenty-five years. The mode value (the length of musical training mentioned most) indicates, however, that it takes sixteen years of study with a qualified teacher to be able to become a professional musician. This is even longer than the ten years Ericsson thinks are necessary, based on his own research. When the whole group is split into different instrument sub-groups, there is an interesting difference between singers and the other specialisation groups. The mean length of musical training is for all instrument groups about fifteen years, but only for the singers it is less: mean length being 10.83 years. For all other groups the mean length of musical training is longer and the minimum length ranges from eight years (violinists) to twelve years (composers and conductors). Interesting also is that there is again a difference between the oldest cohorts (born between 1890 and 1925) and the youngest cohorts (born between 1937 and 1960). The length of study years for the oldest cohorts ranged from four to twenty-two years, but for the youngest cohorts it ranged from twelve to twenty-six years. It seems that the time necessary to become a professional musician increased during the twentieth century. Possibly this is due to the increased technical demands laid upon the musicians, as described in paragraph 5.5.1.

The pianists in the study by Sosniak started to have formal instruction between the age of three and nine years. The age at which they first won a major competition ranged between nineteen and thirty-one. This suggests that they had between twelve and twenty-five years of formal instruction before winning the competition. The average length of the study was seventeen years.

In conclusion of this paragraph some remarks about the question whether is it possible to start too early with music education.

There have been no reports of children starting "too early'; some musicians in Bloom's and Manturzewska's study started as young as three years old with music education. According to Lehmann, Sloboda en Woody (2007) no age is too young to start with music education, as long as it is appropriate for the development and ability of the child. They mention the teaching of musical notation as an example of a rather abstract skill that is best taught when the child has ample experience with dealing with musical sounds "by ear". To teach children under the age of four specific instrumental techniques might be difficult, because children at that age do not have the ability to focus on specific techniques yet. For such young children instruments can be used to illustrate how sounds are generated and to let them become acquainted with the instruments. Musical games are usually the most appropriate way to introduce children to music as soon as they are able to attentive and controlled responses (Lehmann, Sloboda and Woody 2007).

5.5.3 Amount of study hours

The starting age is not the only factor contributing to the total amount of studied hours at a certain age. It is obvious that the amount of practice at one particular or limited amount of time is also a contributing factor. A study performed by Ericsson et al. (1993) showed the importance of the amount of practice. In this study by Ericsson, Krampe and Tesch-Römer (1993), quite large differences appeared between the four groups participating in the research: the group of best violinists had accumulated, at the age of eighteen, an average of 7,410 hours in practice. This was reliably more than the 5,301 hours the group of good violinists at average accumulated. The group of music education students had accumulated 3,420 hours of practice at age eighteen. According to Ericsson et al. (1993; Krampe and Ericsson 1995) the difference in accumulated hours of practice between the best and the good violinists explains the difference in performance level at the moment of the study.

For the two best groups of violinists (the best and the good violinists) the amount of hours practised alone in one week did not differ significantly. The average of hours for these two groups was 24.3 hours. This did differ significantly from the group of music education students, who practised on average 9.3 hours a week. There was also a significant difference in the amount of practice sessions the students had per week. The best and the good students had an average of 19.5 sessions in one week; the music education students had an average of 7.1 sessions. The duration of the sessions did not differ significantly.

There is a reliable difference between the two best groups and the music education students. Ericsson, Krampe and Tesch-Römer (1993) conclude from this that "there is a complete correspondence between the skill level of the groups and their average accumulation of practice time alone with the violin" (p.379). Furthermore, the average amount of practice hours for the professional violinists is 7,336. This is very close to the 7,410 from the best students and the difference is not significant. This is interesting, because the best violinists are expected to find a professional career in orchestras such as the ones the professional violinists were engaged in.

As in the study on the violinists, the pianists in the second study were asked to keep a diary. From this the researchers learned that the expert pianists spent 26.71 hours to practice alone, significantly

more than the 1.88 hours of the amateurs. Also for these participants, the amount of practice alone from the beginning of music instruction was estimated. At the age of eighteen the expert pianists had accumulated an average of 7.606 hours of practice alone, reliably more than the 1,606 hours the amateurs accumulated.

These results are in accordance with the results of the study by Sloboda et al. (Sloboda, Davidson, Howe and Moore 1996; Davidson, Howe and Sloboda 1997). They discovered objective differences between five different level-groups. The specialists appeared to achieve the best grades and the given-up instrumentalists the lowest. The specialists also progressed much faster through the grade examinations than the other groups. Therefore it could be assumed that the specialist group was somehow more talented than the other groups. However, when the progression through the examinations was compared to the accumulated amount of practice by each group, it appeared that there were no group differences. This means that every group had to accumulate the same amount of practice to progress to the next grade. The specialist group progressed so much quicker because they reached the necessary hours of practice sooner than the other groups. By the age of thirteen (the last age for which substantial data are available for all groups) the mean accumulated hours of practice on all instruments for the different groups was (from group one to group five) 2572, 1434, 1438, 807 and 439. Sloboda et al. (1996) add to these numbers the interesting observation that the amount of hours accumulated by group one is comparable to the estimates of accumulated practice made by the best violinists and pianists from the studies by Ericsson et al. (1993).

Lehmann and Ericsson (1998) investigated an expert pianist's preparation for a public music performance. The preparation time for this recital was nine months in which the pianist had to master and memorize three pieces of music, divided into eight movements. This pianist had studied for fifteen years at the moment of the study and in these fifteen years she had accumulated almost 10.000 hours of study. This is in accordance with the above mentioned study by Ericsson et al. in which it is stated that it takes at least ten years of preparation to become a professional musician. In Ericsson's study (Ericsson, Krampe and Tesch-Römer 1993) the students had accumulated an average of 7,410 hours of practice at the age of eighteen. The pianist in the Lehmann and Ericsson study was twenty-five years old and had therefore accumulated more hours of practice.

As will be clear now, starting age is an important factor contributing to gaining an expert level of performance. However, there are differences in performance level between individuals who started early. This is due to the weekly amount of deliberate practice. The studies performed by Ericsson et al. show a correlation between the amount of deliberate practice and the level of performance. This can also be concluded from a study performed by Hallam (1998). She found that length of time learning (the age at which a child started) and time spent practising are important predictors of learning outcome. Together with age in month those factors highly significantly contributed to the overall achievement score of the children in Hallam's study. The correlations of achievement with length of study (.69) were greater than with age (.67), which, according to Hallam, suggests that learning is more important than maturation in predicting achievement.

