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A Handful of Considerations

Perspectives on Left-handedness in Violin Playing
and Violin Pedagogy

Abstract

Title: *A Handful of Considerations* – Perspectives on Left-handedness in Violin Playing and Violin Pedagogy

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The topic of this study is left-handedness as a phenomenon in violin playing and classical violin pedagogy. The aim of the study is to investigate what kind of knowledge and approaches are crucial for taking left-handedness into account when teaching left-handed violinists in the normatively right-handed violin pedagogy.

The body of knowledge arises from literature on hemispheric lateralization, left-handedness, attributes of violin playing, and earlier studies on hand-preference and musical performance, hemispheric adaptations to musical training, and children's conceptions of left and right. A background-study was carried out on left-handedness in guitar playing.

The study employs abductive reasoning, has an auto-ethnographic thread and draws on the hermeneutical epistemology. The theoretical framework rests on the cultural-psychological perspective on music education.

The data was collected in two parts using qualitative ethnography-inspired methods. First qualitative thematic interview was used for gathering strategically sampled data from expert respondents on violin playing, pedagogy and violin-making. Secondly non-participant observation and follow-up interview was used for examining a beginner violin lesson.

The findings of the study suggest that violin pedagogues need knowledge of the lateralization effects on violin playing and methodological understanding for pupils' handedness and maturity of motor development. The data suggests that left-handedness is not a disadvantage in violin playing when provided with education that recognizes it. Reversed violin playing is considered as an alternative for strongly left-handed pupils. The data shows that violin education needs open discussion on left-handedness in terms of prejudices in orchestras, and raised awareness on the availability of left-handed instruments.

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In Stockholm on June 4th, 2015

Krista Pyykönen

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1. Introduction

Left-handedness means practically that a person prefers to use their left hand over their right hand when performing precision and detail demanding motor tasks. Approximately 10-13% of people in all human population in every culture and society are left-handed. (Orell-Leed, 2005, pp. 5-8.) There are over 200 million left-handed people in the world, and in the European Union area alone, the number is around 74 million (Bertrand, 2001, p. 7). In other words, roughly every tenth person is left-handed, and therefore a violin teacher can anticipate that every tenth violin pupil may have a dominant left hand disposition. However, left-handedness is rarely addressed in any violin school, method or pedagogical material for violin teachers (Pyykönen, 2010).

In the editorial of Helsinki Times (22.1.2015), the Finnish journalist Anni Lassila discusses how left-handed people are, from an early age, accustomed to living in a right-handed world using their own tools, scissors, can-openers etc. in the everyday life. This leads me to question, if there are pedagogical applications available and employed by violin teachers for taking left-handedness into account when teaching left-handed violin pupils? Thus, the focus of my study is left-handedness and violin playing in violin pedagogy, and more broadly in the normative right-handed working landscape of professional violinists.

This study follows the earlier findings of my bachelor thesis *The Devil Plays Left-handed, Are Lefty Violinists Diabolic? - Aspects of Teaching Left-handed Violinists* (Pyykönen, 2010). The results of the bachelor study were presented at the Finnish String Teacher's Association's convention in February 2011, as well as at the Left-handed Festival *Vasurit* in Finland in July 2010. The early findings of this study have already been presented at the ESTA Sweden- convention of the Swedish String Teacher's Association at Malmö Academy of Music in January 9th, 2015.

Based on the earlier findings of my interview data combined with recent studies from the field of psychology and my own completed course studies in psychology at the University of Helsinki, my pre-understanding is that learning to play a *musical instrument*¹ such as the violin is a process that involves a number of physical functions that are neurologically related to lateralization; hemispheric specialization that also causes the phenomenon of handedness (Kalat, 2009, p. 412). Furthermore, violin playing is an asymmetrical activity that requires specialized manual skills and shows hand-preference similarly to tennis, baseball, fencing, snooker and writing. Therefore, biological pre-requisites – the level of the handedness – have an effect on playing an instrument that is designed for right-handed people. Regardless, reversed violin playing is not a commonly employed alternative for normative right-handed violin playing. This rises my concern to investigate the multi-sidedness of this phenomenon.

As there are relatively few left-handed violinists, there are also few left-handed violin pedagogues. Hence, violin teachers are challenged to recognize left-handedness as a pedagogical phenomenon: understanding the relationship of handedness and the development of instrumental skills in violin playing and having sufficient tools for supporting the coordination tasks that might go against the pupil's natural manual preference.

Since it is fundamentally different to teach traditional right-handed violin playing to a strongly right-handed pupil and to a strongly left-handed pupil, it is relevant to

¹ An instrument is defined as a tool or implement, especially for precision work, and a musical instrument is an object or device for producing musical sounds (Oxford English Dictionary, 2015).

examine left-handedness as a violin pedagogical issue. Lastly, as guitar playing has adopted reversed playing as a left-handed alternative for right-handed playing, it is relevant to investigate such patterns of action of left-handed guitar playing that could offer new possibilities for left-handed violinists.

1.1. Structure of the thesis

This thesis has a starting point in chapter 2 where I present the aim of the study, the research question, as well as discuss the delimitations of the study. Later, in the background chapter 3, I introduce the three main points-of-departure of the study: the biological nature of left-handedness, left-handedness as a cultural-educational phenomenon, and lastly, handedness in violin playing. Shortly after, in chapter 4, I present earlier studies on the effects of handedness and musical training among professional musicians, as well as children's comprehension of the concepts of left and right. Furthermore, I introduce the perspectives of the mirror neurons in music education and an exemplified left-handed method in violin pedagogy. Together these chapters build the body of knowledge for the study.

I present the theoretical framework for the study that lies in the cultural-psychological perspective on musical learning in chapter 5. Next, in chapter 6, I explain the methods used for the data collection of the two conducted main studies. Prior to these two them, a brief background study was conducted on left-handedness in guitar pedagogy. After describing the analysis process of the empirical data, I present the findings of these studies thematically in chapters 7-10. In chapter 11, I discuss the findings in dialogue with the body of knowledge. Thereby I am presenting the new knowledge on left-handedness in violin pedagogy.

1.2. Use of concepts

The use of concepts in this thesis follows the style of the American Psychological Association (APA), in which all new concepts are presented in italics the first time they are presented. Furthermore, I am employing the APA style for referring to and citing written sources of data. However, in the body text, I have chosen to address violin makers, violinists, pedagogues, authors and scientists (i.e. Eugène Ysaÿe, Gasparo da Sàlo, Jean Piaget) referred to in my literature sources by their full names for the reason that they are historically well-known and established as such. Furthermore, one respondent of the interview study (chapter that specifically asked to remain anonymous, is being referred as "N.N." in the body text and citations.

2. Aim of the study

This qualitative study is part of the diverse field of music education research. It aims to investigate the knowledge and approaches of violin pedagogy that are crucial for taking left-handedness into account when teaching left-handed violinists in order to support their development as violinists. This practical knowledge is a contribution for the applied teaching practices of violin pedagogues. I have a strong personal interest in the research subject because it is closely related to my professional engagement in violin pedagogy and my personal experiences as a left-handed violinist.

2.1. The research question

All research begins from seeking an answer to a question. The question can be motivated by finding an empty spot among already existing research, but often the researcher finds a way to raise the question for both scientific and societal discussion (Esaiasson et al 2007, pp. 31-32). The aim of the research rises from limiting one's perspective on the research question that often lies in the researcher's personal interest and involvement in a specific context (Björk & Räisänen, 2003, p. 230; Flick, 2009, pp. 98-99). The research question of this study is:

What is crucial to take into account in order to support the learning of left-handed pupils?

2.2. Delimitations of the study

The present study focuses on the many-sided problem area of left-handedness and violin playing in violin pedagogy. However, the study does not investigate left-handedness in all instrumental music education, although it includes a background study on left-handed guitar playing.

Methodologically the study focuses on the teaching, learning and playing of left-handed violinists. The data was collected through strategic sampling by interviewing left-handed musicians, left-handed violin pedagogues, a right-handed violin pedagogue teaching left-handed pupils, and a right-handed violin maker. The interview study also mentions a case of a left-handedly playing violin teacher teaching right-handed learners, but does not explicitly focus on it. However, this case of violin pedagogy is partly addressed by one participant and, regarding this respect, followed up. Furthermore, the present study includes an observation study of a right-handed violin pedagogue teaching left-handed learners, but does not include observations on the teaching practices of the interviewed left-handed pedagogues.

3. Background — three points of departure

In this chapter, I have chosen to approach the research question from three points-of-departure for building the body of knowledge for the following empirical studies. The chosen perspectives are the neurology of left-handedness, left-handedness as a cultural phenomenon, and the right-handedly dominated tradition of violin playing.

3.1. From hemispheric lateralization to left-handedness

In order to approach the subject of left-handedness in violin playing, it is important to learn about the neurology and supposed cause of left-handedness, as well as to define the following terms: *lateralization*, *hemispheric dominance*, and *handedness*.

3.1.1. Defining lateralization and handedness

It has been known since 1861, when Dr. Paul Broca discovered the speech control area on the left hemisphere of the human brain, that the brain consists of two hemispheres which instead of being mirror images of each other are specialized in processing and controlling different functions (Smits, 2012, p. 181). The left hemisphere of the cerebral cortex controls the skin receptors and muscles largely on the right side of the body, and the right hemisphere is connected to those on the left side of the body (Eysenck & Keane, 2010, p. 625) (see Figure 1, p. 60). The left hemisphere is also specialized for processing language and the right hemisphere for recognizing emotion and spatial relationships. *Lateralization* means the division of labor between the two hemispheres (Kalat, 2009, pp. 404-406).

The right hemisphere controls predominately the left hand, and the left hemisphere the right hand. Studies suggest that people with larger left than right *planum temporale* (a section of the temporal cortex) prefer to use primarily their right hand for motor tasks, such as writing. We are talking about *hemispheric dominance* and *handedness*, which is also connected to auditory and visual perception, as well as speech processing. There can also be different combinations of dominance, called *mixed-dominance*. (Kalat, 2009, pp. 408-412; Sitnikova, 2012.) These connections are relevant to understand when examining lateralization in relation to instrumental learning in music, which involves motor, auditory and visual processing.

Hemispheric dominance leads a person to choose to perform motor and coordination tasks with their preferred hand – left-handed people choosing the left hand and right-handed people the right hand (Orell-Leed, 2005, pp. 17-18). If a person aims consciously to practice both hemispheres equally ignoring the hemispheric dominance, the *corpus callosum*² will develop new neural connections between the hemispheres leading to increased plasticity in the brain functions. The ability to operate equally with both hands is called manual *ambidexterity*, and the maximization of the use of both hemispheres can help a person to become increasingly resourceful and even improve IQ-scores (Paul, 1992, p. 46; Randerson, 2001; Smits, 2012).

² The corpus callosum is a band of nerve fibers that joins the two hemispheres of the brain (Oxford English Dictionary, 2015).

3.1.2. The unknown cause of left-handedness

The cause of left-handedness is unknown since there are no theories up-to-date that fully explain *why* left-handedness exists (Paavilainen, Anttila, Oksala & Stenus, 2002, p. 110). However, the literature suggests that in violin playing lateralization has an effect on firstly, how we perceive and process music, and secondly, how we control the fine-motor functions while playing the instrument (Eerola, Louhivuori & Moisala, 2003, p. 234).

In order to understand the possible causes of left-handedness, I will now present some existing theories. Certain theorists suggest that left-handedness is originated either from primitive warfare, from the act of nursing when holding the baby close to the heart and leaving the right hand free for task performance, or from social learning, if right-handedness is seen as a socially learned skill that left-handed people simply failed to learn. Another theory is Annett's *right shift factor* theory, which suggests that left-handedness is genetic. If found in the person, the gene in question will lead to right-handedness, but if not found, a person might become left-handed. Lastly, the theory of *self-stabilization* builds on the conception that both left-handedness and homosexuality are traits that in time naturally self-stabilize on a constant 10% frequency of the population in any environment regardless of the non-supportive conditions (Coren, 1993, p. 54; Smits, 2012, pp. 240-242). Subsequently, it is safe to assume that every tenth beginner violin pupil is left-handed, since the percentage of left-handers in all human population is stable.

3.2. The phenomenon of left-handedness: an exception to the norm of right-handedness

In this section, I will shed light to the cultural history of left-handedness in order gain understanding on why left-handedness is a relevant topic of discussion in the context of education, society and tradition. These factors are connected to music education and violin pedagogy.

3.2.1. Cultural conceptions of left-handedness

In consequence of primitive conceptions of dualistic polarization, in all human societies throughout history, left and right have been perceived as binary opposites. This maintained separation has also carried on the legacy of dualistic classifications – some as early as the ones created by Pythagoras and Aristotle – that associate right with masculinity, power, fortune and correctness, and left with the opposites of these characters. (Hertz, 2013; McManus, 2002.)

Language enforces³ this dualism, and has supported the globally spread views of left-handedness being an unfavorable quality. Yet, in some sports such as tennis, baseball and fencing, left-handedness has been considered as an advantage of surprise. However, the existing disregard of left-handedness has led left-handed people to remain an unorganized minority group with no real sense of collective identity, unlike the other stable minority group, the LGTB-community (lesbian, gay, transgender, bisexual) that has gained social visibility. (Coren, 1993; McManus,

³The very word *left* itself in the English language comes from the Anglo-Saxon word *lyft*, which has two meanings: weak and broken. In modern German, *links* means simultaneously left, cunning and dangerous, and *recht* stands for right, true and correct. The Latin word *sinister* refers to both left and evil, and *dexter* to right and fortune. (Coren, 1993; Smits, 2012.)

2002; Smits, 2012.) The resistance towards left-handedness has been evident in the history of education, which I am going to discuss in the next section.

3.2.2. Left-handedness in education

In general... parents and teachers will in the long run earn the gratitude of the child if they do all they can to make him right-handed from the very start. (Burt, 1961, p. 323)

In line with the British child psychologist Cyril Burt's statement above, educational institutions have reacted towards left-handedness in three different ways: with hostility, with ignorance or with tolerance. Since the end of the 1950's the cultural attitudes towards left-handedness have become increasingly tolerant, but there are cultural areas that show a powerful rejection of left-handedness, namely etiquette, literature and religion. Hence, left-handed people have been discriminated against by social, educational and religious institutions in form of *handism* (Bertrand, 2001, p. 8; Coren, 1993, p. 10, 277; Smits, 2012, p. 58). For example, in the 1950's, the professor of education at Brooklyn College, Gertrude Hildreth, in New York City, stressed that a left-handed child *should not be permitted to make his own choices in handedness for basic skills* (Smits, 2012, pp. 23-27).

In the Western countries, there was a strong societal pressure to educate left-handed pupils to become right-handed still in the 1950's using encouragement, persuasion, warning, humiliation, guilt and force. (Bertrand, 2001, pp. 90-101; Coren, 1993.) Even if left-handed pupils are no longer expected to avoid the use of their left hand, they are expected to adjust to the right-handed learning settings, which often means teaching themselves by internalizing the demonstrated right-handed instructions without additional educational help (Smits, 2012, p. 254). This is also the case in modern violin pedagogy.

Understanding these perspectives may help to find out why left-handedness is a phenomenon that has very little visibility also in music education, how the tradition of violin playing might carry the history of manual discrimination that derives from social and educational handism, and why left-handed musicians generally play their instruments according to the right-handed norm. It is relevant to remember that the history of symphony orchestra has gone through periods that only included right-handedly playing white male musicians (Thomson, 2003, p. 22).

3.3. Background of left-handedness in violin playing

The over 400-year-old violin can be considered as one of the oldest gadgets still in use. The techniques that are used for teaching how to play it today are often based on methods that are at least 100 years old, and rarely take into account recent pedagogical theories or psychological research. It seems that some violin pedagogues consciously resist new influences of change and consider new applications as a distraction to the tradition instead of applying them in the methods and use them as a way to make the instrument more relevant to new learners, and help to meet the new societal challenges the field of classical music education is encountering. (Vilnite, 2014.)

In this section, I am examining the aspects of violin playing that have relation to the sidedness of violin making, left-handedness and the body of the violin player. The central interest is to find out why the right-handed players prefer to play the violin by bowing with their dominant right hand, and what kinds of methodological

instructions can be found in terms of left-handedness and the bodily basis of the instrumental learning in violin pedagogy.

3.3.1. The right-handed history of violin playing

The violin was developed from its ancestor instruments but was established into its four-stringed form in the 1550's. The first celebrated luthiers making the four-stringed instruments were the Italian Andrea Amati and Gasparo de Salò. The earliest illustrated evidence of the four-stringed violins of the 16th century shed light to how the violin has been played, and how the techniques have evolved since. (Boyden, 1965.)

Evidence suggests that the primitive bow was swept diagonally across the strings and controlled by the right hand (Boyden, 1965, pp. 6, 46). However, some illustrations show that the violin had also been played left-handedly, since one can find paintings showing left-handedly playing violinists, for example in the oil painting on canvas *Fisherman playing the Violin*⁴ by Frans Hals (see Figure 2, page 60).

There are no technical or structural demands for the violin to be built traditionally right-handedly other than the global right-handed dominance. In fact, the right-sidedness of the traditional violin is notable for example in the case of the Guarneri *del Gesù* violins. One third of them have been built so that the f-hole on the bass side on the left is intentionally longer than on the treble on the right in order to make the bass notes stronger. The reason for why they have been built that way is simply for facilitating and meeting the needs of the right-handed majority of musicians. (Pyykönen, 2010.)

In terms of the cultural value of violins, they can be seen as historical instruments and considered as cultural artifacts or *objets d'art*. Occasionally, they have been reversed for left-handed playing – by re-stringing and changing the place of the bridge, bass bar and sound post (Ward, 1971) (see Figure 3, page 61) – which might in light of the cultural value be, in some aspects, questionable. I will discuss this further in chapters 8 and 11.

3.3.2. The significance of the bow-hand in bowing

When looking at the development and history of the violin bow, one will find out that the bow has undergone changes that have enabled the advancement of playing techniques. The early violin bow in the 16th century did not differ significantly from the bows of other stringed instruments (*lira da braccio*) but there were differences in regards to shape and length. Originally all early bows were rounder than the modern bow, which was gradually decreased in order to make playing new techniques possible. Before the establishment of the modern bow-hold, there were two main trends of holding the bow: the French school, where the bow was held with three fingers on top of the stick, little finger lifted up and the thumb under the hair, and the Italian school, which was closer to the modern hold, according to which all four fingers were placed on the stick and the thumb on under it close to the frog. (Boyden, 1965, pp. 12, 45-48.) (See Figure 4, page 61).

In the 17th century a great number of the early bows were discarded, and during the 1600-1800's, the length of the violin bow had nearly doubled from 38cm to 65cm. The longer bow introduced longer *legato*-slurs, and in the 17th century, the Italian violin school developed a lighter bow-hold enabling the playing of the *portato*- and *tremolo*-styles. In the 18th century the bow hand was ideally free, relaxed

⁴ "The Fisherman playing the Violin" by Frans Hals, ca. 1630, that is currently located in the collections of Thyssen-Bornemisza Museum in Madrid (www.museothyssen.org, 1.3.2015).

and light, and in the 1800-1850's, the violinists Louis Spohr and Pierre Baillot among other promoted new emphases for the bow-hold (Nelson, 2003). It is evident that as the bows and bowing techniques developed significantly, the fine-motor control of bowing also evolved and became more challenging for the musician.

Today, the physiological basis of violin playing is seen to be the bow rubbing against the string causing it to vibrate. How the bow rubs against the string affects the dynamics, color and articulation of the vibrating sound. The violin hand, normatively the left hand, regulates the length of the vibrating part of the string causing the pitch of the sound to be higher or lower. With the vibrato, the violinist regulates the frequency of the changes between the straight sound and the elevated pitch. (Pyykönen, 2010.)

It has been commonly agreed in the modern violin education that the bowing hand is equally if not more significant to the violin playing than the hand regulating the pitch of the sound. There are over 15 different bowing styles and over 80 variations of these styles. The violinist will play these techniques with the bow as an extension of the bow-arm, whereas the fingering hand has direct contact with the string, and therefore requires less fine motor muscle control than the bow-hand. (Thomson, 2003, pp. 8, 11.)

To support this view, Carl Flesch wrote that the bow-hand technique is more challenging than the fingering technique because of the indirect contact with the string, and that the richness of sound in violin playing really is depended on bowing. Similarly, Eugène Ysayë wrote that anyone can learn to imitate the fingering in violin playing but to master the bowing is true artistry. Also, it has been said that the fingering hand plays notes and the bow-hand plays music, and it indeed seems that the apparently simple bowing involves something that makes considerable demands. (Nelson, 2003, p. 200; Thomson, 2003, p. 8; Smits, 2012, pp. 90-92.)

Against this common understanding of the significance of the bow-hand, Thomson (2003) describes that left-handed pupils are often encouraged to play right-handedly based on the argument that as left-handed violinists, they get to do the challenging fingering with their dominant left hand (p. 12). However, if that would be an advantage in violin playing and the bowing would be more beneficial using the weaker motor hand, most right-handed violinists would choose to play the violin the reversed left-handed way fingering with their right hand and controlling the bow with their left hand. The evidence suggests that right-handed violinists choose to bow with their stronger right motor hand for creating the personal, artistic and musical character of violin playing, and the majority of left-handed players have to do the same using their weaker motor hand.

3.3.3. Levels of handedness and violin playing

As previously explained, left-handed musicians are a good example of managing skill-requiring manual tasks with the non-preferred hand. With sufficient training, most left-handed players – but not all – manage to play the normative right-handed way. When looking at professions that demand precision and reliability of manual control, such as dentists, surgeons and musicians, it is notable that for some reason only left-handed musicians are heavily urged to perform right-handedly while it is not recommended in the other profession (Smits, 2012).

One of the possible neural reasons why left-handedness has an effect on normative right-handed violin playing is that a person's hand movements are connected to complicated combinations of reflexes. There are two main reflex groups used in string-instrument playing: the primitive grip reflex that is usually equally developed early in both hands, and the stretch reflex that is connected to muscle power and laterality. In normative violin playing the left hand fingering mostly involves

the grip reflex and the right hand bowing the stretch reflex. A strongly left-handed pupils may not have developed high precision in the right side upper limb control, they are therefore more likely to face challenges in the bowing technique. (Fülep, 1964.) This unfamiliarity has sometimes been unfairly interpreted as clumsiness:

My daughter started playing the violin when she was 5-years old. She had problems with the bow hand, and the teacher asked: "Is your daughter left-handed?" When I answered "No", the teacher said: "That's good. I would not have started teaching her if she was. Left-handed pupils are so clumsy." (Laaksonen, 1985, p. 123.)

This presumption of left-handers being clumsy or unfit to play the violin adds to the challenge of left-handedness in violin pedagogy that has not been given the attention it needs. If within the first two to three years of violin playing such problems with bowing appear that regular pedagogical exercises fail to correct, the pupil in question may be unidentifiably left-handed. Thus, a teacher may save resources if they already during the first lesson asks about the pupil's handedness (Fülep, 1964).

In his writing on left-handedness in violin pedagogy, Fülep (1964) describes five types of handedness and their direct adequacy to violin playing:

- a) Right-handed pupil: Suitable for violin playing
- b) Ambidextrous pupil: Extremely suitable for violin playing
- c) Left-handed pupil: Suitable if trained with special exercises
- d) Extremely left-handed pupil: Not suitable for violin playing

As a tool for investigating how dominantly handed a violin pupil is, teachers may use Oldfield's handedness-test that involves 12 questions about hand-preference in regards to writing, drawing, throwing, cutting with scissors, brushing teeth, cutting without the fork, peeling, brushing, lighting a match, and opening a lid. (Coren, 1993, pp. 35-38; Smits, 2012; Paul, 1992, p. 97.) The results are categorized in seven handedness types:

- 1) Strongly right-handed
- 2) Moderately right-handed (mixed right-handed)
- 3) Weakly right-handed (mixed right-handed)
- 4) Ambidextrous
- 5) Weakly left-handed (mixed-left-handed)
- 6) Moderately left-handed (mixed left-handed)
- 7) Strongly left-handed

To add to these seven handedness categories, one can also recognize the *forced left-handers*, a group of people who use their left hand due to a right hand injury or amputation, as well as the *forgotten left-handers*, right-handed people who originally were left-handed but were forced to give up their handedness (Bertrand, 2001, p. 184; Laaksonen, 1985, pp. 42-47).

I took the Oldfield's handedness-test on February 14th, 2015 and scored in the scale as strongly left-handed, which places me among 5% of the population. Based on Fülep's (1964) earlier description of extremely strongly left-handed violinists, five decades ago I might not have been considered suitable for violin playing due to my hand-preference. In fact, prior to my professional violin studies, I often received feedback on stiffness in my right hand bow hand. According to the critique, I could not shake my right hand wrist fast enough and my bowing techniques were clumsy.

For me it was understandable, because I never used my right hand for any other fine-motor functions outside of violin playing.

Still today regardless of having trained my bowing technique according to the normative right-handed standards, I prefer to apply the rosin to my bow by holding the rosin in my weaker right hand and rubbing the bow on it using my stronger left hand. I have observed that all my right-handed pupils do it the opposite way, and when teaching them how to apply the rosin, I have to consciously demonstrate it in my non-preferred way. In other words, my left-handedness has a strong biological basis that cannot be ignored even when having established a professional level of right-handed normative violin playing, and as I am conscious of that, I am able to make reconsideration and adaptations to my own violin pedagogy.

When it comes to pedagogic solutions for exclusively strongly left-handed violin pupils, reversed left-handed violin playing might be an option. While for some pupils whose hands are equally strong the hand-preference does not have a great impact on learning to play the violin, there are pupils whose progress has been hindered by playing the violin right-handedly. By changing to left-handed violin playing the pupils may start to make natural progress. Furthermore, left-handed violin playing may also be *the only* option for people living with injuries or upper-limb amputation (Kral, 1972).

My understanding as a violin pedagogue is that it is important to be able to recognize the pupils' handedness in the very beginning of the violin playing practice. Through basic exercises the teachers will have to make a deliberated decisions whether or not the left-handed pupil should continue playing the violin right-handed or alternatively left-handedly. In the case of exclusively left-handed violinists, such as Professor Terje Moe Hansen (2015), who stated *I started playing the violin the left-handed way because it would have been impossible for me to play it the right-handed way*, playing the violin right-handedly is not always an option. Therefore playing it left-handedly should be an acknowledged alternative in terms of equality of music education.

3.3.4. The bodily basis of violin playing in violin pedagogy

Violin playing is an activity that involves asymmetrical body positions, movement and use of muscles. Therefore it has a bodily basis. In this section, I am discussing the acknowledgements of sidedness and bodily bases of violin playing in chosen violin schools as well as in other instrumental methodology.

In their study on violin pedagogy in folk music, von Wachenfeldt, Brändström and Liljas (2012) found out that in violin lessons the teacher used the body as a pulse-keeper through upper-body movement or by stamping, demonstrated finger-settings, and concentrated greatly on the details of bowing techniques and rhythmical and melodic figurations (p. 83). The learning process also included movement imitation.

Most violin schools introduce motor exercises in beginner violin pedagogy. Here are some examples from three schools used in Sweden (Brodin, 2014; Suzuki, 2007; Tilling Gratte, 2000). When examining the exercises provided by these violin schools, I noticed that the exercises performed without the instruments employ symmetrically both hands, but the exercises with the instrument are heavily focused on the motor function development of the bow-hand:

- 1) Exercises without instrument: Swimming movements, holding an imaginary ball in front of the body with two hands, holding an imaginary pile of logs with two hands

2) Exercises with instrument:

- a) Violin-hand: swinging the arm under the violin's neck, doing an elevator-like slide on the strings, finger tapping on the violin
- b) Bow-hand exercises: imitating soup stirring, imitating circling around a flagpole, imitating archery with the bow, landing on the string like a helicopter, doing a seesaw-like movement on the string, imitating a rocket and an airplane, making a rabbit head with the fingers, imagining that the two middle fingers are feet under water and the index finger and little finger are on a deck.

These preparatory exercises emphasize strongly the priority of bow-hand development, and employ a number of cultural references and fantasy. In fact, as a left-handed violinist, I notice that most of these exercises are based on the assumption that the pupil would use their right hand bow-hand for stirring the soup, archery etc. I strongly believe that there are left-handed learners – myself included – who would perform all of these tasks with their dominant left hand if given the chance.

I have been told by my past violin teachers to shake my right hand bow-hand wrist really fast as if I were waving a friend goodbye, to paint a wall with a big brush on my right hand, or to stroke the back of a horse with my right hand. I thought to myself: *But I would never do that with my right hand, I would do it with my left hand.* Therefore, instructing a left-handed pupil to imitate soup stirring with their right hand bow-hand skips over the stage of first instructing them how to stir the soup with the right hand in real life. Consequently, a left-handed pupil cannot be automatically expected to know how the tasks should feel in the right hand and how to apply them to violin playing.

An infant who starts to play the violin has a growing body that absorbs different stimuli for developing new skills. Therefore acquiring instrumental techniques involves motor control and muscle training in addition to musical skills. The neural basis of violin playing is connected to the different roles and tasks of the hemispheres, and the teacher has a responsibility to involve such exercises in methods that will stimulate both hemispheres to work together. However, as many instrumental teachers use similar teaching methods that they have been taught by without giving much critical thought on the evaluation of those methods, they may therefore experience difficulties in identifying unexplained tensions in the body, or incorrect positions due to body asymmetry and lateralization. (Rolland, 1974, pp. 14-42; Schenck, 2000, pp. 97-124, 178-188; Schleuter, 1997, pp. 20-21, 120; Suzuki, 2007; Vilmite, 2014.)