The amount of practice accumulated by the popular musicians in Green's study (2003) differed hugely: some practised several hours a day, but one of the subjects had hardly practised at all. The amount of practice in a certain period of life depended on their mood, other commitments, or motivation. Also starting in a new band or composing a song influenced the amount of practice in a positive way. All these factors together resulted in periods of intense practice alternating with periods without hardly any practice at all. An important difference with classical music students seems to be that the popular musicians do not practice when they do not feel like it, whereas the classical students are likely (and expected) to practice every day for several hours (Green 2003, Ericsson, Krampe and Tesch-Römer 1993).

5.6 Other characteristics of the individual

Howe and Davidson (1998) think there are additional influences, which contribute to the effects usually attributed to talent. These are:

- Relevant prior knowledge and skills
- Attentiveness, concentration, and distractibility
- Interests and acquired preferences
- Motivation and competitiveness
- Self-confidence and optimism
- Other aspects of temperament and personality (see Kemp and Mills 2002)
- Enthusiasm and energy level
- Fatigue and anxiety

Hallam (1998) also mentions some of these, such as relevant prior knowledge, interest, motivation and self-confidence in her study on the predictors and dropout in instrumental tuition.

5.6.1 Motivation

Ericsson et al. (1993) state motivation is the first of four condition of optimal learning and improvement of performance. O'Neill (1997) also stresses the importance of motivation in the process of becoming an expert performer. But she states that there is yet a lot unknown about the way motivation helps in this process. Dweck (2002) cites several studies that showed the influence of motivation of the achievements of several high-level performers. It appears that many now famous athletes or artists were once ordinary or low-achieving children until they were motivated to dedicate enormous amounts of time to practice and training.

Generally two types of motivation are distinguished: intrinsic motivation and extrinsic motivation. The first one is considered to be necessary for and beneficial to creativity, the last one harmful (Collins and Amabile 1999). Intrinsic motivation could be described as the motivation to engage in a certain activity for its own sake, because the individual likes the task, is interested in it, moved or challenged by it or perceives it as satisfying. A major consequence of intrinsic motivation is that

people are able to work for a long time and very concentrated on a task. Extrinsic motivation on the other hand is motivation to engage in an activity for reasons or goals that are extrinsic to the task itself, for example a (monetary) reward, praise from parents or teachers, or passing an exam. The main effect of extrinsic motivation is that, according to Collins and Amabile, individuals become less creative than when they are intrinsically motivated. Another effect is that people are more easily distracted from their work. There is more recent research, however, that suggests not all kind of extrinsic motivation is harmful for creativity. Amabile (cited in Collins and Amabile 1999) made a distinction between two kinds of extrinsic motivators that should explain for the different effects of it. The first type is synergistic extrinsic motivation. This provides the individual with information about his performance and how to improve; it can therefore act in support of the intrinsic motivation. The synergistic extrinsic motivation is mainly important in the phase of creativity where consolidation of an idea or skill is important. When an individual starts, for example, practising a new piece of music, he is likely to be very enthusiastic about it. But later on, when he has to work on difficult parts or small details, this enthusiasm may decline. In this phase synergistic extrinsic motivation could be of help. It is important, however, that the extrinsic motivators leave the individual sense of self-determination and self-control intact. The second type is non-synergistic extrinsic motivation, which has a more controlling character. This kind is incompatible with intrinsic motivation

There are different opinions about the development of motivation. Kemp and Mills (2002), for example, think that the first musical responses of a child are intrinsically motivated. They call it "manifestations of the child's musical needs" (p.9). Parents and other caretakers can react on these musical actions in enjoyable activities and the child will learn of this to ask for more. However, according to Kemp and Mills, it is important that the parents leave it to their child to start a musical action. They should never push their child in doing a musical activity when the child is not willing to do so and then praise the child for it. That way, the inner motivation of the child may disappear and be replaced by extrinsic motivation. This will make it nearly impossible for the child to reach a high level of performance, because that will only be possible when the child is intrinsically motivated.

Not everyone thinks the development of motivation works this way. Several researchers think children are first motivated by their parents or teachers to behave musically, and will only later develop an intrinsic motivation for music. For example, Ericsson, Krampe and Tesch-Römer (1993) write that "the social reaction of parents and other individuals in the immediate environment must be very important in establishing this original motivation" (p.372). The child may start liking music because its parents react very enthusiastically when it sings or conducts while a CD is playing. To put it more precisely: the child does not necessarily like the music, but it likes to be praised by his parents or receive their attention.

The parents are also important motivators when the deliberate practice has already started. They help their child with a daily practice schedule and point out the value of daily practice. By praising the child when it practices in a right way, the child internalizes this way of practising and the motivation

will be intrinsic. Praising the child this way might be synergistic extrinsic motivation. Later in life, when the individual has become a professional musician, he will practise mainly out of intrinsic motivation, but short-term goals such as concerts also (extrinsically) motivate him.

According to Dweck (2002) the way parents and teachers praise a child is very important in developing intrinsic motivation to study. When they only praise a good achievement, this may lead the child to thinking that he has an unchangeable musical talent and practice will not help develop this talent. It may be not motivating for the child to be praised this way, because every child has occasions at which his achievements are not that good and praise will not be given then. According to Dweck this will not make the child work harder a next time because he thinks working hard is not influencing his achievements, whereas praising the child's efforts will lead the child to be motivated to study and hence develop his potential.

In spite of the different views on the development of motivation, researchers do agree on the necessity of intrinsic motivated musical behaviour, because it will otherwise not be possible for an individual to practice the great amount of hours needed to reach a high level (e.g. Ericsson, Krampe and Tesch-Römer 1993; Howe, Davidson and Sloboda 1998).

6 MUSIC AND THE HUMAN BRAIN

During the last decades, research has been done on where music making is located in the human brain and whether it is possible to see an effect of music on the brains of adults and children. The reason why this matter is being addressed in this literature study is that this research provides some evidence to the notion that early music education or training leads to developments in the brain, which do not take place when an individual starts with music education at a higher age.

This chapter will start with a section on how the brain functions and a description of the parts of the brain that have a role in the making and listening to music. Subsequently, several studies on the influence of music on the brain will be reviewed. One must keep in mind while reading this chapter, that "neuroscience technologies are complicated and in evolution" (Flohr and Hodges 2002): it appears there is much scientists still do not know about the brain and the influences of music.

6.1 THE HUMAN BRAIN

From research done during the 1970's it was concluded that music could be localized in the right hemisphere. Later research, however, showed this conclusion was too simple. Music making and listening to music appeared to involve parts all over the brain (e.g. Hodges 2000; Flohr and Hodges 2002). According to Hodges (2000) and Altenmüller (2001), the musical functions of the brain are modulized. With this they mean that different musical functions are in different modules in the brain, also in different parts of the brain. Flohr and Hodges (2002) combine this idea with the idea of "connectionism". Connectionism takes a holistic view of the brain, stating that the brain functions as a whole. When these theories are combined the idea exists of different parts or modules of the brain for different musical functions working together in a co-ordinated way.