4. Earlier studies on left-handedness in perception and learning

Handedness is a widely neglected yet important aspect of music performance and musical learning (Kopiez, R., Jabusch, H.C., Galley, N., Homann, J.C., Lehmann, A. & Altenmuller, E., 2011). In fact, left-handed people are often deliberately excluded from Western studies of neuroscience for reducing variance in data, even though the inclusion of left-handers would bring more insight in handedness-related studies (Willems, R. M., Van der Haegen, L., Fisher, S. E., Francks, C., 2014). The violinist and violin pedagogue Ryan J. Thomson (2006) has also made a related observation: *There are no scientific studies on record where left-handers playing violin right-handedly would be compared to left-handers playing violin left-handedly.*

Similarly on the field of music psychology, Bicknell (2011) states that questions on whether or not left-handedness is an advantage or a disadvantage for instrumental music making, and if left-handed people feel excluded as a minority of learners, have been very little studied. Likewise, Collins (2013) speculates: *If I knew more about how music processing occurs, could I assist my students to reach that state of musical independence more effectively?* (p. 218). This present study explores also these questions, and in this chapter, I am going to present studies from the field of music psychology, neuropsychology and developmental psychology that have relevance for gaining knowledge on musical learning and handedness for violin pedagogues.

4.1. Left-handedness in childhood

Studies⁵ show that there are fewer left-handers among adults than children, because the number of people demonstrating left-handed preferences decreases as children get older (Coren, 1993, p. 50; Sitnikova, 2012). The cause for this phenomenon is uncertain, but in the context of violin playing, it implies that left-handedness may be more significant in the beginner stage of violin playing than when begun later in life.

It has been discovered that children do not fully comprehend the conception of left and right before the age of seven. In tests conducted by Jean Piaget in 1928, children were asked to show their right and left hand, and right and left foot. When asked to do so, most 5-6-year old children answered correctly. The task required a conception of the right and left side. However, when Piaget asked the children to point to their own right and left hand and right and left foot while standing opposite to them, they failed to answer correctly. (McManus, 2002, pp. 86-89.)

Children under 7 years old – a common age of beginning to play a string-instrument on music lessons – comprehend left and right as unchangeable qualities instead of understanding the relation of observing left and right from different directions. Even children at nine years of age were still not completely aware of this, which led to Piaget's following stages of children's conception of left and right:

⁵ Porac, C. & Coren, S. (1981): A study where 5147 people aged 8-100 were asked a questionnaire on their preferences for the use of hand.

Stage 1: Children understand left and right in relation to themselves

Stage 2: Children understand left and right in relation to other people's perspectives. *Socialism: your right, my left*

Stage 3: Children understand the position relations between objects and that left and right are independent object-free concepts

These findings have relevance for understanding how children in the age of starting to play a musical instrument comprehend left and right (although Piaget's study is nearly 100 years old, it is still relevant as the findings were replicated in 1961 by David Elkind, and similar conclusions were made again in 1994 by Robert Rigal). Not only do the studies show that the conceptions are difficult to understand for children in the ages of 5-7, but it also demonstrates that they need pedagogical attention for helping them to understand them in relation to themselves, their bodies, their teacher and peers, as well as to the holding and placement of their instrument.

4.2. The neurology of handedness and instrumental training among adult musicians

Both practice-based (Kopiez, Galley & Lehmann, 2010; Kopiez et al., 2011) and neurological studies (Bangert & Schlaug, 2006) reveal that musicians who have started playing the violin in childhood show few signs of handedness in their professional musicianship in adulthood. According to Kopiez et. al. (2010, 2011), years of practice lead the notable differences between left-handed and right-handed violinists to become insignificant. Similar conclusions were previously drawn by Bangert and Schlaug whose findings suggest that continuous instrumental music practice leads to adaptations in the hemispheres.

4.2.1. The handprint musical training leaves on the brain

In their neurological study on specialization of the cortex caused by long-term instrumental training, Bangert and Schlaug (2006) found out that there are considerable cortical differences within musicians, namely structural changes on the hemispheric expression in response to long-term instrumental training. The findings suggest that there are associations between the attained sensorimotor skills – playing the piano or the violin – and the features of the external cortical brain anatomy. In other words, the cortex of a professional pianist looks different than a violinist's, because piano playing is more manually symmetrical than violin playing (see Figures 5 and Figure 6, p. 62). Thus, the different hemispheric expressions depend on which instrument the participants has played. All musicians taking part of the study were right-handed.

In conclusion, musicians start their instrumental training early, which in continuity leads to highly specialized sensorimotor skills. Playing a manually asymmetrical instrument, has significant effects on hemispheric expression and leaves a *handprint* on the musician's cortex (Bangert & Schlaug, 2006). These findings are in line with Limb, Kemeny, Ortigoza, Rouhani and Braun's (2006) results on hemispheric lateralization and rhythmic listening. My understanding is that these studies give evidence suggesting that lateralization is linked to the physiology of violin playing, and therefore needs to be considered when discussing the teaching and learning of left-handed violinists.

4.2.2. Studies on the disadvantages and advantages of left-handed musicianship

Two studies conducted by (Kopiez et al., 2010, 2011) suggest that left-handedness affects finger tapping speed among violinists despite of amount of practice, but does not hinder their professional musician careers. In the latter study, by asking 24 violinists, Kopiez et al. (2011) found no significant association between left-handedness and increased physical discomfort while playing, nor negative feelings about one's instrumental skills. Furthermore, left-handed players showed a tendency to rate their playing position more beneficial than right-handed players in right-handed playing. Left-handed string players tended also to be more content with their expressive skills than their right-handed colleagues.

In a previous study conducted by Kopiez, Galley and Lehmann (2010), 128 piano and violin students at a conservatoire took part in a calculated tapping speed test, where speed, regularity and fatigue were measured. The data was combined to retrospective interviews on the participants' amount of practice. The results suggested that pianists performed faster in tapping due to their similar manual performance on both hands, whereas violinists only were used to tapping with the left hand. However, the findings indicated that the lateralization effect remains in despite of practice. Another finding was that there seemed to be a higher percentage of non-right-handers among musicians than in the general population.

These studies bring knowledge of left-handed adult musicians, namely that their handedness has not hindered them from becoming professional musicians, which confirms the already known fact that most left-handed violinists play right-handedly on a professional level.

4.2.3. Mirror neuron studies applied for music education

Lastly, I have visited studies revealing that *mirror neurons* – neurons that become activated during preparation for movement and while watching someone else move – have significance for musical learning. The mirror neurons facilitate imitation and understanding of the actions of others as well as the motor actions behind the visual signals. As musical perception rarely comes without visual and kinesthetic sensations and has complex multi-sensory connections, mirror neurons also apply in musical and music pedagogical communication. It is relevant to acknowledge that demonstration and imitation may be a more effective means for learning complex motor skills than verbal instructions. (Cohen in Hallam, Cross & Thaut, 2009; Eysenck&Keane, 2010, p. 140; Kalat, 2009, p. 237; Molnar-Szakacs & Overy, 2006; Reynolds & Reason, 2012.)

As mirror neurons enable communication and help to interact through imitation, interpretation of movement and visual signals, knowledge of these studies may encourage violin teachers to use mirroring movements, demonstration and imitation as a tool for training spacial awareness and sidedness among beginner pupils. Such aspects are presented later in chapter 9.

4.3. A violin pedagogy developed for left-handed pupils exemplified

There are few practitioners reported to have adopted left-handed violin playing in their violin pedagogy and developed didactics for the needs of left-handed pupil. One of them was Jerzy Blaskiewicz (Pyykönen, 2010). His pedagogy was an exception to the generally right-handed Finnish string pedagogy, and attracted a great number of left-handers who were offered the alternative of left-handed playing. I am going to present his views on left-handedness and violin playing in 2009.

Blaskiewicz started teaching left-handed pupils reversed after one parent insisted it for their left-handed child. It was at first difficult to get used to, but Blaskiewicz used a mirror as a tool to help himself see the process from the other perspective. Later he felt that he no longer noticed the difference:

I have had left-handedly playing pupils for five years now, I don't think that even the examination jury would address it anymore.

Violin playing is an individual process, and not all left-handed pupils wish to play reversed. Blaskiewicz told that teachers are expected to find out how strongly left-handed the pupil is. For those with equally strong hands, playing right-handedly may not be an issue, but for strongly left-handed pupils, it would be advisable to start left-handedly. Blaskiewicz called such left-handers *truly, strongly, fully and really left-handed*. He experienced that *ordering a left-handed violin for them was easy*, and one could also consider reversing an old instrument for a left-hander.

In some cases, if the muscle memory has already adapted to right-handed playing, it may not be worth undoing, but when applied, reversed playing includes all the basic components: bowing straight, the position of the wrist, relaxation and movement exercises. Also the challenges are often similar to all pupils: how the violin sits right, releasing tensions, moving the bow. Hence, the toolkit of exercises only needs to be applied *to looking from another perspective*. Blaskiewicz noted:

If someone can't make the bow go straight, it does not necessarily have to do with handedness: others manage directly, others need more time.

All problems need to be rehearsed away with persistence, and if re-adjusted to a reversed playing, it may take up to a year to attain improvements. Unresolved technical difficulties among left-handers playing right-handedly can manifest as lack of precision or steeliness in the *spiccato* and *staccato* bowing:

It is like when someone speaks another language with an accent, there is something foreign in it. But there are many kinds of left-handed people.

Attitudes against left-handedness in violin playing are mild, and Blaskiewicz believed that teachers only oppose to left-handed playing out of fear for not being able to identify mistakes or problems. He continued that reversed playing does not distract in ensembles, because with enough space between the players, there is room for the bows to go in different directions. The audience may not even notice the left-handed violinist in the section, because all bows move in the same up-down-direction. Blaskiewicz:

Berglund [a Finnish violinist and conductor] was left-handed and used to play a long time in the orchestra. And right now I have two left-handed violinists in my orchestra and there are no problems. One just needs to sit a bit further apart.

This interview gives insight and a reference point for the statements of my respondents in this study. Some of the statements are in line with those of Blaskiewicz's, some in contrast with his views, and I will discuss them together in chapter 11.

5. Theoretical considerations: A cultural-psychological perspective on musical learning in violin playing

Human nature must necessarily be understood through an historical analysis of language, myth and ritual. (Cole, 1996, p. 23)

The cultural-psychological views on learning entail the premises that the mind and cognition of an individual cannot be separated from the cultural context and its norms and values, which eventually mediate the person's cultural identity. The cultural-psychological view on learning recognizes the diversity of meaning-making processes, and in the music educational context enables looking deeper into the practices, examining the role of culture in these practices, settings, strategies and ways of thinking both employed by the teachers and pupils. (Barrett, 2011, pp. 3-5.)

Culture is man-made, and therefore learning is always situated in cultural settings and depended on the available cultural resources. The cultural meaning-making, which is an internal process created in a culture, lies in the tradition of hermeneutics (Bruner in Illeris, 2009, p. 161). Pre-understanding rests on a person's earlier experiences, learning and feelings. It is the first orientation for a study. In the process of knowing, the *knower* is one of the most important instruments in the research, and the chosen methods and techniques are adjusted accordingly to them (Gustavsson, 2003, pp. 75, 119; Molander, 1994, p. 232; Patel & Davidson, 1994).

I am a left-handed person, violinist and violin pedagogue. I have played the violin for over 20 years. Therefore the subject of this study is closely familiar to me. Thus, when conducting this study, I am carrying the personal experiences of my life-world with me. Left-handedness is one characteristic of human life, one phenomenon. As a left-handed person, I have an opportunity to examine this phenomenon from within, and my experiences may give such insight to this study that one cannot find from the outside.

Following this reasoning above, a hermeneutical epistemology is an integral part of the cultural-psychological perspective on musical learning which I am applying to this study of violin playing. As music education is interdisciplinary by nature, the cultural-psychological approach enables me to combine my music educational knowledge with studies from the fields of music psychology and neuropsychology, and provides opportunities to question some of the taken-for-granted assumptions that have shaped violin education, and to reconsider its aims, theories, and practices (Barrett, 2011, p. 5-6).

Learning takes place through conventionalized tools that are used in the cultural context, thus cultural tools are mediators between the learner and the learning object. Learning is in other words culturally framed, and the people are also reformed by the participation in the culture. These cultural tools in the teacher's music-cultural toolbox can be composition, improvisation, instrument, performance practice, musical notation, symbols, signs, verbal output and physical artifacts that play a role in the shaping of learning and action in interaction with other people. (Barrett, 2011, pp. 9-10, 116; Hultberg, 2009.)

The approach builds on Vygotsky's (1978) cultural-historical theory, where people are seen carrying the culture they live in in their consciousness. Vygotsky's views on social and cultural influences on children's learning were connected to the daily social interactions between the children and their parents, teachers and peers in *the*

zone of proximal development, which is the distance of the child's actual independent developmental level and the level of potential development under guidance or among more advanced peers.

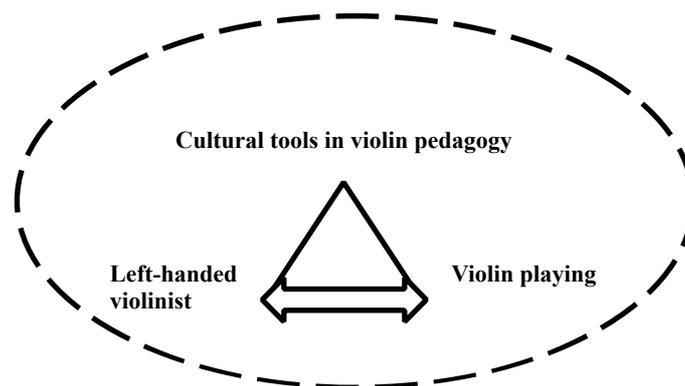
Cultural-psychological learning also requires an *intersubjective ability* to interpret other people's signals that are presented through the conceptualized tools, which are often unreflected upon (Bruner, 1996; Risberg, 2014). Thus, in the music educational contexts the individual differences of the learners' outlooks on the conventions may differ from one other. This can lead to new alternative ways of making music and change or develop the established conventions (Hultberg, 2005, p. 127).

The differences in learning between pupils can depend on their different biological ways of internalize visual, auditory and motor input, partly because they have different views on learning based on earlier experiences (Hultberg, 2009). Therefore, they require individual *scaffolding*⁶ through reflective practice (Bruner in Barrett, 2011, p. 93). My interest lies in finding out what kind of contextual pedagogical tool are used for scaffolding the learning processes of left-handed violinists in violin lessons, and what kind of conventionalizations apply in the culture of violin playing. In the context of left-handedness in violin pedagogy, I will focus on examining:

- 1) such material and instrumental tool that are used for the action of violin playing
- 2) such conventions and procedures in violin pedagogy that mediate practices, and lingual and social interaction
- 3) such representations of culture that manifest in levels of meaning-making, and such specialized cultures as the symphony orchestra

(Hultberg, 2005, pp. 142-143; Wartofsky, 1979)

In my following observation study, I am applying Hultberg's (2009, p. 56) cultural-psychological model for musical learning in the local context of violin playing in violin lessons. I am interested in finding out what kinds of individual cultural tools the violin teachers use when teaching their left-handed pupils. My application of Hultberg's cultural-psychological model for musical learning in the flexible cultural context of violin lessons is presented as followed:



⁶ Scaffolding is support tailored to a child's current needs, constantly changing to fit the child's emerging abilities while learning a new skill. It requires attention to what the child is capable of doing, as well as awareness of the long-term goals of learning. (Tan, Pfordresher & Harré, 2010, pp. 172-173.)