For the following description of the human brain, a chapter by Altenmüller and Gruhn in The science and psychology of music performance (2002), edited by Parncutt and McPherson, was mainly used.

The brain can be divided in three parts: the hindbrain, the midbrain and the forebrain. Together the hindbrain and the midbrain form the brain stem which regulates all vital functions (breathing, heartbeat etc.), but also regulates many sensory and motor functions (eye movements and visual and auditory reflexes).

The hindbrain also consists of three parts: the medulla, the pons and the cerebellum. The cerebellum controls body equilibrium and accurate timing of movements. The cerebellum is therefore relevant for the learning of musical performance skills. The midbrain consists of two parts, the thalamus and the hypothalamus. The first of these acts as a gateway for the cortex by transmitting information from all sensory systems to the cerebral cortex. The hypothalamus controls all autonomic and endocrine functions.

The forebrain consists of the two outer hemispheres of the brain and three structures that lie deeper in the brain. These are the basal ganglia, the hippocampus and the amygdaloid nucleus. All three of them are relevant to musical performance because the basal ganglia is involved in regulating motor performance, the hippocampus in memory storage and the amygdaloid nucleus harmonizes the autonomic and endocrine responses in concurrence with emotional states.

The outer part of the brain is called the cerebral cortex, which controls all the cognitive functions. The cortex consists of approximately 100 billion neurons. The neurons are interconnected by a dense web of nerve fibres which make it possible for the nerve cells to communicate with ten thousands of other cells. In the network of fibres are so called synapses. These are small nodes connecting the different kinds of nerve cells. Information is transported in the brain through these synapses. As well as the rest of the brain, the cortex consists of two hemispheres. The corpus callosum is the connection between the two parts of the cortex. It consists of 100 million fibres in a bundle.
The two cortex hemispheres look symmetrical, but there are some differences. Their function is different as well. Another feature of the cortex is that each hemisphere is concerned with sensory and motor processes of the opposite side of the body. A third feature of the cortex, important in the context of this document, is that early intense training, starting before the age of ten, is likely to lead to enlargement of the cortical region involved in the trained ability.
Each hemisphere is divided into four regions, the frontal (front), temporal (side), parietal (upper back), and occipital (back) lobes. Every one of the lobes has its own function. The frontal lobes are mainly concerned with the planning of future action and the control of movement. The temporal lobes are concerned with hearing and with cross-modal learning, memory and emotion. The parietal lobes are responsible for the processing of somatic sensation and body image. Finally, the occipital lobes are concerned with processing vision. It will be clear from this short description of the human brain, that many parts of the brain are involved in music making.

First, for making music very refined motor skills are required. These are required after years of practice. To be able to improve one's performance auditory feedback is necessary. This means that one is able to hear what one is doing and is able to react. Therefore, music making requires integration of auditory and motor capacity. In addition, in order to play an instrument or sing, somatosensory feedback is also necessary; this means feeling what your body does and making adjustments if necessary. For this the kinaesthetic sense has to be well developed. This kinaesthetic sense allows for control of muscle and tendon tension, it makes a person aware of the position of his body and limbs.

Making music requires the ability to make voluntary movements. There are four parts involved in voluntary movements: the primary motor area (M1), the supplementary motor area (SMA), the cingulate motor area (CMA), and the premotor area (PMA). In the M1 the movements of body parts are represented in a separate and systematic order. For example, the leg muscles are represented on the top and the inner side of the hemisphere, the left leg in the right hemisphere and the right leg

in the left hemisphere. A body part which asks for more control, for example because it needs to be able of making fine movements, like the tongue, is represented in a larger part of the brain. This is because of the larger amount of nerve cells that are required to transport the information from the brain to the muscle cells. It is important to note that the representation of body parts can change by usage, for example music training.

In the SMA particularly the co-ordination of the two hands is controlled. This is mainly done by the sequencing of complex movements and the triggering of movements based on internal cues. The SMA is divided into two parts. In the anterior SMA, as far as known on this moment, the planning of complex movements is processed. In the posterior SMA two-handed movements are controlled, in particular in the synchronization of the hands during complex movements. The function of the CMA is not yet clear. It seems to be important in the intervention between cortical cognitive functions and limbic-emotional functions. The fourth part of the brain involved in voluntary movements is the premotor area (PMA) which is mainly involved when externally stimulated behaviour is planned or prepared.

The SMA, PMA and CMA are so-called secondary motor areas: this means they are not planning simple movements but rather movement patterns. Two other parts of the brain involved in movement are the cerebellum and the basal ganglia. The first of these is involved in the timing and accuracy of fine-tuned movements. The basal ganglia are necessary for all voluntary movements that are not automated. They control the voluntary movement by selecting the right motor actions and by comparing the goal and course of the actions with previous motor experiences. Also in the basal ganglia is the emotional evaluation of motor behaviour because the information from the cortex and the limbic emotional system come together there.

Information is transported in the brain through neurons or nerve cells. Afferent neurons transport information from the organs and tissues to the central nervous system (CNS), efferent neurons transport information from the CNS to the effector cells (active in secreting antibodies) and interneurons connect neurons within the CNS. There are many types of neurons, but a general description of their anatomy is possible. They consist of three parts: first the cell body (soma). The second part is the axon, a very thin cable that extends the soma and transports information away from the soma. Every neuron has only one axon, but the axon is capable of specializing and therefore can communicate with different types of target cells. The third part of the neuron is the dendrite; this is the information-receiving network of a neuron. Every neuron has many dendrites and these are extended in many branches. Neurons communicate with each other through contact between the dendrite of one neuron and the axon of another. Where these two meet, there is a synapse. The axons are covered with myelin; this enables the information to be transported faster than in unmyelinated axons. By use of the neurons the myelination improves, thereby causing advanced information transportation. When neurons are not used anymore (or in certain diseases) demyelination may occur[18] (Smit 1996).

[18] From http://en.wikipedia.org/wiki/Neuron, site visited 07-07-2005.

6.2 The development of the brain

Flohr and Hodges (2002) describe four elements in the development of the brain that are relevant to the question of an early start: critical periods, optimal periods, windows of opportunity and plasticity. The idea of critical periods is that in certain time frames stimulation is needed for developments to occur or that at certain developmental stages the organism is more receptive to environmental influences (Spreen, Risser and Edgell 1995). When this stimulation or influence is not present the development will not occur or only stunted, even if the stimulation is there after this time frame. For the brain this means that it is only open for certain experiences during specific periods in the development of the human being. If the experience is not there, certain developments will not occur. The existence of critical periods may depend on some "biological clock", on brain structures that have developed causing the impossibility to recognise or interpret new sensory data, or a combination of both. For music, any critical periods have not yet been found, according to Flohr and Hodges. Münte and colleagues (2002), however, think that plastic changes in the brain that are specific for musicians are to happen before the age of seven. It is not impossible to become a musician when starting after that age, but the changes in the brain will not occur. Hodges (in McPherson 2006) uses an investigation by Moore et al. (2003) among professional musicians that showed that an early start is essential to become a concert artist.

This may be different for the optimal periods. These are periods in the development of an individual in which development will be easier or faster. For music there are several example known of optimal periods. It is easier to learn to sing in tune during the age of three to six than when a person is twenty-five years of age. Research by Flohr showed that it easier to learn the different musical languages of jazz, classical music or atonal music before the age of six than later in life. Flohr and Miller tested, using EEG (see appendix II) how children aged five reacted to different styles of music. The different styles did not produce different EEG readings. When the same children were tested again two years later, the EEG readings showed different reactions depending on the sort of music (Flohr 1999).

"Windows of opportunity" is a theoretical concept describing there are certain general time frames in which critical or optimal developments are likely to take place. A window of opportunity is therefore not the same as a critical or optimal period and, according to Flohr and Hodges, it is important to make the distinction between critical and optimal periods when talking about windows of opportunity, because of the difference between them. Later, Flohr (2004) states it like this: "Windows of opportunity are either optimal windows or critical windows. The media, public, and music education in general needs to be clear in the use of optimal and critical periods of development" (Flohr 2004).

Plasticity is the ability of the brain to change. It is referred to as "the general ability of our central nervous system to adapt to both changing environmental conditions and newly imposed tasks during life span" (Altenmüller and Gruhn 2002, p. 63). Altenmüller and Gruhn write that musical experience and training, accompanied by the individual's development, cause changes that occur not only in the

neuronal network of the brain (e.g. stronger neuronal connections), but in the overall gross structure as well. Several authors (Amunts et al. 1997, Hallett 1995, Rauschecker 2001) state that plasticity is greatest in a young person's brain and that plasticity decreases with aging. Rauschecker even claims that "age of onset of musical training has been shown to be critical for the extent of reorganization" (2001, p.334).

According to Münte, Altenmüller and Jäncke (2002) plasticity is caused on the one hand by the new growth and improvement of dendrites, synapses and neurons, and on the other hand to the disinhibition (slowing down or suppression) or inhibition of already existing lateral connections between neurons by afferent[19] input. These two mechanisms are also recognised by Pascual-Leone (2001). He thinks the inhibition (or "unmasking" as he calls it, p. 317) of already existing connections is the first, necessary step in order to later establish long-term changes by the new growth of dendrites en thus new connections. When this happens, skills have become automatic.

6.3 Music performance and the brain

In the last fifteen years several studies have been performed to find out more about the role of music on the brain and on the differences in the brain of musicians and non-musicians. Some examples of the influence of music have been discussed in paragraph 1.1.3. It appeared that music making may have positive effects for other extra-musical activity and skills, such as spatial reasoning.
Other influences of music can be found in the brain itself. Some parts of the brain of musicians seem to have developed in a different way than the brains of non-musicians. One of the studies showing that their brains of musicians and non-musicians are different in some aspects is the one performed by Schlaug et al. (1995b). They studied the part of the brain called planum temporale. The planum temporale is part of the cortex and is involved in auditory association. Previous research has shown that the planum temporale in human beings (and other higher primates) is asymmetrical, being larger on the left side. As a result, researchers agree that this asymmetry is connected to the left side dominance for language-related auditory processing. Moreover, post-mortem and in vivo research has shown that the left planum temporale is dominant in the production and comprehension of language (in a majority of the people). There have been several attempts to localize musical functions, but these have been not really successful yet, because this research has not produced clear results. According to Schlaug et al. this will change now, because of a new technique to study the brain with the so-called positron emission tomography PET[20]. Research with PET has shown that the left hemisphere is active during phonological, lexical, or semantic language tasks, and that the right hemisphere is active during melodic and pitch perception tasks. However, this depends on the level of musical experience of the subject. More experienced subjects' left hemisphere is active during musical tasks.

[19] Afferent is a concept from the anatomy and is used to indicate any part of the body (a vein or nervus) that leads to another part of the body (a structure or organ) from http://en.wikipediaorg/wiki/Afferent, site visited 28-08-2007.

[20] Please note that explanations for all abbreviations used in this chapter can be found in Appendix B.

For their own study Schlaug et al. used in vivo magnetic resonance morphometry of the planum temporale, which means that they measured the left and right hemisphere of the planum temporale of their living subjects. Their subjects were thirty musicians, of whom eleven with perfect pitch and nineteen without, and thirty non-musicians. The subjects were matched for age (mean age twenty-six), sex (male) and handedness (right). It appeared that the musicians with perfect pitch had a significant larger left planum temporale than the musicians without perfect pitch and the non-musicians. According to Schlaug et al. this study showed that PET is able to localize musical perception in the brain area which includes the planum temporale, while previous post mortem research, cited by Schlaug et al. had already shown that the left planum temporale was involved in music perception. The authors suggest that an increase of musical functions of the brain is shown by a larger left-right asymmetry of the planum temporale.

However, according to Schlaug et al. it is not yet certain whether this asymmetry is caused by training or innate factors such as talent, or that the asymmetry causes the greater ability for musical performance. But they suggest it is possible that the gross anatomy of the brain is still susceptible for change after birth, because the maturation of fibre tracts and intracortical neuropil (the brain tissue between the cell bodies, which is with fibre tracts presumed to be determinants of gyral shape) is still progressing at the age of seven, thus implying that the changes in the musicians' brains were caused by their training.

Other research by Schlaug et al. (1995a) provided also evidence of the influence of early music training on the brain. They studied 30 musicians (violinists and pianists) and 30 non-musicians. There was a division made between musicians having started musical training before the age of seven and those having started after that age. Three of the musicians appeared to be non-consistent right-handed according to the several hand preference tests that were performed; the other subjects were all clearly right-handed. The symmetry of the hand motor performance was also tested. This test showed that the musicians performed the tasks with a larger symmetry between the left and right hand than the non-musicians. The measurements of the anterior part of the corpus callosum showed that this brain area was significantly larger in musicians than in non-musicians. This difference could be completely attributed to the musicians who started music training before the age of seven. This finding is interesting, as a larger corpus callosum is positively correlated with a higher capacity for interhemispheric communication and with a larger symmetry between the hemispheres. This faster communication enhances the performance of complex sequential bimanual motor sequences. From research cited by Schlaug et al (1995a) it appears that brain plasticity is largest in early childhood. In this period large amounts of brain cells are capable of changing their function. This means that an early commencement of musical training enhances the development of brain cells as corpus callosum cells. This causes, as will be clear from the above, an easier communication between the two hemispheres and thus an easier performance of bimanual hand motor sequences. These findings are in accordance with findings cited by Flohr and Miller (2000). They write that several studies lend support to the idea that early music education for children fosters more efficient and profuse connections in the brain.