6. Method

This multi-method study includes two parts of empirical primary data collection, in which I have combined the following ethnographically inspired qualitative research methods:

Part 1. Qualitative interview study

Part 2. Observation with follow-up interview

In the following sub-chapters I am going to explain how the combined methodology of this study builds on abductive reasoning and auto-ethnography, and how the two parts of the study, interview and observation were carried out. Furthermore, I will present a background study that I conducted on left-handedness in guitar playing.

6.1. Abductive reasoning and an auto-ethnographic thread of the study

In qualitative research, hypotheses are rare, but instead the researcher often addresses their own outspoken pre-assumptions (Eskola & Suonranta, 1999, pp. 19-20). *Abduction* is a scientific tool used when a generally inductive approach of data collection on a small number of respondents is complemented by the researcher's own pre-understanding (Hultberg, 2000, p. 41-42). This study builds on abductive reasoning, meaning that the study integrates my loose hypothetical assumptions – pre-understanding – and reflective ability into the dialogue of the empirical studies and the theoretical body of knowledge. However, in abductive studies, the premises do not guarantee the conclusions (McKaughan, 2008).

I was within and without.

The statement above is picked from F. Scott Fitzgerald's novel *The Great Gatsby* (1925) and describes the dual aspects of being simultaneously a participant and an observer of action. I use it to describe my own position in this study that is *ethnographically inspired* and *auto-ethnographically threaded* (Alvesson & Sköldberg, 2007). Since I study a social environment I am closely familiar with, and have a deep pre-understanding of the phenomenon in focus.

Auto-ethnography is an approach in the crossing point where the researcher and the social environment meet. Ssempijja (2012, p. 231) explains that in auto-ethnography the researcher interprets and describes the native life from within the culture *through his/hers lenses*, as a so-called *halfie*⁷. In this study, I consider being part of the culture of violin pedagogy: being on my professional homeland and my colleagues and pupils being its people. Ssempijja (2012) states, that being partly insider to the phenomenon helps to comprehend what we are studying, and being partly outsider gives objectivity to data-analysis. From this point-of-view, my halfie position gives insight and reflective resources to the study, but requires carefulness of not projecting my own views as a left-handed violinist on the data.

⁷ Ssempijja (2012) writes about a researcher's position in auto-ethnography, in between being a *native* (insider) and a *non-native* (outsider). He calls the researcher *halfie* (half insider, half outsider) when they research their own culture, their homeland, their own people.

6.2. A background study on left-handed guitar playing

In order to understand how left-handedness has been recognized in the pedagogy of another stringed instrument, I have taken a closer look in left-handed guitar playing in form of a brief background study. I focused on finding out whether or not there are such pedagogical conceptions of left-handedness in guitar playing that differ from the ones in violin pedagogy, or could be applied in supporting the development of left-handed violinists, and if there are differences between guitar pedagogy in the classical and non-classical genres in terms of left-handedness.

I conducted two interviews in writing by corresponding with selected experts by email, Troy Stetina in the United States and Leon de Wit Sandström in Arvika, Sweden. Troy Stetina is a right-handed guitarist and the creator of the complete left-handed guitar method for non-classical guitarists (1998). Leon de Wit Sandström is a left-handed classical guitarist currently conducting his bachelor study at Ingesund College of Music on guitar teachers' views on left-handedness in guitar playing. Both correspondents answered to all of my questions and agreed to participate in this study with their names.

I formulated my open-ended interview questions after studying Stetina's earlier publication, *Left-handed guitar, the complete method*⁸ (1998). The interviews in writing took place in February 2015 via email due to geographic distances. I asked both experts the same qualitative interview questions on the following themes:

- The need for a left-handed guitar method
- The availability of instruments for left-handed guitarists
- The pedagogical views on left-handedness in guitar playing
- The attitudes against or for left-handedness in guitar playing
- The pedagogical solutions for left-handed pupils

The results of this background study are presented in chapter 7.

6.3. Main Study Part 1: Qualitative interview study

An interview is a conversation happening in between two views. It mediates knowledge, experience, opinion, attitude and assessment. A qualitative interview study aims to gain understanding of experience, meaning, life-world, discussion, dialogue and language. (Jacobsen, 1993, pp. 10-11; Kvale, 1997, pp. 12, 22.)

6.3.1. Semi-structured qualitative interview study

One form of qualitative interview is the semi-structured life-world interview. It is defined as an interview with an aim of gathering descriptions of the respondent's life-world in order to interpret the meaning of a specific phenomenon. Technically speaking, a semi-structured interview is not completely open nor a structured ques-

⁸ In the preface of his guitar method, Stetina (1998) states that society's preference for right-handedness runs deep and in the past, left-handed players have had to adapt their technique to right-handed guitars, playing them upside down or *backwards*. He notes that guitar methods and magazines have a strong right-handed bias as the fretting hand is commonly called *the left hand* and the picking hand is called *the right hand*. Also, all chord and neck diagrams are always shown from the right-handed perspective as a standard practice.

tionnaire. Instead it focuses on pre-selected themes. In a semi-structured qualitative interview different interviewers may get different responses from the interviewees based on their sensitivity and knowledge about the research subject. The interview may also give new insight for the respondent on their own life-situation. (Kvale, 1997.)

The sources of data collection according to Björk and Räisänen (2003, p. 231) can be divided to primary sources: the data one gathers by the researcher for a specific study, and secondary sources: other people's previous studies on the same subject. In the design of this qualitative interview study, I am following the seven methodological stages⁹ of Kvale (1997) for collecting my primary interview data.

6.3.2. Design of the qualitative interview study

According to Tuomi and Sarajärvi (2002), the themes for a qualitative interview study rise from the phenomenon that is studied and from already existing knowledge (pp. 77-78). Since I already had conducted some of the interviews for this study in 2009 (Pyykönen, 2010), I had a strong understanding on how to design the follow-up interview questions for this study in 2014-2015. I aimed to conduct the interviews with understandable, short and everyday language questions. Each interview was aimed to take less than one hour of time.

In the *thematizing* and *planning* of this study, I made sure to go through all the thematic areas with all my respondents even if the order and extent of answers would vary among the respondents, as suggested by Tuomi and Sarajärvi (2002). The interview questions connected the interview themes together. I focused on the following themes when conducting the interviews:

- 1) Themes for left-handed violinists: the orientation of playing, the effects of left-handedness on violin playing, pedagogical experiences with violin teachers, challenges and areas of ease, technical exercises, attitudes for or against left-handedness, orchestras and ensembles
- 2) Themes for right- and left-handed violin pedagogues: recognition of left-handed pupils, pedagogical tools for teaching left-handed pupils, orientations of playing, pedagogical knowledge on left-handedness, attitudes for or against left-handedness, methodological readiness, orchestras and ensembles
- 3) Themes for a violin maker: violin as an instrument, history of the violin as a cultural gadget, reversal of the violin, making of left-handed violins, orchestras and ensembles

6.3.3. Strategic sampling for respondents and correspondents

Experts have technical process oriented and interpretive
knowledge referring to their specific professional sphere of activity
(Flick, 2009, p. 166)

In qualitative research, the researcher uses discretionary sampling where the focus is on a small amount of cases and the relevance of the data builds on quality instead of quantity (Eskola & Suonranta, 1999; Gustavsson, 2003). An expert interview is a form of semi-structured interviews, where the respondents both complete and enrich the study by giving such insight that arises from their expertise on the subject in practice, not only in theory (Alasuutari, 1999, pp. 270-271). Experts can be

⁹ Kvale's (1997) seven methodological stages of a qualitative interview are thematizing, planning, interviewing, transcribing, analyzing, verifying, and reporting the findings.

interviewed for gaining knowledge and/or context knowledge for filling missing gaps of information, and by strategically selecting different expert respondents, one can gain broader understanding of the phenomenon (Flick, 2009, pp. 165-169).

In this study, the strategic sampling of expert respondents was based on the following criteria:

- 1) Personal experience of being a left-handed violinist or experiential views on training left-handed violinists
- 2) Professional experience on left-handedness in violin pedagogy
- 3) Professional perspective on left-handed violin playing or violin making

All of the experts were specialists on the field of violin playing, violin pedagogy or violin making. Some experts were interviewed in writing due to geographical distances which made it impossible to meet them in person. In order to dissociate the experts interviewed orally and in writing, I am referring to them as respondents (orally interviewed) and correspondents (interviewed in writing). The respondents and correspondents in my interview study were:

1) Left-handed violinists and violin pedagogues

Respondents

- Mats Strand, violin pedagogue, violinist
- Kari Olamaa, diploma-violinist, violin pedagogue

Correspondents

- Terje Moe Hansen, Professor of violin playing at Norwegian Academy of Music, a left-handedly playing internationally acclaimed concert violinist
- An anonymous violin pedagogue, (N.N.) violinist

2) Right-handed violinists and violin pedagogues

Respondent

- Matoula Zachariadou, violin pedagogue, violinist teaching left-handed pupils in her violin groups

Correspondent

- Ryan J. Thomson, violin pedagogue, violinist, author of *Playing the violin and fiddle left-handed* (1997) in New Hampshire in the USA, a left-handedly playing right-handed violinist who reversed in left-handed violin playing after an injury that ended his right-handed musician career, and who has since published on left-handedness in violin pedagogy

3) Right-handed violin maker

Respondent

Ilkka Vainio, violin maker, CEO of Risto Vainio Oy, who has insight on violin making and the right-handedness of the instrument

6.3.4. Settings

I first contacted the respondents personally, via email or by phone to ask them to participate in the study. In this stage I introduced the aim of the study and the thematic framework of the interview. I also explained the reason why I would like to interview the expert. All experts agreed to be interviewed, but one decided to drop out after reading the transcript of the interview, and another one wanted to stay anonymous. Most of the interviews were conducted in the respondents working place, at their home or at a scheduled after-work meeting at a public place. All interviews were collected in Helsinki, Finland, Stockholm, Sweden and Malmö, Sweden.

One of the respondents, Mats Strand, I met at the ESTA Sweden-convention of the Swedish String Teachers' Association by coincidence, after I presented my preliminary findings of the study on January 9th, 2015. He expressed his interest in the study, and I conducted the interview two days after on January 11th 2015.

The participating experts Olamaa, Hansen, Thomson, Vainio, and a participant who specifically wished to remain anonymous, referred to as "N.N." were first interviewed between 22.5.-30.9.2009 for the preceding bachelor study (Pyykönen, 2010), and again with a follow-up interview conducted 24.11.2014-20.2.2015 for this study in order to gain knowledge of their current views on the phenomenon. As these experts had a chance to alter their previous answers and add new insight and knowledge, they brought many new perspectives to this study. For example Olamaa was first interviewed on 22.7.2009 and again on 24.11.2014 based on his previous answers. During his follow-up interview, he discussed many new topics that he didn't bring up in 2009. Moreover, he critically altered a number of his previous points-of-view.

I had scheduled 60-90 minutes for each interview, but in reality the interviews were 22,5-75min of length and the average length of the interviews was 40 min. The interviews were recorded on speech recorded. According to Hirsjärvi and Hurme (2001), by recording the thematic interview, the researcher can guarantee that the data will be analyzed with the original expressions and meanings included (p. 92).

6.4. Main Study Part 2: Observation and follow-up interview

Observation provides first-hand data by meeting people in their natural environment by perceiving what people do, rather than what they say. It is commonly used in ethnographic studies, aiming to be naturalistic and seeing a group of people in their natural environment, and it is often combined with interview, filming, photographing etc. (Esaiasson, 2007, pp. 343-358). According to von Wachenfeldt et al. (2012), an ethnographically inspired observation method can give a realistic, lively and trustworthy description of the contents and structure of an instrumental music lesson (p. 79).

I have observed one violin group lesson of a left-handed pupil and right-handed pupils. The lesson was filmed on video. During the observation I made field notes, which I after the observation wrote down to a short descriptive text. The type of observation in this study is called focused observation, which according to von Wachenfeldt et al. (2012) is a suitable method when the researcher has experience and pre-understanding of the subject of the research (p. 80). In their study on folk music pedagogy for the violin and the guitar, von Wachenfeldt et al. found out that there was not enough qualified music pedagogical studies on their subject, and so

their study could be seen as a *pioneer study with an explorative character* (p. 80). This study has a similar position in the field of music education research.

6.4.1. Participants and settings

The participants in the observation study consisted of Matoula Zachariadou and her group of beginner violin pupils. One of the pupils was left-handed and the others were right-handed. All pupils played the violin right-handedly. The pupils were born 10 months apart from each other, hence the age division of the group was 5-7 years. The pupils had been taking lessons together since September 2014, so they had been playing together roughly three months prior to the study. For ethical reasons, I have chosen to withdraw from giving further information about the pupils.

The observed 45min group lesson took place on November 28th, 2014 in a local culture school in central Sweden. The room of the lesson was spacious, and had a grand piano. The pupils were gathered in the center of the room, where they unpacked their violin cases and prepared for playing. They were placed in a half-circle or a row as the lesson progressed.

6.4.2. Documentation

The documentation of the observation consisted on 50 minutes of video material. There was around 3 minutes of filmed material before the lesson begun, and around 2 minutes after it finished. The video camera was placed in the back of the room so that all pupils were in the picture. Additionally, on the other side of the room, I had a tablet, which I used for filming for a *backup* from another angle. However, the filming of the video camera was successful and provided a higher quality of documentation superior to the tablet, portraying the lesson in higher precision and therefore I used the video camera data for the analysis of observation data.

6.4.3. Follow-up interview

Stimulated recall interviews involve the participants to watch the video of the observed event and respond to it by stimulated reflection. The participants mirror the ethnographically collect data thorough stimulated- recall by returning to the original situation, which enables mutual understanding of the data between the researcher and the participant (Heikinheimo, 2009, pp. 123-126, 136-144, 244).

As a variation of stimulated recall, Hultberg (2006) has created an after-observation follow-up interview technique. In Hultberg's technique, the researcher shows their participants pre-selected clips of the observation video-material for supporting the recall of the participants on such events that have significance for the study. The method has later been employed by Anna Backman Bister (2014) in her doctoral dissertation (p. 98). In my observation study, I have chosen to use a similar method, which I consider a variation of Hultberg's stimulated-recall -inspired method.

Because the observation in this study took place right before the pupils' Christmas concert the following week, I could not find a time for a follow-up interview with all participants before the beginning of the holiday break. Therefore I only met Zachariadou after the holiday on January 13th, 2015, almost 1,5 months after the original session. The length of the break between the observation and the follow-up interview was determined by circumstances, but nevertheless Zachariadou was able to recall the lesson as we watched selected clips of the video together.

6.5 Analysis

The primary data in this study consists of interview and observation data. I have filmed all observation material on video, and recorded all interviews on audio-recorder and then transcribed the material word-by-word. After the thematizing, planning, interviewing and transcribing stages of Kvale's (1997) model, analysis follows. I have chosen to analyze the data from a cultural-psychological perspective on musical learning. As earlier explained, this perspective recognizes learning to take place in a cultural context and depending on available cultural resources, because knowledge is mediated through conceptualized cultural tools (Hultberg, 2009).

6.5.1. Analysis of interview data

In the content analysis process, the transcribing of the interviews took on average 2,5 hours per interview, and I gained 35 pages of transcribed material in total. I have read the transcriptions many times with and without the interview recording in order to gain a complete picture of the answers. Then I organized the answers within thematic sections, and used colored pens to mark the different topics in each interview transcript. For example:

*There were no significant **visible differences in the motor skills of the hands***

*He later told that he had thought I had **quite significant motor problems in the beginning...***

From the cultural-psychological perspective, I aimed to identify the material tools, physical gestures and cultural conceptions found in the empirical data that I had re-grouped based on similarities and differences. Finally, I was able to re-organize the cultural tools that I found into three categories:

- 1) Material conceptual tools in the local context of violin lessons
- 2) Conceptualized tools used in procedures in the local context of violin lessons
- 3) Conceptualizations in a wider cultural context of violin playing

I am going to present these representations in chapter 8.

6.5.2. Analysis of correspondence data

When researching which ever phenomenon, there is always some knowledge to be found. When conducting this study, I had to make the decision of which perspectives on this subject of study were relevant and important for investigating the music pedagogical procedures and cultural conceptions for bringing out new knowledge on left-handedness in violin playing. Parts of this knowledge was available for me only via email-correspondence due to geographical distances. Because I considered this data central for this study, I decided to combine it with the interview data. Since my three correspondents sent their answers in written form, I didn't transcribe them, but used thematic color marking and re-grouping before I combined the correspondence data with the findings of the interview data.

6.5.3. Analysis of observation and follow-up interview data

Because observation is usually combined with other research techniques, the analysis of data can be presented in many different ways. Qualitative studies include descriptions of the central phenomena with citations from the situation (Esaiaasson, 2007, pp. 343-358). During the observed lesson, I made notes of the activities, and

immediately after the session, I wrote a short descriptive text as suggested by Krüger (2008). For example:

The teacher is systematically correcting the bow-hold. Asking how to hold the bow. The children answer that the middle finger comes close to the thumb. The left-handed pupil needs help to correct the hold. She would also take the bow to her left hand, but even the two right-handers do so a few times.

After the observation I watched the video documentation three times, each time making notes of the central events of the lesson. Then I compared my notes with the short descriptive text I had written after the observation.

I made a list of the observable manifestations of the culturally conceptualized gestures, exercises and tools, paying attention to how and when they emerged. I found the following clips from the video material to bring forward to the follow-up interview:

- 1) [08:00-10:15]: Swinging the body from side to side without the instrument, the teacher standing before the pupils back towards them and showing an example
- 2) [11:00-15:10] Bow-hand exercises without the violin: *The witch* or *The spider*
- 3) [15:15-16:52] Constructing a bow-hold without the violin
- 4) [17:00-18:12] Bow-hand exercise without the violin: *Stirring the stew*
- 5) [19:40-20:35] Holding the violin in play position and after in under the bow hand arm
- 6) [35:02-39:15] Rehearsing a piece of music with spacial movement

I used these six snippets during the follow-up interview with the teacher. In my stimulated-recall inspired follow-up interview, I asked the teacher Zachariadou to comment freely on the six video clips that I had pre-determinedly selected for viewing. The interview was 38 minutes of length and took place in the teachers working place. I then transcribed the follow-up interview word-to-word. For example, on clip 3 *Constructing a bow-hold*, Zachariadou commented:

There are different learning paces between the participants, and between the ways they understand the instructions and then act by themselves.

Lastly I combined the transcribed comments with the observation data findings. I present the findings in chapter 9.

6.6. Ethical considerations of the studies

The ethical principle of an interview study is to aim to make the respondent's current situation better in terms of non-maleficence, beneficence, autonomy and justice (Flick, 2009, p. 37; Kvale, 1997, pp. 105-113, 142). This means that the researcher assures confidentiality in the planning, conducting, transcribing, reporting and publishing of the study by leaving such private information that could identify the respondent anonymous. Secondly, the researcher aims to interpret and analyze the data as truthfully as possible. Thirdly, the researcher assures the consequences of participation in the study, in other words that no later damage will inflict on the participant after the interview. (Trost, 2010, pp. 123-126.)

In my study, all participants that are using their own name in the study have agreed to be identified. All interviews are transcribed in word-to-word precision to ensure truthful interpretation and analysis, and the participants were shown the transcripts

so that they got a chance to make changes or additions to the text. Since the participants were sharing personal information on their own experiences, I paid special attention to sensitivity to their pace and willingness to talk during the interviewing. One interviewed respondent decided later on to drop out of the study and forbid the use of the interview data even anonymously. I respected that decision and left out the interview from the study.

The participants of the observation study are anonymous in this study in order to protect their autonomy and privacy. Since the participants were children aged 5-7, all documentation of the lesson was done with full written informed consent with the pupils' parents and the teacher.

6.7. Method discussion

There are four components for evaluating the reliability of an interview and an observation study build on congruence, precision, objectivity and consistency (Trost, 2010, p. 131). In this study, I have aimed for high congruence, mainly by asking the respondents questions from the same thematic areas. I have used recording-devices to document the studies, and transcription in order to treat the data with precision. I have been truthful to the data and used Kvale's (1997) model as a guideline for the empirical studies. I have put the study in the framework of the cultural-psychological perspective, and analyzed the data using Hultberg's (2009) model for musical learning.

I aimed this way for consistency in analysis and presentation of results. I am now going to discuss the reliability of the study in two parts:

Firstly, the body of knowledge was built on the earlier findings of my bachelor thesis (Pyykönen, 2010). In addition, I used sources from the fields of violin pedagogy, music and developmental psychology. I also collected data on the history of left-handedness and left-handedness in guitar playing. Many of the authors who had written about left-handedness and to whom I referred to in this study (Smits, De Wit Sandström, Thomson) are either left-handed people or have a personal interest in left-handedness. Therefore, I have been critically aware of the material I have chosen to refer to, in order to avoid a strong bias.

Moreover, I am aware that some of the references I have used are popular scientific or older than a decade. However, since I am portraying a minority-phenomenon and the sources are scarce, I have deliberately chosen to include all such sources that bring relevant knowledge to the study. Also, most of the popular scientific publications were written by university professors or other scholars.

The empirical data that I have used in the study consist on interviews, an observation and a follow-up interview, as well as correspondent statements. I trust the reliability of the collected data, since I have personally been involved in the majority of the data collection. Only the expert statements of the correspondents were collected without face-to-face meeting due to geographic distances, but the correspondents are people with strong expertise in the subject, which was crucial for the study.

7. Findings of the background study

This brief study suggests that it is more commonly accepted to play the guitar left-handedly in the non-classical than in the classical guitar tradition. In the non-classical tradition, the availability of learning material and instruments is accessible. Moreover, left-handed playing is not rejected by non-classical teachers, and the number of left-handed guitarists is comparably significant¹⁰. The suggestion that the classical tradition is more reluctant towards left-handedness than the non-classical one has relevance to violin pedagogy, which is also classically institutionalized.

The non-classical guitarist Stetina shares his views on the *need* for taking left-handedness into consideration in guitar pedagogy:

Need? Well, I think left-handed people will find it easier to learn and play left-handed. The question maybe should be, "why should left-handed people be forced to play reversed?"

This approach shows acceptance toward left-handedness, and as confirmed by Stetina, it describes the attitudes towards left-handed non-classical guitar playing:

Guitar is a very open, popular instrument. Left-handed playing is just a bit more unusual, that is all.

The openness presented in Stetina's statement is further emphasized in his view of that the tools need to be modified to meet the needs of the learning person. His approach is also characterized in his views on instrumental availability, as he states that currently true left-handed guitars are available for left-handed players.

Contrarily to Stetina's statements, the classically trained left-handed guitarist De Wit Sandström shows that there are opposite views especially in regards to availability of learning material, knowledge and approaches in classical guitar playing:

The left-handed student has two choices, both choices will cause future problems [...] Playing the right handed guitar will probably cause problems with the playing technique. Playing the left-handed guitar will probably cause problems to find the instrument that you want or even teachers who want to teach you in the left-handed way.

In contrast to Stetina, De Wit Sandström has encountered reluctance towards left-handedness in classical guitar pedagogy:

Yes, there are teachers that are for and against left-handed guitar playing, and those who don't know or who think that it is up to the student to decide what to do about it [...] As far as I know it is probably more common to play the left-handed guitar in rock and pop music than in classical.

Lastly, on the availability of classical instruments, De Wit Sandstorm confirms the different approaches for left-handedness in classical guitar playing compared to non-classical tradition:

Yes there are some left handed guitars Yamaha, Ramirez, Cordoba concerto and many more etc. but if we have a very specific wish we have to ask a guitar maker to build a guitar which is often expensive.

This background study confirms my pre-understanding that the views on left-handedness in guitar playing are more tentative in classical than in no-classical genre.

¹⁰ Examples of well-known non-classical musicians playing the guitar left-handed: Kurt Cobain, Iggy Pop, Bob Gendof, Joan Jett, Paul McCartney, Jimi Hendrix, and Tony Iommi among others.

8. Findings of the interview study

When I started to analyzing process, I was examining the data in relation to the literature sources that formed the body of knowledge in the background of the study. I aimed that the data collected from the respondents and correspondents would be in dialogue with the literature findings and within the chosen theoretical framework of the cultural-psychological perspective.

8.1. Material conceptual tools for left-handed violin playing in the local context of violin lessons

8.1.1. Artifacts and cultural tools – perspectives on the instrument

One of the great challenges of left-handed violin playing is the availability of high-quality violins. The availability of left-handed violinist may be locationally depended, thus easier to access in certain countries. One can order a new left-handedly violin from a violin maker or from a violin shop, but a busy luthier might turn the order down.

Vainio: If violin makers have enough orders, they will unlikely take the time to build a violin that needs everything to be built the opposite way.

Similarly, Thomson describes the availability of new left-handed violins in the US:

There is an economic factor. Violin dealers and music stores that sell violins find left handed playing troublesome. It is much easier to keep right handed violins in stock, rather than to have both left and right violins for sale. I hear regularly from left handed individuals in many areas of the US who attempt to purchase a left handed violin at a local store and are told, "there is no such thing as a left handed violin."

Consequently, both participants state that there are possibilities for purchasing left-handed violins for the needs of left-handed players, but there are still contrasting views on how easily available the instruments are for the player. An option, however for purchasing a new left-handed violin is the reversing an old instrument. This too, however is a debatable procedure that the relevance of which is questioned by my participants.

Vainio: If one would treat a Stradivari violin as a piece of fine arts, such as the *Mona Lisa* for example, it would be put behind a glass and hid in a dark place, where one could look at it without direct sun light. It would be taken out of the frame once a year with gloves and be checked that everything was fine and then be put right back in there. But since it is a violin, it goes through all kinds of procedures, and it is being used.

As presented previously in section 3.3.1. and now confirmed by Vainio, unlike some other instruments, especially historical violins are such cultural artifacts that are considered more as pieces of art rather than tools in the living culture of music-making.

Olamaa adds: A guitar, ukulele or a mandolin is easy to reverse, but in case of a violin, it is a great challenge to reverse a high-value instrument. There are even left-handed pianos, and a drum set is modular and can also be put together both ways. In the basic guitar it is also very easy to change to left-handed

playing with minor adjustments. Perhaps that's why left-handed playing is more popular in guitar playing than violin playing.

In a similar way, Vainio concludes:

I doubt that any violin maker would reverse an old instrument, and therefore left-handed players may have limited opportunities in finding a rich-sounding high-quality instrument to play. All alteration procedures destroy the original value of the instrument, which cannot be approved.

As presented, the problem of selling new left-handed instruments is a question of economical profitability, and in case of building new violins it is a challenge to find an available luthier for the commission. Moreover, the optional reversal of old violins is a debatable question of the cultural value of the instruments and respect towards the luthiers' original works.

8.1.2. Visual tools – mirrors and illustrations

As left-handed violin playing is a mirror-image of right-handed violin playing, some violin educators use visual tools, including the mirror, for facilitating the teaching and learning processes during violin lessons. Furthermore, left-handed musicians may also prefer to use the mirror for their own practicing. In other words, since there is a lack of adapted instruments and learning material for left-handed players that would facilitate the learning processes in violin lessons, practitioners have created their own solutions.

Olamaa describes why visual tools may be necessary in violin pedagogy for left-handed pupils:

I think it is important that the teacher is able to see if there is a need to play reversed, and if so, to have the necessary tools to educate the child in a mirror-image manner.

The need for the teacher to be able to see the reversed playing corresponds with a similar need of the student's in case the teacher plays reversed, as confirmed by the left-handed Terje Moe Hansen:

Yes I sometimes use a mirror in my playing and teaching. In this way I quit the visual confusion if it exists.

Further evidence of the importance of the mirror is confirmed by the left-handed violinist and pedagogue who plays right-handedly, Mats Strand, who says that he has had a strong preference to use a mirror when practicing his own playing:

I have gotten confirmation of how it looks when I am playing, but also in a way, when playing in front of the mirror I find the feeling of playing easier, things fall into their places. I have always gained confidence by playing in front of the mirror when being nervous before a concert, or something else. I can always go to the mirror and feel myself again, recognize myself and find myself in a way. It is difficult to describe why that is.

This shows that the mirror is used as a supporting tool on all levels of violin playing, and found suitable for even expert performers and teachers in addition to being considered necessary for the learning of the left-handed pupils.

Contrarily to this, however, the ambidextrous Olamaa emphasizes the importance of the pupil's own internalization of sidedness instead of using visual helping tools:

Such spatial games in the room where the pupil cannot simply rely on the mirror image but needs to think over which side is left and which right.

Besides the mirror, there are other visual tools that may be useful for facilitating the learning of the reversed violin playing. Thomson describes using visual tools, such as illustrations of the violin's strings when teaching left-handedly playing pupils who have not re-strung their instruments:

That is an interesting teaching project for me since that configuration greatly influences playing technique such as double stops, fingering intervals etc.

In this study, left-handedly playing violin teachers were the only ones who had used mirrors and illustrations in their pedagogy, and the views of how much they should be employed in violin pedagogy differed slightly between respondents.

8.2. Professional and pedagogical procedures on left-handedness in violin playing

8.2.1. Determining the orientation of playing in beginner pedagogy

According to my left-handed respondents who had begun playing as children, they all started playing the right-handed way by their teachers' and/or parents' instruction.

Zachariadou explains:

Older pupils often say it themselves, and ask how one should proceed. But if they are young pupils, and the parents have not informed about handedness, I will sooner or later notice it when they take notes and write with the left hand.

All respondents recommend to start playing the violin right-handedly, but if the pupil demonstrates strong left-handedness or has already been playing the violin left-handedly, one should choose the left-handed way of playing.

Olamaa: As far as I have understood it, the violin can be played in two ways. Depending on the amount of practice and quality, as well as the support of a teacher, of one practices enough and correctly, one will learn.

Contrary to this understanding, most violin teachers leave the option of left-handed playing unexplored. The option of reversed playing could be considered as an alternative even if one would mostly employ the right-handed approach.

Olamaa: Probably in my own teaching I will approach by teaching everyone traditionally, but with a very strongly, exclusively left-handed pupil I will offer an alternative to play the reversed way. Not with all left-handed pupils, though, since if the playing goes well the right-handed way, it is not worth committing to the extra work of reversing the instrument etc.

The left-handedly playing violin educator, Hansen agrees:

Traditionally every player has to play with the bow in the right hand, I think.