Elbert et al (1995) performed a study to compare the representation in the brain of the left hand of musicians and of non-musicians. From previous research they learned that changes in input in the brain or central nervous system induce plastic changes in the brain. These changes were for example observed in the auditory systems and the motor systems. The measured changes were small for smaller limbs, for example a decrease of several millimetres of brain tissue representing the finger after an amputation of only a finger, but were bigger after an amputation of a whole leg or arm. On the other hand, experiences with monkeys and humans have shown that increase in input in the brain causes a growth of the brain part representing that part of the body, for example an increased cortical representation of the index finger of Braille readers.

To study the increased cortical representation of often used body parts further, Elbert et al. decided to compare string players (violinists, cellists and one guitarist) and non-musicians. The aim of the study was to investigate the effects of different afferent input to the two sides of the brain. String players use their second to fifth digit of the left hand for fingering the strings. The first digit of the left hand, the thumb, is not as active as the other fingers, but it grasps the neck of the violin and moves a little in order to change the position of the hand. The fingers of the right hand are not involved in individual movements as they together hold the bow. Using magnetic source imaging, Elbert et al. showed that the cerebral cortices of the string players were different in size than the cortices of the non-musicians. Before the actual research took place, the string players were asked to keep a small diary in which they had to record how much they had exercised every day for one week. They were also asked to estimate how much practice they had accumulated the previous month and year. The data showed that the centre of cortical representation for tactile stimulation of the fingers of the left hand of the string players was shifted compared to that of the non-musicians, suggesting that the cortical area representing the fingers of the left hand was increased. The strength of response was increased in the musicians. For the musicians' thumb the shift was significant smaller than for the little finger. Analysis of the data for the whole hand showed that there was a significant difference between the left hands and the right hands of the musicians. In addition there was a difference between the left hands of the musicians compared to the left hand of the non-musicians: the neural activity after stimulation was bigger for the musicians' left hand than for the non-musicians' left hand.
Elbert et al. found a correlation between the age at which the string players had begun their musical training and the magnitude of the change in neural activity after stimulation in comparison with the non-musicians. There was no significant relation between the amount of practice of the musicians and the size of the cortical representations.
To explain the differences between the musicians and the non-musicians, Elbert et al. mention two possible explanations. The first is already mentioned in the article by Schlaug et al. (1995b): it presumes that the string players are successful because their cortical representation of their left hand is already enlarged compared to their right hand and compared to other humans. Therefore, when they start with musical training it is easier for them to become successful and to continue. Elbert et al. object to this explanation that animal research already clearly showed use-dependent enlargements of somatosensory brain areas.

The second explanation is that the results are a consequence of a shift in cortical responsivity and an intensification of the response. Elbert et al. propose a third option that explains the results as a consequence of an expansion of the left-hand cortical representation. According to them this third explanation is more valid, because there is a correlation between amount of cortical reorganization and age at which musical training began and also because the change in neural activity follows the one direction that is consistent with the expansion theory.

Encouraged by the previous described studies, Amunts et al. (1997) wanted to investigate whether the early start and long duration of musicians' motor training and the complex bimanual finger movements of pianists may lead to persistent, macrostructural adaptations of the motor cortex, which may underlie the representational plasticity seen in persons who are acquiring and performing fine motor skills. Amunts and colleagues cite earlier research which showed that there is cortical asymmetry in the human brain correlated with the handedness of people. Right-handed individuals show a larger left hemisphere than left-handed individuals and vice verse. They assumed that musicians who are intensely bimanual trained, for example pianists, show a smaller cortical asymmetry in comparison with non-musicians. They also assumed, based on the study by Schlaug (1995a) and Elbert (1995), that the differences between musicians and non-musicians are correlated with the age of first musical and motor training.
The subjects were male, right-handed professional musicians, all keyboard players. The control subjects were individuals who had never played an instrument or individuals who had played an instrument for less than one year after the age of ten. The controls were all right-handed and were not professional typists. The researchers studied the size of the primary motor cortex, the so-called intrasulcal length of the posterior gyrus (ILPG). This brain area was chosen as it is a correlate of the cortical motor hand representation. The research showed a leftward asymmetry in ILPG for both the musicians and the non-musicians caused by their right-handedness, but the asymmetry for the right-handed control subjects was significant larger than for the musicians. This was due to the fact that the right hemisphere of the posterior gyrus was larger in the musicians than in the non-musicians. The right hemisphere is controlling the left hand that is non-dominant in right-handed subjects. Keyboard players use their left hand more than non-keyboard players, which explains the smaller asymmetry.

Amunts et al. also investigated whether there was a correlation between age of first musical training and the ILPG. There appeared to be a high correlation between an early start and the left and right ILPG. The younger an individual was when beginning with musical training, the larger the ILPG was. Again, the same question was asked: is the difference in the brain anatomy a result of the daily practice of the musicians or were the subjects able to become musicians because of their more symmetrical motor cortex? Amunts et al. answer this question referring to the high correlation between age of first musical training and ILPG. They conclude from this correlation that there is a "training-induced anatomical plasticity" (Amunts et al. 1997, p. 212). These findings agree with a research results from Hallet (1995), which indicate plasticity decreases with aging and that the most thorough plasticity

effects occur during the first years of life. But Amunts et al. acknowledge the fact that only about forty percent of the ILPG is determined by age of commencement, and that therefore there must be other explanations as well. This could hardly be otherwise, as other parts of the brain than the motor cortex play an important role in bimanual finger movements, for example the basal ganglia, the supplementary motor cortex and the cerebellum. Changes in the motor cortex are changes in the macrostructure of the brain. Amunts et al. cite several studies that showed that changes in the microstructure of the brain, for example increase of the amount of synapses, are possible. These micro structural changes could lead to macro structural changes. These cited studies prove that long-term representational changes in the brain occurred as a consequence of intense and long-lasting motor activity, such as musical practice.

Schlaug (Altenmüller, Wiesendanger and Kesselring 2006) also tried to find an answer to the question whether children become musicians because their brains have a certain shape that is apt for music or because they start young enough to enable their brain to adapt to the demands made by the musical practice. Schlaug et al. tested 50 children aged 5 to 7 before they started with piano or violin lessons. They also tested 25 children in the same age without music lessons. Besides the tests (several intelligence tests, auditory analysis tests and motor tests) they underwent and MRI. After one year of music training both groups of children were tested again. It appeared that there were no difference between the children in the first test episode, before any of the children had had music lessons. According to Schlaug this is "making it unlikely that children who choose to learn an instrument do so because they have an atypical brain, and suggesting that the atypicalities seen in the brains of adult musicians are most likely the product of intensive music training rather than pre-existing biological markers of musicality" (Schlaug in Altenmüller, Wiesendanger and Kesselring 2006, p. 145). Schlaug presents preliminary results because only half of the children has completed their second round of testing, but already it is clear that the change in scores in tasks directly related to music training of the children with music lessons is significantly greater than in the control group, being fine motor skills and auditory discrimination. There were also (non-significant) differences in the increase of grey matter. In another investigation, this time with children aged nine to eleven years with three to four years of music education, there appeared to be a small but significant difference in the volume of grey matter, whereby the musically educated children had the largest volume. In addition, the musically trained children performed better on the vocabulary subtest of the WISC-III[21] (an intelligence test), a mathematics test and a phonemic awareness test.

The importance of the above mentioned research results is expressed clearly by Altenmüller and Gruhn (2002, p. 79): "The main point here is that the brain is most flexible (or plastic) during the early years of childhood; later it becomes increasingly difficult to compensate for an underdeveloped disposition for motor skills and fine motor reflexes."

[21] The WISC-III (Wechsler Intelligence Scale for Children, third version) exists of 13 subtests that measure the verbal and performance intelligence. The verbal intelligence subtests measure language skills by asking oral questions. One of the subtests measures children's vocabulary. The performance subtests measure spatial skills.

7 CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

In this last chapter the questions posed in chapter 1 will be revisited and, if possible, answers will be formulated as a conclusion. In addition, a discussion will lead to recommendations for further research.

7.1 Conclusions

1. Should children start early with music lessons in order to become professional musicians? Is there a certain age at which children should ideally begin with music lessons?

In Sosniak's study (1985) all subjects started with music education between the age of three and nine. In Manturzewska's study there where larger differences in starting age, but the mean age at which the outstanding musicians started was 6.9 years. There was an interesting difference between the oldest subjects in this study and the younger one. It appeared that for the older subjects the starting age seemed less important for becoming a professional musician. However, the musicians who started after nine years of age were only composers and conductors. The results of her study made Manturzewska conclude that if musical training starts after nine, the career will not lead up to the mastery of the instrument on a outstanding, professional level. It appears from the research that most classical expert musicians started before the age of nine. Some started later, but with reference to the amount of accumulated study hours, it seems important to start early.

In Ericsson, Krampe and Tesch-Römer's study (1993) study the expert pianists started at an average age of 5.8 years, the amateur pianists had started at a mean age of 9.9 years. The mean starting age of the (professional) violinists was 7.9 years. In another study by Ericsson (Krampe and Ericsson 1996) the professional pianists had started at a mean age of 6,75, significantly younger than the amateur pianists, whose mean starting age was 9.33 years.

Jørgensen in his study also showed that on average the excellent students started earlier than the good students did. There were however considerable differences between singers and instrumentalists. The singers started significantly later than the instrumentalists, the minimum age at which singers started was nine years, for the instrumentalists this was five years. Regarding the mean starting age, Jørgensen only found significant results for the singers. The excellent singers started on average at the age of 9.5 years, the good students started on average at the age of 18.0 years.

In neuroscience Altenmüller and Gruhn (2002) show there is evidence that early intense training before the age of ten is likely to lead to enlargement of the cortical region involved in the trained ability. This enlargement is due to the fact that there are more nerve cells in the involved region. This plasticity is greatest in a young person's brain and may lead to a more successful musical development. According to Rauschecker (2001) the age of onset of musical training is even critical for the extent of the plasticity or reorganization of the brain. According to Münte et al. (2002) these plastic changes should occur before the age of seven. Musical development after that age is possible, but may progress slower.

Flohr and Hodges (2002) make a difference between critical periods and optimal periods. Critical

periods, they state, are not yet found for musical development. But there is evidence for optimal periods. It is, for example, easier to learn to sing in tune at the age of three than later in life, and it is easier to learn musical languages before the age of six.
A last example of evidence is provided by Schlaug et al. (1995), who showed that musicians whose musical training started before the age of seven have a greater corpus callosum that non-musicians or musicians who started after the age of seven. The size of the corpus callosum is positively correlated with a higher capacity for interhemispheric communication which enhances the performance of complex bimanual motor sequences.
From the above mentioned research examples it becomes clear that there is evidence that the age at which music training starts has influence on the shape of the brain and that this influences the further musical development of the musicians. The exact age at which musical training should start depends on the specific musical activity, but the findings seem to indicate that children should start before the age of seven to ten. However, as Hodges (2006) states, there is a "need to place neuromusical findings within a larger context", because the musical brain does not grow in isolation (p. 63).

2. Are there physical or psychological barriers that prevent starting with music lessons before the age of four?
In the literature there are no indications there are physical or psychological barriers to start before the age of four as long as the musical engagement in which the child is involved is appropriate to the development and capacity of the child (Lehmann, Sloboda and Woody 2007).

3. Are there other important – external - variables that influence the level of musical expertise reached by a person?
One-to-one teaching appeared to be a beneficial influence in the musical development of children. This was shown by Bloom (1984, in Lepper and Woolverton 2002) and by Davidson, Howe, Sloboda and Moore (1997). The research by Davidson and colleagues showed that the best three groups of music students received individual instruction. Lepper and Woolverton (2002) explain why children benefit more from one-to-one teaching than from class instruction. In private lessons the teacher is able to design practice activities for the individual student that maximise his improvement and the teacher is also able to direct all his attention to one pupil, which elicits more effort and on-task attention from the pupil. A further advantage is that the teacher is able to react more to the needs and previous knowledge of the student instead of the average knowledge in a class.
One-to-one teaching has also a positive influence on the non-musical effects of music education. From Letland's meta-analysis (2000) it became clear that one-to-one teaching may lead to better results on spatial reasoning than group teaching.