The participants, although playing left-handedly themselves, believe that it may be valuable to play the violin right-handedly even if the option of left-handed playing has been crucial for their own progress to become a professional violinist. These views are connected to the aspects of instrumental availability and orchestral playing.

However, Thomson reminds that the pedagogical decision of choosing between right-handed and left-handed playing requires serious deliberation:

Teachers should make well-deliberated decisions based upon the facts of the nature of handedness.

Indications of the benefits of reversing to left-handed playing are for example the pupil's discomfort in right-handed playing, or if the pupil has only played the violin for a short period of time, but already has significant problems with the right-handed playing technique. This can be difficult to evaluate, since there are no studies on the discomfort of left-handed beginner instrumentalists.

Olamaa reflects:

If one could find such pedagogical evidence that left-handed violin playing generally takes away some substantive hindrance and discomfort from left-handed violinist, I would be in favor of it, but not as a statement alone.

He believes that a left-handed violinist will get used to play the right-handed way if the training is begun early enough:

The younger, the easier it is for the brain to *be shaped* and the physical aspect to be learned, such as the rotation of the hand. Through correct repetition, one will learn.

For testing reaction time of both hands in order to investigate if there is imbalance between the manual motor skills.

Olamaa: Wiggling of the fingers, coordination games using both hands for seeing if one of the hands is coming a bit after the other, and if it is always the same hand that is slower. One can see a lot from a person's face, if they need to try very hard, and if the motor skills are evenly developed.

Even if my participants are aware of the option of left-handed violin playing, most of them still recommend starting to play the violin normatively, even in cases where they have needed the option of left-handed playing themselves. The decision of how to start violin playing with a strongly left-handed pupil is not unambiguous, but rather requires the teacher's investigation, engagement and deliberation, as well as preparedness to consider the level of handedness from the beginning of the violin studies.

8.2.2. Pedagogical strategies for training the weaker hand

Since the commonly used motor exercises for violin playing emphasize right-handedness and disregard left-handedness, I asked my respondents to share such exercises that are aiming to train a left-handed pupil's motor skills.

Hansen states: The motor operations are similar in reversed playing and therefore I do not have special exercises for left-handedly playing violinist. Instead the same standard exercises will be done the other way around.

According to my respondents, a violin teacher needs to be able to diagnose and target the primary problem, find out the cause for the problem and then fix it regardless of the pupil's handedness.

Olamaa: Familiarization and early shaping can according to his experience successfully lead to learning the handwork of violin playing the right-handed way. It has led to me being ambidextrous apart from writing and holding the fork. I cannot say if it has required more effort but it has not diminished my left-handedness but rather lead towards ambidexterity. That, in my opinion, it is a good thing that increases versatility and adaptability in many different situations, so one can even discuss it being

an ideal scenario [...] It is the teacher's responsibility to make sure that there will not be too great a gap between the two hands' development.

Strand agrees with Olamaa's statement:

I use methods designed to solve individual problems regardless of the handedness. I see it as a personalized way of finding solutions.

Like Strand, who has never had difficulties in learning left hand violin techniques like *vibrato*, an anonymous respondent (N.N.) describes that the agility of their dominant left hand has led to situations where the choice of repertoire and pedagogy followed the development of the stronger left hand instead of the weaker right hand. The pieces they practiced included such advanced techniques that they were able to manage with the left hand but not the less-developed bow hand.

N.N.: I have always had more problems with my bow-hand, but I don't know if it is because I am left-handed. Scales on the other hand have been *easy*. I would say my left hand has more agility than the right.

No matter which pedagogical strategy a teacher chooses for educating left-handed violin pupils, they need to recognize the possible misbalance of the coordination of the hands that normative violin playing bring about among left-handed violinists. My respondents stress the importance of exercising both hands equally and withdrawing from choosing the repertoire based on the maturity of the more skilled hand, and instead focusing on exercising the weaker motor hand. To be able to do so, the teachers need to be informed and aware of the pupil's handedness.

8.2.3. Perspectives on orchestras and ensembles

As mentioned previously, professional violinists who play left-handedly are a marginal phenomenon in orchestras, and their orientation has been seen possibly problematic in orchestras.

Olamaa explains why:

The orchestra culture has not yet adopted left-handed playing as its own in to the mainstream of professional orchestras. Will it become more common really depends on whether or not playing the violin left-handed will be come common or not [...] The special arrangements in orchestra playing may make job opportunities more challenging, and may take away attention from playing the music.

In regards to job opportunities, Strand states:

If one plays left-handedly, they need to be able to win which ever position regardless of handedness.

Olamaa adds to this view:

It really comes down to the playing skills. Even in the orchestra auditions one plays behind the curtain, so the jury will not see how the person plays.

These conditions are consistent with the absence and invisibility of left-handed playing in orchestras, which is confirmed by Zachariadou:

Perhaps there is someone in the orchestra playing the opposite way, but it should not matter [if someone plays left-handedly]. Maybe I have heard of it but I have never seen it.

It seems that the strongest pedagogical argument in favor of right-handed violin playing for left-handed pupils, is the perspective of professional orchestra playing. The arguments entail both logistical arrangements and visual disturbances.

Olamaa: I once discussed with a cellist who was extremely *exclusively left-handed* and played the cello the other way. She had met difficulties with placing the cello, although the cello requires more space than the violin.

Hansen states that as a teacher, playing reversed has never been a problem, but it causes practical problems in orchestra which can be overcome:

The visual disturbance some experience, when he/she sees the bow in opposite direction can be reduced by placing the links violinist in the inner places in the group.

Similarly, Strand recalls seeing a left-handed cellist in a symphony orchestra, and reflects:

While watching, one also puts a mark on it, even if it's just a question of getting over it. Once one gets used to the visibility of left-handed playing, one starts to focus on listening to the music.

Even if left-handed violin playing in professional orchestra playing still is a topic of discussion, in chamber music it is a mere advantage. Especially in a string quartet, having one of the two violinists playing left-handedly enables both of the violins to have their f-holes towards the audience when seated opposite to each other. In the traditional settings, the second violinist is further away from the audience than the first violinist, or placed on the opposite side of the ensemble, and will have their f-holes pointing away from the audience.

Hansen describes a personal experience:

I did not like to play in orchestras... Last week I played string trio, fantastic to play links then, all instrument turned out to the public gives a much richer sound.

To illustrate the context described by Hansen, see a picture of Rudolf Kolisch playing in a string quartet left-handedly (Figure 7, p. 63) as well as Thomson's (2003, p. 15) suggestions for seating left-handed musicians in the orchestra sections. (Figure 8, p. 63)

8.2.4. Concepts used for left-handedness and violin playing

Violin pedagogy has not yet established professional language on left-handedness. Instead, music educators and musicians use different concepts when referring to the functions of the hands in instrumental playing. For example in violin playing, the bow-hand has also been called simply the right hand, and the fretting hand in guitar playing the left hand. This shows that the sidedness and right-handed dominance in playing an asymmetrical instrument adapts terms that describe manual sidedness instead of the function of the hand performs. My respondents and correspondents refer to left-handed violin playing and left-handedness using the following terms in different languages:

1) On playing left-handedly:

The left-handed way of playing: Hansen calls it *playing links*, which refers to the German work *links* for *left*. Olamaa uses terms playing *vasemmin päin*, Finnish for *the left-way around*.

The other way of playing: Zachariadou uses the word *tvärtom*, Swedish for *the opposite way*. Hansen calls it *the other way*, and Thomson referred to *bowing backwards*.

The wrong way of playing: Strand used the term *felt håll*, Swedish for *the wrong way*, and Olamaa also used a term *väärin päin*, Finnish for *the wrong-way around*.

2) On right-handed playing: Olamaa, Strand and Hansen used the terms *normal*, *typical*, *traditional* or *the right way* on right-handed violin playing.

3) On the different levels of left-handedness:

Exclusive handedness: Olamaa talk about *exclusive handedness* as well as

Ambidextrous handedness: *bi-manual* or *ambidextrous* handedness.

Olamaa's chosen terms are in line of those used by Blaszkiewicz, see section 3.3, and those categorized by Fülep in section 2.3.3.

4) On describing the discomfort of right-handed violin playing:

Uncomfortable right-handed playing: The left-handedly playing violinist and violin pedagogue Hansen uses two different terms *unnatural* and *wrong* to describe the feeling of playing the violin right-handedly.

This demonstrates that left-handed violinists use a variety of terms describing left-handed violin playing, even calling it playing the wrong way around, and recognize different levels of hand-preference. In the next section I will present participants' reflections on their experiences on left-handedness and violin playing.

8.3. Statements of left-handedness in professional practice

8.3.1. Experiences of handedness in violin playing

Left-handedness manifests in different levels as previously explained. The level of handedness also affects how left-handed violinists have experienced its impact on their professional practice. Terje Moe Hansen describes that there was no possible way for him to play the violin right-handedly:

I know that I could never have been a professional violinist if I had to play normally. With the bow in my left hand I felt I had played violin before. With the bow in the right I just felt it was wrong and unnatural [...] For me it was much easier to play links.

Therefore, at the age of 19, he decided to start playing left-handedly:

I had a motor disposition for playing links. Everything was easier this way.

Hansen reflects on the problems that the right-handed majority would meet if expected to start playing the violin the left-handed way if expected to. Thomson agrees and says:

I am sure that right-handed people were forced to start doing things left-handed, they would be very vocal and organized in their refusal.

Hansen reflects on the conditions of his left-handedness as a professional violinist:

The links situation was more in my mind as young player, today it is only a positive fact that I enjoy, I feel it more like a resource than a problem. I think it is an important issue to discuss.

Likewise, Strand reflects:

I have always been proud of his left-handedness and may feel a sense of belonging or affinity with other left-handers, and with my left-handed pupils sometimes jokingly talk about being a bit more artistic, *we lefties*. I also find it interesting that so many of my teaching colleagues are left-handed.

Through these statements the participants exemplify how they have managed to leave behind the feeling of being an *outsider* among other violinists (see section 7.3.3.) but instead taking pride in their left-handedness. For others, left-handedness may even be perceived as an advantage that can lead to an ideal ambidexterity in motor skills. These discoveries are difficult to explain since comparing to right-handed players is impossible due to the individual nature of the experiences.

Olamaa: Sometimes I have noticed that in comparison to my right-handed colleagues, my left hand has more strength, endurance and speed. There is a bit more of everything in the left hand and it learns faster than the right. It is a benefit, that I have noticed, but the right hand has never really felt weaker, either. The right hand is nicely on board, and the left hand is slightly ahead.

The strongly left-handed Strand has contrasting experiences on the challenges of the bowing technique:

I got to simply work very hard on it [the bowing]. For example, when I had fast string crossings to play, in Preludium & Allegro [Kreisler], in Allegro there are string crossings that are quite tricky, and I had difficulties combining them with the fingers.

Strand explains that he became interested in technique and started to teach himself to sort out the left and right hand really precisely. He began to play the difficult string crossing parts with the bow hand only:

I can still see from the notes on my music sheet that I had created an etude. I simply separated the hands.

These statements exemplify how each participant has employed a unique strategy of coping with the motor challenges and advantages that their left-handedness has brought to violin playing. I share Strand's experience of having had the need to separate the bow-hand and fingering hand completely in the preparation phases of a music piece. Like he explains, all my challenges in playing have come from the stiffness of my right hand, and the amount of effort I have had to put in training my bow-hand has been monumental in comparison to my left hand exercises.

8.3.2. Pedagogical considerations on motivation and practicing

A general challenge for the pedagogy for beginner violinists that Olamaa brought up was that the educational circumstances have changed along with the societal changes.

Olamaa: There is a lower level of educational discipline than before. Thus, it is increasingly difficult to evaluate if a child is challenged with motor development or if the child simply does not practice violin playing. Therefore, the teacher might be unable to tell what causes the problems in learning. The current parental involvement in practicing is much different than in the ideal settings of the Suzuki-model, where parents are involved as violin teachers at home six days a week.

Olamaa's views of the problem of practicing routines are in line with those of Blaszkiewicz's (see section 3.3.). For these reasons, the teacher needs to make sure

that the lack of practicing is not the reason for technical problems, and to define what in fact is the goal of the teaching. Does one play *for fun* or for gaining curricular achievements? Since not all pupils aim for professional careers as violinist, do they need to be trained according to the right-handed norm?

Vainio questions this view:

Are we not always departing from the option of the playing becoming the pupil's future profession?

This is an important perspective in violin pedagogy, and adds to the challenges of the teacher to identify problems and causalities in the pupil's playing. However, as the respondents have stated previously, starting to play the violin left-handedly no longer is considered as a hindrance for a professional career, which again questions the need for training left-handed pupils primarily right-handedly, altogether.

On the other hand, Olamaa reminds that it is understandable that the motivation to play will decrease if the playing feels uncomfortable and the ergonomics are not right:

Nobody wants to volunteer in something that is uncomfortable for the body, feels wrong and makes the brain work the way it does not want to work. On the other hand, one can think it is a question of getting used to.

There is a need for discussing the importance of making the pupil feel that being left-handed is not a problem. The teachers usually do not address handedness even if they probably notice it when taking notes. Strand brings up the significance of support and scaffolding in the beginner pedagogy.

Strand: What I can remember as really positive was that my teacher supported me, believed in me and took me seriously even if he later told me that he thought I had quite significant motor problems in the beginning. When we later met, he was really happy to see how well it turned out for me, what I have learned and what I do today.

My participants highlight the meaningfulness of the teacher not making left-handedness a problem for violin education: even if the handedness may not be directly discussed with the pupil, the pupil should not feel that it would be a hindrance for learning to play the violin. The participants stress the need for openness regarding any pedagogical solutions considering the pupil's future development.

8.3.3. Existing attitudes towards left-handedness

Left-handedness in all societal aspects is a minority phenomenon that remains invisible when the left-hander performs tasks right-handedly. In violin playing, however, the exclusively left-handedness becomes inevitably visible, if the person chooses to play the violin left-handedly. The visibility of left-handedness still raises concern among some violin educators and as previously stated, prejudices in orchestral playing among other musicians and audience members.

Strand recalls that when he was preparing for college auditions, he took a lesson with a retired teacher who had worked in the institution in question. As the professor was aware of the negative attitudes towards left-handedness, he tried to warn Strand from being exposed as a left-hander.

Strand: When he saw me making notes with my left hand, he told me to not do it during the audition, because there are people who have opinions on left-handedness, and there might be someone there who has an attitude against it. He kindly told me not to tell or show that I was one.

Olamaa reflects on his milder experiences of handism:

I have only heard the old saying *done with the left hand* [as for something being done poorly], maybe I should start saying *done with my right hand* back at the right-handed people.

Being left-handed is often not a disadvantage when playing the standard way, because no-one can see it.

N.N.: Most people haven't paid attention to it, probably because I play the right-way around.

In the reversed visible left-handed violin playing, attention and attitudes are a more significant question.

Hansen: Some find it strange and from time to time I can feel a little bit as an outsider. But I have no problem with the attention it gives.

As a left-handedly playing violinist, Thomson shares these experiences:

I met a few people who were so seriously bothered by my left-handed playing that they actually became angry. One man told me that it made him physically ill to watch me bowing backwards.