The accumulated amount of study hours appears to be another very important contributor to the level of music performance an individual will reach. The study on five different groups of music students by Sloboda, Davidson, Howe and Moore (1996) showed that it was the amount of practice that made the best students reach the highest levels of the examination system sooner than the other students. The

students all needed the same number of practising hours to reach a next level, but the best students practised most and were therefore able to reach a higher level of musical performance at a certain age than the other students in the study.
The study by Ericsson, Krampe and Tesch-Römer (1993) also showed that the best students had accumulated the most practice hours and the music teacher students the least. The good students had accumulated intermediate amounts of study hours.
An interesting detail of those two studies was that the amount of study hours accumulated by the best students in the study by Sloboda et al. (1996) was comparable to the amount of study hours accumulated by the best students in Ericsson's study when they were at the same age.
In other studies by Ericsson, Krampe and Tesch-Römer (1993) professional pianists and amateur pianists were compared: in this study the best musicians studied the most as well and a study by Lehmann and Ericsson (1998) showed that a professional pianist had accumulated about 10.000 hours of practice at the age of twenty-five.

Another important factor in contributing to a high level of musical expertise is the ***amount of parental support***. In Davidson's study (Davidson, Howe, Moore and Sloboda 1996) it appeared that the best students (from groups 1 and 2) had parents with the highest levels of involvement and support. The students in the intermediate level groups had parents with intermediate levels of involvement and the parents of the children who stopped having music lesson were least involved in their child's practice and music study.
A study by O'Neill (1997) showed that parents from high achieving children were significantly more involved in their child's music lessons than parents from other children. A small study by Stollery and McPhee showed that for music teachers and music psychologists parental "support and encouragement in various forms" and "motivation through praise" were the most important factors influencing their musical development.
A last study showing that the support of parents is crucial in musicians' development was performed by Sloboda and Howe, who interviewed music students and their parents (1991a). They suggest that the support of the parents mainly in helping the child practise and motivating the child. Consequently, parental support is very important, because without practice and motivation, no child is likely to become a professional musician.

According to Ericsson (Ericsson, Krampe and Tesch-Römer 1993; Ericsson 1996; 1997) ***the way an individual practises*** is very important. He states that mere repetition of a musical work is not enough to improve one's skills. It is important that students receive explicit instructions what to study and how, supervision from a teacher who is able to recognise errors and help the student correct the errors and give personal feedback. Ericsson and colleagues call the most effective practice deliberate practice. They state that "deliberate practice" has the following "ingredients": a well-defined task with an appropriate difficulty level, informative feedback and opportunities for repetition and correction of errors.

Also from other studies the structure of the practice appears to be very important (Davidson, Howe and Sloboda 1997). Gruson (1988) concluded from her study on beginning and experienced pianists that experienced musicians practice differently than beginners. They usually divide the musical work in smaller parts or fragments and rehearse those parts instead of repeating the whole piece time after time.

4. Do popular musicians and classical musicians differ in their development?

It is not yet possible to make definitive statements concerning the ideal starting age of popular musicians, because there is not enough research. From the studies reviewed in this literature study it appears that most popular musicians start at an older age than most classical musicians. The male musicians in Clawson's study (1999) started playing a rock instrument on average at the age of 12.9 years; the females were even older (mean age 18.0). In this study there were no accounts of the subjects playing a classical instrument before starting with rock music, but it is possible they could already play an instrument.

In Green's study some of the musicians started with playing music at a young age, but very few exact data are provided. In addition, the group of musicians Green interviewed is very small to make definitive statements.

5. Is there a relation between musicality, making music (playing an instrument, composing or singing) and intelligence and other general developmental skills (social, emotional)?

The results of various studies on this subject have produced rather different results, which is in part due to the different research methods that were used and the different aspects of intelligence that were studied. A division could be made between studies that investigated the influence of music on spatial reasoning, on general IQ scores, on reading skills and on social skills.

Regarding spatial-reasoning skills, Letland (2000) made a meta-analysis of 15 studies studying the effect of music education. She concludes that "active instruction in music does appear to enhance spatial-temporal performance for preschool and elementary-aged children, at least while instruction is occurring and at least up through two years of instruction" (p. 220). However, it is not yet known whether this effect lasts after the music education has stopped. Letland also concluded that the effect of music education on spatial reasoning is larger when children are taught in a one-to-one situation.

Schellenberg studied whether music education could increase the scores on IQ tests. It appeared that IQ scores from children who had either keyboard training or vocal lesson with the Kodaly method increased more than IQ scores from children who had drama lessons or no lessons at all. Besides this, the academic achievements of the children in the music education groups increased more than the academic achievements of the other children. A study performed by Bastian in elementary schools in Berlin produced less clear results. He used two IQ tests to measure the change in intelligent quotient. Only one of the tests showed a small increase of the IQ scores of the children who received extra music lessons, but the other test produced no significant differences.

For reading skills the results are also not clear yet. Douglas and Willats (1994) studied the influence of music education of children with reading problems and found that music education improved the reading abilities of the children compared to children who did not receive music education. However, Butzlaff (2000) states that this study showed some methodological problems because of which the results are rather equivocal. His meta-analysis of studies on the influence of music on literary skills shows that a positive influence of music can not be stated with certainty yet.

From Bastian's study (2003) the – weak – results showed that the children's in schools with more music education thought of themselves as more social and less likely to exclude classmates. However, these results were a bit controversial. Koopman (2005) acknowledged the fact that the children's self-reports were more positive on schools with more music education than on schools with the normal amount of music education, but stresses the fact that the children reported about their own behaviour instead of independent adults judging the children's behaviour.
Gembris (2003) cites a music project, in which children from different backgrounds learned – through the music – to play, work and talk with each other instead of fighting and arguing. In this project music seemed to play a positive and critical role. According to Gembris this is due to the fact that it is impossible to measure all effects music has on people's behaviour with tests (like the ones Bastian used). A study by Adamek (1997) showed that people who learned to sing of were used to sing in their families or schools in childhood were later in life happier and more social.

There is only one study referring to influencing the emotional development of children through music education. This is Costa-Giomi's study (2004). This study showed that children who received piano lessons had a higher self-esteem than children who did not receive piano lessons.

7.2 Discussion and recommendations for further research

Studying human behaviour and development is not an exact science; this means that it is not possible to give exact answers or answers that are applicable to all human beings. Human beings' behaviour is not systematic, but is influenced by many factors. Factors mentioned in this literature study are the genes, educational influences and influences from parents, peers or other people in a person's life. As a result, it is very difficult to say with certainty what an individual has to do to reach a specific aim. There will always be people who contradict the general rules with their course of life. In this literature study some general rules were formulated that might help educators, parents or politicians to make decisions about music education for children. However, this does not mean that these rules are valid in all situations and for all human beings. But it can be stated that following these rules will make it more probable and easier to reach a certain aim, in this case a professional level of music performance.

From the research discussed and reviewed in this literature study several important factors that were expected to influence musical development indeed appeared to be very important. These are

the age at which a child starts with musical training; the amount of practice the child accumulates during his life, the way a child practises and the influence of the parents. But from the research there appeared to be other contributors to musical development as well: the influence from peers and siblings, the influence from the teacher and motivation.
Motivation is one of the most important factors in reaching a high level in whatever field, and thus also in the field of music performance. It is only possible to practise and work several hours a day for more than ten years when a person is highly motivated. One serious task of music educators is thus to motivate their students or to offer an environment in which motivation is advanced and rewarded. The kind of motivation an individual feels for studying may change during his lifetime, but generally it is important that a person is intrinsically motivated and is autonomous instead of forced to make music or practise by extrinsic rewards or threats. This way a musician is more likely to maintain his practice.
Another important contributor to children's musical development is the teacher. Some authors even state that, besides starting age and motivation, this is the most important factor.
Initially a teacher is important in motivating the child and in advancing the child's interest in music. In this period the character of the teacher is important, he (or se) should be a nice and warm person. Later this becomes more irrelevant, but the qualities of the teacher as a musicians gain relevance. The teacher should be able to teach in a right way, but also to show the student the way in the professional music world.
From the studies on popular musicians it became clear that peers are very important for popular musicians, possibly even more important than a teacher. The peers provide each other with musical examples, training experiences and theoretical knowledge. From practising together in bands, popular musicians learn a lot. The role of peers seems less important for classical musicians. Siblings are not as important as teacher, peers or parents, but do play a role in the musical development of children. They provide a role model for young siblings when they already play an instrument themselves and sometimes make a child more eager to become a good musician. Siblings can also encourage a brother or sister who plays an instrument because they imitate their parents.

Some questions were not answered reading the literature for this study and other questions rose. Some of the studies discussed in this document provided the reader with interesting information, but could answer more questions when slightly adjusted. For example, the study by Jørgensen (2001) made clear that there is relationship between starting age and level of musical performance in conservatoire students. However, it would also be interesting to know if the results where more clearly if Jørgensen would have added amateur musicians to the study as well.
Other questions also rose from his study. For example, what is the influence of the first instrument a child learns to play on later music making? In none of the studies the first instrument and the starting age of the playing the first instrument was considered. Only the main instrument and the students' starting age on that instrument were investigated. However, starting with the recorder could influence progression when later playing another instrument. This would mean that in further

research on this topic researchers should not only ask for the starting age of the main instrument a subject plays but for the starting age of a previous instrument as well.

I will finish my literature study with a rather utopian research proposition:
A group of researchers will follow a large sample of children from the moment they start having music lessons until they are grown up. All factors that are now known to contribute musical development – starting age, amount of practice hours, influence of parents, siblings, peers, and teachers, motivation - will be measured regularly through questionnaires and interviews and with the help of brain techniques. After fifteen years the different influences, experiences and developments of children who end up as professional musicians (classical, pop or otherwise) and children who will have other professional careers will be clear.

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APPENDICES

APPENDIX A

The Associated Board Music Examinations

In the United Kingdom the four Royal Colleges of Music have established a charitable company for the benefit of music education which is called the Associated Board or the Royal schools of Music. The main activity of the Board is the operation of an authoritative and internationally recognised system of exams and assessments. The aim of this system is to encourage and motivate instrumentalists and singers by providing them goals and the possibility to measure improvement.

There are eight Grades of examination with Grade 1 being the easiest and Grade 8 the most difficult. Everyone can enter the system in any Grade, irrespective of age or having taken a previous Grade. There are Grades for many instruments and singing (called practical grades), solo jazz, theory and practical musicianship. Before entering practical Grade 6 or above, solo jazz, theory or practical musicianship Grade 5 (or above) must be passed. Before entering Grade 1 it is possible to do a prep test, which is a preparation for the Grade 1 examination.

The exams are taken by examiners who are respected musicians from every branch of the profession. Before being allowed assessing students themselves, the examiner has to follow an individual training of a weekend and a five day period. On the fifth day the examiner has to take exams observed by the Chief Examiner. A reading panel reads the exam forms to maintain the quality of the examiner, and seminars and trainings are offered frequently (Taylor 2001).

APPENDIX B

Information about several methods to study the brain

EEG

Electroencephalogram (EEG) measures the small amounts of electricity which is produced by brain cells over a certain period of time. This is done by placing several electrodes on a subject's skull. EEG research provides four types of data: frequency (Herz), amplitude (microvolts), form and distribution. The frequency is most often used to set a diagnose or for other research ends. Originally EEG was used to study different levels of arousal in a person, but nowadays it is also used to study cognitive processes in general and music processing specifically.

MRI

Magnetic Resonance Imaging (MRI) is usually employed for medical diagnostics, but it appeared also very useful to gain insight in the normal development of the human brain. MRI produces detailed pictures of any internal part of the body, not just the brain. MRI does not provide information about functions of body parts.

The functional MRI (fMRI) is used to gain information about changes in the volume, flow or oxygenation that happens when an individual performs a certain task (Flohr 1999). This technique does give information about location ànd function, and is currently used to provide more information over musicians' brains.

A disadvantage of this technique is that the subjects have to lie in a very noisy machine, the MRI scanner. The motion of the camera's in the scanner produce a rhythmical sound that competes with the musical sounds the subjects have to listen to in research on music. After better (nonmagnetic) headphones or other solutions have been found, fMRI is probably is very useful instrument in studying the influence of music on the brain (Flohr and Hodges (2002).

Overy et al. (2004) describe a manner which limits the noise of the MRI scanner and avoids any interference with the auditory stimuli. They used a sparse temporal sampling technique with clustered volume acquisition. In this way they could take advantage of the natural delay in the cerebrovascular response to neural activity.

PET

Usually this technique, like MRI, is used to diagnose someone when he or she is ill, but it can also be used for research. Positron emission tomography (PET) helps researchers to visualize fine details of the brain. Besides that PET is capable of determining the activity levels that are occurring in various brain areas (Flohr 1999). To get this information from the brain, radioactively tagged oxygen, water or glucose is inhaled or injected intro the bloodstream. The subject is then asked to perform certain tasks while PET scans detect brain metabolism or regional cerebral blood flow. It is also possible to identity area's that are most active during the tasks by subtracting the activation patterns of one

task from another. In this way it is also possible to see what brain areas are less active during certain tasks which can be very useful information.
A disadvantage from PET is that it only gives information about function and not about the location. That is why PET is often used together with MRI data. This combination gives information about what is happening were in the brain (Flohr and Hodges 2002).
According to Flohr (1999) another disadvantage of PET is that it requires the injection of water, oxygen and glucose. Parents are not very willing to give researchers permission to do consent for this when it is for research ends and not to cure their child.

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