Olamaa comments:

It is a greater risk to become singled out when one is noticeably different. To be distinctively different is especially in the orchestra playing a bit challenging. I suppose there is some amount of astonishment out there.

From an educational perspective, Thomson believes that most violin teachers are absolutely sure that playing the violin left-handed is a bad idea:

Presently have two left-handed playing students, one who was refused left handed lessons by other local violin teachers, and also a left handed banjo student. Both of them are very happy to be playing left handed.

Thomson states that he has experienced a professional violinist accusing him of working to *destroy classical traditions* of music:

In the US there is both good progress in acceptance of left-handed playing in some circles, but also increased resistance in other circles. In my experience, string teachers who teach privately are becoming more accepting, but many teachers in institutions, music schools, Suzuki, etc. are becoming more firm in their belief that students shouldn't be allowed the choice to play left handed.

Hansen describes his own experiences as a teacher for another left-handedly playing violinist:

I have had one on a masterclass. It was a bit strange the first minutes, but after it felt OK and quite normal.

Zachariadou shares her positive experience as a right-handed violinist taking violin lessons with a teacher who played left-handedly:

He worked with us course participants very thoroughly, carefully and methodologically. His approach for the fingerboard was in many ways completely new for me. Since I already had a well-developed left hand technique, the new insights and know-how felt really liberating and enabled enormous development on my left hand. As a right-handed violin student, I got a chance to work on my left hand for it's own step-by-step.

It seems that my left-handed and right-handed experts have different views on the attitudes towards left-handedness based on their experiences. For the left-handed and left-handedly playing respondents, the views may rise from a personal per-

spective if they have had first-hand experience of being objected by the attitudes. However, even if some of respondents had experienced resistance towards their way of playing by colleagues and audience members, learning from a left-handedly playing teacher was not considered a distraction in the pedagogical process for my right-handed respondent.

8.3.4. The need for discussion among violin educators

According to my respondents, teaching left-handed pupils does not require any special pedagogy but rather the understanding of the phenomenon of left-handedness. The respondents summarized that for some reason, left-handedness is not recognized in the modern violin pedagogy, nor do violin teachers generally know about the handedness effects on motor skills, or about the alternative left-handed violin playing. Therefore, a constructive discussion is needed for raising awareness.

Olamaa: As the culture and the institution of violin pedagogy have not adopted left-handed playing as something of their own, the practitioners do not think about the alternative or know about the option.

Zachariadou told me that when she was given a copy of Fülep's (1964) publication on left-handedness during her violin pedagogy studies, she experienced a new discovery: "*Oh, right!*" After that she got new thoughts and awareness of left-handedness and left-handed players:

It is extremely important for becoming violin teachers to have access to studies, articles, and research that has been conducted on left-handedness.

Strand agrees that knowledge on left-handedness is a resource in the teaching profession that one can utilize in their work:

Knowing about the hemispheric dominance can help to recognize some issues when a left-handed pupil plays right-handed.

It seems that violin pedagogy is currently not employing existing tools to examine pupils' left-handedness even if they are available. Olamaa reveals one way of experimenting the option of left-handed playing in violin classes:

During one didactic lecture we tried out building up the basic postures of violin playing by simulating it the left-handed way. We got to experience how it feels for an amateur to try violin playing for the first time by reversing the system for ourselves. Reversing a violin for left-handed playing is an extensive work. Therefore, there should be one left-handed customized violin in each classroom in case of a left-handed pupil. Unfortunately there is very seldom an opportunity to experiment. That probably explains why there are so few violinists playing left-handed.

In line with his earlier writings¹¹ (2009) and Olamaa's idea, Thomson suggest testing handedness in violin lessons by having two violins at hand: the right-handed one and an additional left-handed one. The teacher will explore together with the left-handed pupil which way of playing feels more natural to them.

¹¹In his article (2009), Thomson writes that when using two violins in the beginning of the violin studies, the left-handed pupil will learn to do the basic exercises with both hands. Since the beginner technique of the fingering hand has little motor differences between the hands, the real focus will be on deciding which hand feels better as a bow hand.

Thomson: When a violin bow is held out to a child for the first time, the right-handed children usually take it in their right hand and left-handed usually take it into their left hands.

I have converted one 3/4-size pupil violin left-handed for the purpose of my own experimentation. I found the procedure to be relatively simple to perform. My understanding is that having a left-handed violin in a violin class is a tool that could significantly facilitate later pedagogical decision-making of violin teachers.

As presented earlier in this study, there are still different types of attitudes on left-handedness among violin educators. In terms of discussing left-handedness in violin methodology, my respondents have different views on the importance of a methodological discourse.

Hansen states: I do not think this is necessary, for me it is more important to discuss attitudes.

Zachariadou however feels that knowledge about left-handedness is important above all for methodology students; students who are becoming teachers.

Zachariadou: Absolutely, there is a need for that for both professional pedagogues and methodology student in string instruments. It would be very interesting to access research on it in sports. There should be an equally strong right-handed and -footed problem there, as well.

The right-handed violin pedagogue, Zachariadou concludes that the most important thing for teachers training left-handed pupils is to maintain curiosity:

Continue to be curious. To see it as a challenge but not give up but instead stretch one's knowledge and skill to do more. That is what one needs in this profession. Nothing has been set to stone forever, and there is always more to discover.

The left-handed Strand highlights that left-handedness should not be considered as a violin pedagogical problem, but as a case that needs solutions:

One should simply have preparedness for it, *a methodological portfolio for the left-handed pupil*, and to work more on certain exercises.

Strand talks about the importance in finding a manual balance and to have a place for left-handedness in one's teaching methods. For attaining such preparedness as violin teachers, Strand thinks that left-handedness should be presented clearly in the violin methodology:

It is not talked about, although I believe it might have been talked about had I played the violin left-handedly instead of the regular way.

Strand continues to reflect:

In my methodological studies there was nothing that came up as *think about these things when you have a left-handed pupil, it may be like this or this*. In stead, the topic of discussion is just something in the air that one perhaps had heard about, but it to understand what the difference is, one should perhaps have read about it.

Strand reflects upon that perhaps in everything, when people start doing changes from an early age, then it may become more accepted, when people are more used to seeing it. He believes that it could also be a question of time for things to change, but that openness is required.

Strand: It would be good, if one could see left-handed violin playing as an accepted alternative for violin playing, and find methods for a right-handed player to see it from the other direction [...] If there were someone who could not play right-handedly, I hope that they

would be given the option and help to play the other way around.

Thomson adds: I am 100% confident that the violin teaching world will come in time to develop a new attitude about left-handed playing. There is no other possible direction that things can go.

As there is a need for discussion on pedagogical approaches for left-handed pupils among violin teachers, a set of collective concepts on left-handedness is needed to be established in order to initiate, ignite and above all establish such discussion.

9. Findings of the observation study

In this chapter, I am presenting the findings of an observation study and a follow-up interview with Zachariadou on her own teaching. The findings are presented thematically after short descriptions of each observation event, that were reflected upon during the follow-up interviews by watching associated video clips with relevance to left-handedness. The clips have been numbered according to the order they were presented in the observation video. The findings, however, have been reorganized in the following sections: spatial training for children's challenges of comprehending the left and right sides in violin playing, exercises for coordination and motor skills, and lastly, instrument-independent bodily aspects of violin pedagogy.

9.1. Spatial training for comprehending sidedness

In this section, I am focusing on Zachariadou's views on the importance of spatial training in beginner violin pedagogy for solving problems of understanding left and right.

Description video clip 1:

In the first video clip, Zachariadou instructs an exercise without the instrument. The pupils stand in a row and swing their bodies to the left, back to the middle, to the right, and again back to the middle. At first the teacher stands in front of the pupils back towards them and moves to the same direction with them. Then she changes the instructions.

Zachariadou: Now I am going to turn around and we are going to move to the opposite directions, I am going to the right when you are going to the left.

Left-handed pupil: This is so difficult.

While continuing the movements, Zachariadou keeps asking, which way is to the right and which way is to the left. As the children are confused, Zachariadou answers to her own questions

Zachariadou: This is left, this is right.

While watching the clip, Zachariadou explains:

The aim of spatial training is to develop the pupils' sense of balance and readiness for the instrument playing as well as readiness for ensemble playing and rhythmic precision in group.

During the viewing on the video documented lesson, Zachariadou comments on the children's progress in their spatial perception through the exercise.

Zachariadou: The pupils have been doing the exercise since September 2014, and it may have become a bit easier for the pupils, as they have become faster prepared for action. This exercise works for this group that can be a bit unorganized.

When the children were doing the exercise in the opposite direction than the teacher, all of them were moving towards the right side even if they were verbally instructed to go to the left, and to the left when they were instructed to swing to the right. As the new verbal instruction was not consistent with the observed experience, all of the pupils were confused by the assignment. The visual cue of the teacher moving to the opposite direction was suddenly a stronger signal than the given verbal cue. In other words the knowledge the teacher distributed by demonstration was more significant than the verbally distributed knowledge. This finding is important for gaining knowledge on children's conception of left and right in music lessons.

Description video clip 5:

In clip 5, the pupils are preparing for rehearsing their up-coming Christmas concert piece. The task in this clip is to place the violin in a *resting position* under the right arm. The youngest of the pupils is having difficulties of perceiving which arm is right, and places the violin under the left arm. The teacher corrects the pupils and helps to place the violin on the right side.

Zachariadou comments that as the children get older it becomes easier for them to put the violin under the right arm:

Yes, I have seen this mostly with children under eight years old. I think it's the motor function that simply has not been developed yet. One can see that the youngest is having the most trouble, there is a significant age-difference between the youngest and the oldest, since there are many months between the youngest and the oldest. These are the movements that one performs in everyday life but does not think about it.

I told Zachariadou that in my work as a violin educator, I have noticed that when I stand facing my younger pupils aged 4-8 they tend to mirror my movements instead of processing whether I hold the violin on my right or left side. Especially, when I teach them to hold their violins under their right-side arm for concert preparation, they often put the violin under their left arm if I am standing in front of them facing them. They seem to mirror my gestures directly instead of turning the lateral information to their perspective.

Zachariadou answered to my reflection:

But have you notice that they will put the violin under the left arm even if you are not doing anything, without a visual model? I think it is the *now we cross-* movement from left side to the right side that is difficult. The coordination of crossing.

I find this phenomenon extremely interesting, since my experience is that young pupils get increasingly confused when I stand in front of them as a mirror image and give verbal instructions that would require them to process the instruction together with the visual cue. Whether it is because the problem of crossing from one side of the body to the other, or the combination of verbal and visual cues not fitting together, the phenomenon really shows how difficult body sidedness is to comprehend for young pupils. I have not experienced similar phenomenon among adult pupils. Likewise, Zachariadou states that it is most common among children under eight years of age.

9.2. Maturity of coordination in technical training

This section presents the findings on children's maturity in performing technical exercises preparatory to violin playing. In the exercises on clips 2-4 Zachariadou is training the pupils motor readiness, technical skills and coordination.

Description video clip 2:

In video clip 2, Zachariadou instructs a bow-hand exercise for fingers, also known as *the spider* or *the witch*, where the fingers work together so that they climb vertically up along the bow all the way to the tip, and then back down. In the clip, the left-handed pupil verbalizes: *It is difficult to climb down*.

The other pupils do not express themselves verbally. During the exercise, the left-handed pupil also drops the bow on the floor once, and says once more: *This is difficult*.

None of the pupils succeed in completing the exercise, but while trying Zachariadou asks them what the fingers are doing. She then explains them that the fingers are working together.

In the end of the clip, Zachariadou gets behind the left-handed pupil and helps her to hold the bow vertically and move the fingers. The pupil is holding to the bottom of the bow with her left hand, and Zachariadou gently removes the left hand grip off the bow.

Zachariadou: The aim of the exercise is to gain flexibility and agility on the bow-hand.

It is visible that the flexibility of the bow-hand develops differently among the pupils. The oldest right-handed pupil has the furthest developed agility in coordinating the fingers in the group, and as described, the left-handed pupil is the only one who vocally expressed how difficult the task was to perform. In other words, the left-handed pupil is not only challenged by the right-handed orientation of the manual task but also by their age-dependent development of motor skills.

Zachariadou: The children's individual maturity and ability to participate in the group has a crucial significance, since the group includes three children with different ages and hand-preferences.

The video shows that it is challenging for teachers who give group lessons to be able to facilitate all pupils according to their existing abilities, their maturity and and development of new skills, but also according to their hand-preference.

Zachariadou explains that the children therefore need different types of scaffolding:

The children develop in different paces, in terms of how they can take in the instructions and then apply them by themselves.

This exemplifies the problem that comes up in group violin lessons. The internalization of instruction is an individual process that employs the learner's unique combination of cultural-psychological and biological learning strategies. However, as stated earlier, when engaged in right-handed teaching, a left-handed pupil has to apply the new knowledge by reversing it from their preferred way to the right-handed way often without additional help.

Description video clip 3:

The exercise on clip 3 focuses on constructing the correct bow-hold. On this clip the children take turns in explaining how one constructs a bow-hold. Only the oldest pupil is able to give a correct explanation, and the younger ones are struggling to give a correct answer.

Pupil 1: First I place the thumb against the middle finger, then the index finger goes on its place, and then the little finger goes bent round.

To which the left-handed pupil comments:

It is difficult to hold the thumb like that.

Once more the verbally most active pupil of the group, the left-handed one comments on the difficulty of the task and helps the bow-hold with her left hand placing it under her right hand fingers. In the end of the clip, the teacher goes by her to help with establishing the bow-hold without the help from the left hand.

While watching the clip, Zachariadou reminds, that one cannot say how long the coordination and control of the fingers will take to mature, in the case of both left-handed and right-handed pupils. In terms of motor tendencies, Zachariadou says that she has noticed that the muscularity of the left hand among left-handers has had more natural training than a right-hander's:

In a way I can see a small tendency: when doing exercises or talking about the left hand, I can see that the left-hander's motor functions are more operational.

What is evident from the video, the left-handed pupil also has a tendency to support the weaker right hand both-hand with her stronger left hand. This finding is in line with Thomson's earlier statements of left-handed pupil naturally preferring to hold the bow with their preferred hand, the left hand. However, this tendency is most likely corrected by violin teachers without further consideration on handedness.

Description video clip 4:

In clip 4, the pupils are instructed to imitate stirring a stew with their bow as a big spoon. First they do large circled movements and then very small circles. Zachariadou instructs them to pause for a moment to check that the thumb of the bow-hand is bent, and then continues to direct the bow-hand straight up and then touching the nose with the bent bow-hand thumb.

Watching the video clip 4, Zachariadou comments:

The aim of the exercise is to develop the co-operation of the arm and the fingers. The difficulty of this exercise comes from understanding which way the pupil is supposed to stir the circles. At first, the children of the age of 5-7 are not conscious about the reversed circles or about other geometrical figures. Many of the exercises aim to give a solid basis for further development.

She adds: Therefore the teacher should aim to give as much time as needed, put themselves in the pupil's place and avoid complicated instructions, and try to find new ways with or without the instrument. To consider the instrument as part of the body, and start from a good posture and natural, free movements.

These comments exemplify why the exercises for bow-hand are heavily emphasizes in beginner violin pedagogy, as presented earlier in section 2.3.4. The importance rises from the need to build a firm basis for the development of bowing techniques. However, as explained by my left-handed respondents, sometimes this basis has not been fully built due to the manual imbalance between the left and the right hand. Thus, some violin pedagogues do not give enough time and emphasis for the weaker bow-hand development of the left-handed pupil when the left hand is capable of performing more advanced techniques.

Furthermore, the natural and free movements that have been discussed in this stimulated-recall interview may feel different to left- and right-handed violinists, as earlier stated by Hansen, who considered the positions of right-handed violin playing unnatural and wrong. Subsequently, even if a right-handed violin teacher would aim to build natural basis for the left-handed pupil from their own right-handed perspective, the positions may not feel natural for the pupil.

9.3. Key elements for early instrumental music training

Finally, this section presents aspects of musical training that have an instrument-independent character, such as perception of time, space, body and voice.

Description video clip 6:

In the last clip 6, the pupils are standing in a row and rehearsing their concert piece. The piece involves exercise for motor readiness, spatial awareness, singing, playing the open D-string with the bow, and a choreography of changing places with each other. The youngest pupil is challenged to concentrate and starts to spin in circles. She also again places the violin under the left arm instead of the right arm.

Zachariadou explains the importance of including these elements into the training:

We use the violin to tell a story. Therefore, developing a periodical feeling is important; beginning, culmination, ending; when it begins, when it ends. For this reason, we are training to collaborate with each other as a group, how to be prepared and how to use our voices and have the music in our bodies.

According to the Zachariadou, for accomplishing these goals, she wishes she would have complementary studies outside violin pedagogy:

I wish I would have the education of a eurhythmics teacher. I believe that children are comfortable with rhythm, body movement, the feeling of periodic structure, and above all with using the voice, singing! To have the music in their mind. I would do more such exercises without the instrument, and then with the instrument – I am a violin teacher – I have that tool. But in this kind of a group, there is so much more than notes and instruments.

Zachariadou's last comment emphasizes the complexity of violin playing that employ the multi-sensor processing of the auditory, visual, and kinesthetic signals of music making. It furthermore emphasizes the importance of the pupil's internalization in the learning process, *to have the music in their minds*, which is connected to their unique biological and cultural learning strategies, as the biological prerequisites cannot be separated from the learning processes.

10. Conclusion of the results

I conclude the findings of the study in the following short sentences:

Firstly, the teacher needs understanding of left-handedness and possible tools like the mirror to conduct the teaching if the pupil plays left-handedly, even if teaching does not include any special methods, since it does not differ from the teaching of right-handedly playing pupils in terms of methodology. The same pedagogical building blocks are employed.

Violin teachers need educational training to be able to recognize handedness and take it into consideration in their pedagogy in order to gain this necessary understanding: namely to understand that the violin as an instrument is primarily built for right-handed players and left-handed pupils are in most cases expected to adapt to the right-handed norm of playing without real educational emphasis on that adaptation. In order to scaffold a left-handed pupil, violin teachers need awareness of left-handedness and knowledge about the option of reversed violin playing, as well as encouragement to apply the traditional pedagogy to left-handed learners.

Attitudes against left-handedness in violin playing, however, still exist among some violin teachers and music professionals, which emerge when left-handedness is visible. Some teachers even refuse to teach left-handedly playing pupils. In orchestras left-handed playing is in some cases considered as a logistical challenge and a visual disturbance, but my respondents considered it something that can be overcome.

The rejection of left-handedness is stronger in classical music education than in the non-classical music education, according to my combined data from guitar and

violin pedagogy. Investigating the reason for this phenomenon requires further studies.

Currently, there are at least the following kinds of left-handed violinists:

- a) Left-handed who are *exclusively left-handed* and who have the motor disposition for engaging *only* in left-handed violin playing (Hansen)
- b) Left-handed who are *strongly left-handed* but through intensive practice have been able to reach a professional level in right-handed violin playing (Pyykönen, Strand, N.N.)
- c) *Ambidextrous* violinists who write with their left hand and report agility in their left hand technique yet without struggling with the right-handed bowing techniques (Olamaa)
- d) *Left-handed violinists due to injury*, who need left-handed violin playing as an option to engage in violin playing (Thomson)

Teaching violin playing to these different left-handed learners requires specifically adapted pedagogical considerations. Since the normative right-handed way of playing is considered the practically easiest alternative, the left-handed option is rarely considered. Even if left-handed players are adjustable and adaptable for normative playing, and early training makes the motor shaping more effective, the processes are nevertheless related to the unchangeable biological basis of the pupil's learning.

There is a great need for spatial and motor exercises prior to beginning the instrumental training because there are significant differences in the maturity of these functions among young children in group lessons. The two empirical studies of this paper suggest that children in the age of 5-7 have challenges in understanding left and right and these two sides of their bodies.

Buying a left-handed violin is becoming increasingly easier but the majority of violin teachers are hesitant to promote or do not know about the option. In regards to the instrumental aspects of violin playing, the violin – among all other tools – has been built for the needs of the right handed majority. The violin is a cultural tool that has historical and artistic value, thus reversing an old violin is morally debatable and might decrease the value of the instrument. A left-handed violin is a mirror-image of the traditional violin.

My left-handed respondents reported both physical advantage in the left hand technique, vibrato, scales etc. as well as challenges in the fine motor tasks of bowing. My right-handed respondent reported challenges in the left hand technique. In terms of the technical aspects of violin playing, the bow-hand is in a central role for producing the sound, and when played by a right-handed violinist, it is controlled by the stronger motor hand. Left-handed players learn to master the bow with their weaker motor hand.

Finally, in order to evoke a pedagogical discussion among violin teachers, the practitioners need collective terms and conceptions on left-handedness. Otherwise, such discussion is impossible to be ignited and established. My data shows that currently violinists and violin teachers see the need for such discussion but use many different terms on left-handedness, which suggests that there are not yet any collective terms in hand.

11. Discussion

Following the cultural-psychological perspective on musical learning that recognizes human learning processes as both culturally and biologically related in the local context of learning (Rogoff, 2003), I have structured this chapter of discussion in three parts: teachers' awareness of the biological and material conditions of violin playing, the patterns of action in violin pedagogy, and recognition of the implication of lateralization in violin playing. Furthermore I raise discussion on ethical considerations towards left-handedness in violin pedagogy.

11.1. Teachers' awareness of the biological and material conditions of violin playing

The data of this study suggests that teachers' awareness of the biological conditions of violin playing, namely hand-preference, affects their knowledge of left-handed violin playing and their readiness to reverse a pupil's playing, find left-handed instruments and/or use left-handed violins for testing hand-preference during lessons. As Rogoff (2003) and Bruner (1996) have acknowledged in their publications on the cultural-psychological perspective of learning, these biological pre-requisites need to be recognized among violin teachers since they are existing parts of the pupils' set of transferable skills when beginning to learn an instrument. In the current moment, however, – as the respondents of this study stated – many violin teachers are still unaware of the option of left-handed violin playing, and the educational knowledge of left-handedness in music education institutions is still insufficient.

The awareness of left-handedness leads to understanding *why* some technical problems may occur among left-handed pupils who play right-handedly, as Blaszkiewicz (Pyykönen, 2010) called it *a foreigner speaking another language* despite of training. Furthermore, the awareness and recognition of the possible effects of hand-preference on violin playing will lead to a more resourceful use of pedagogical tools among teachers. My study shows that similarly to the pedagogy applied for left-handed pupils by Blaszkiewicz (see section 4.3.), Thomson and Hansen – both playing left-handedly and therefore close to the phenomenon – use visual tools to facilitate the pupil's learning, which the right-handedly playing respondents had not done. This is an example of utilizing and interacting through such tools that have not yet been conventionalized in the tradition of violin pedagogy. This is in line with the cultural-psychological perspective of the study (Barrett, 2011; Bruner, 1996; Rogoff, 2003).

This leads me to conclude that the teacher's own level of handedness, as well as experience of left-handedness impact their conceptions of the need for left-handed pedagogical applications. For example, the right-handed Zachariadou saw few differences in the motor learning of right- and left-handed pupils, the ambidextrous Olamaa believed in the success of early shaping of left-handed pupils whereas the strongly left-handed Hansen reported such strong dominance that excluded right-handed normative playing all together, and the right-handed Thomson stated that his understanding of hand-preference grew by learning to play the violin the reversed. This, too, comports with the hermeneutical tradition that goes in the cultural-psychological perspective on learning (Bruner, 1996).

As these aspects have to do with existing awareness and experience of the phenomenon, my understanding is that right-handed teachers may encounter left-handed pupils so rarely that considering their hand-preference might get ignored. Therefore they may be less sensitive towards recognizing the handedness-related connections as they may take right-handedness for granted. After all, they live in a world that is designed to fit their natural preferences (Coren, 1993; Smits, 2012). Thus, also understanding that the instrument itself has been designed for right-handers (as presented in section 3.3.1) – which may cause problems among left-handers – is crucial for giving left-handedness the attention it needs in violin pedagogy.

11.2. The patterns of action in violin pedagogy

In line with the cultural-psychological perspective that considers cultural tools as defining our work even before it is completed (Bruner, 1996, p. 152), a right-handed violin is an artifact and a music-cultural tool that defines the use of it before we start playing on it. In that sense, playing the violin left-handedly means dismissing this conceptualized tradition of violin playing that currently solely recognizes the right-handed pattern of action, and challenges the views on the instrument's value as a cultural artifact (see sections 3.3.2. and 8.1.1.).

It is notable that classical music education shows higher reluctance, handism, towards left-handedness compared to non-classical music education. This is not only evident in the context of orchestras and string-ensembles, where left-handedly playing musicians are still a marginal phenomenon, but also in classical guitar pedagogy. This exemplifies how, alike Vygotsky's (1978) views, people carry culture and its traditions with them in this educational context, and the practitioners of classical music education need to take handism seriously and re-evaluate their teaching methods that may be disregarding left-handed pupils.

At the current moment, the resistance towards left-handedness in violin pedagogy contributes to the following consequences. Firstly, both violin educators and violinists who aim to protect the unchangeable legacy of violin playing and therefore object to reversed playing may work against scaffolding and supporting their left-handed pupils (Bruner, 1996) (see chapter 5), causing the pupils to give up playing or have to practice harder on the bow-hand technique.

Secondly, as the number of left-handedly playing violinists remains marginal, the ones who are professional orchestra musicians may feel like outsiders among their right-handed colleagues. However, as presented in section 4.3., Blaszkiewicz experienced that including left-handedly playing violinists in the sections is not a problem but rather a question of logistical arrangement. Lastly, left-handedly playing musicians may become objected by audience resistance as playing left-handedly is considered a visual disturbance, as reported by Thomson (see 8.3.3.). This suggests that the discrimination and attitudes against left-handedness in the culture of classical music is still tolerated. Therefore, additional education is needed for increasing tolerance towards left-handedness in order to meet the goals of equal opportunities for left-handedly playing classical musicians.

Currently, violin pedagogy is under a great number of research, and recently it has been studied from the points-of-view of i.e. ergonomics, motivation, mental training and preparation for the professional landscape. Some studies point out that violin pedagogy has not changed within the last 100 years even if the society has changed dramatically in terms of educational goals, versatility demands, and challenges such as professional opportunities, mental wellbeing and career success

(Vilnite, 2014; Wolkstein, 2013). In line with the findings of this study, Vilnite and Wolkstein point out the general problem in the current methods and curricula of violin education is that they no longer meet the demands of the society, and therefore need to be reconsidered. Such reconsiderations are also needed in terms of left-handedness. Furthermore, as stated by Collins (2013) (see chapter 4) understanding neural processes in music not only expands the knowhow of music educators, but also supports many of the current methodologies and curriculum design (p. 228). The findings of this study contribute to the practical knowledge recognizing left-handedness in the instrument teachers' everyday work. An example of such didactics that include pedagogical patterns of action for both right- and left-handed violin playing have already existed, as presented in section 4.3. in the pedagogy of Blaszkiewicz.

This study is aimed for violin pedagogues, and especially for right-handed violin pedagogues. Also, this study aims to give more resources for both left- and right-handed teachers for their work with right- and left-handed pupils. Lastly, as a reconsideration, the study shows that having a left-handedly playing violinist as a teacher is not a distraction for a right-handed pupil. Thereby, in line with Thomson's (2006) writings, there are no pedagogical reasons for resisting left-handed violin playing as an alternative for right-handed playing, either.

As all my respondents wished these questions would be broadly discussed in violin teacher training and complementary courses for practicing teachers, and as left-handedness is currently being studied in other asymmetrical instruments – the guitar for example – the time for addressing these issues has now come. In fact, only weeks after this thesis is completed, in May 2015, Hansen is giving a presentation of his left-handedness at the European String Teachers' Association's (ESTA) convention.

11.3. Recognition of the implications of lateralization in violin playing

As the findings of this study reveal that handedness comes in different levels – which are in line with the levels presented in section 3.3.3. (Coren, 1993; Fülep, 1964; Smits, 2012) – they may affect what kind of technical difficulties and advantages the pupils have in violin playing. Therefore, as concluded in chapter 10, teachers need to take hand-preference into account in their teaching strategies. This also means scaffolding the pupil in a way that supports their motivation to play by not treating left-handedness as a problem, but instead to be informed about their individual ways to internalize the learning objects. These are all aspect that are recognized in the theoretical perspective of cultural-psychology (Bruner, 1996), and are consistent with the previous findings of my bachelor thesis (Pyykönen, 2010).

The concluded findings if this study are, however, in contrast with those of Kopiez et al. (2010, 2011) – presented in section 4.2.2. in this thesis – that underrate any physical discomfort or disadvantages among adult left-handed violinists. In contrast to Kopiez et al., the left-handed respondents of this study reported both discomfort and a need for increased amount of training on their weaker right hand prior to their professional studies. Furthermore, the studies of Kopiez et al. do not explain *why* some left-handed violinists prefer to start playing left-handedly, i.e. Hansen, when according to their findings handedness is a minor factor in violin playing.

In fact, contrarily to Kopiez et al. (2010, 2011), the findings of this study suggest that handedness has a more significant effect violin playing in the beginner stage than in later violin studies, as reported by Strand, Hansen and N.N.. In light of these statements, it appears that Kopiez et al. have not considered the possible differences in experienced comfort of playing between left-handedly and right-handedly playing left-handed violinists, nor between left-handed adult and child violinists. Like Bangert and Schlaug (2006) (see section 4.2.1.) suggest, a comparison study would be needed for investigating the cortical adaptations among very young musicians (violin and piano) in order to explore the lateral effects of beginner instrumental training. As Bangert and Schlaug imply that the findings of such a study may differ from those on adult participants, their conclusions support the evidence of this study on that handedness may have a more significant effect on learning to play the violin in beginner level than in later stages of training. This is also relevant to acknowledge since, according to Sitnikova (2012) and Coren (1993), left-handedness is more common among young children than adults (see section 4.1.), even though both Kopiez et al., and the findings of the interview study suggest that among classical violinists, the percentage of non-right-handed players is higher than in average population (see sections 4.2.2. and 8.3.1.).

In line with the findings of Piaget's study on children's conception of left and right comprehension (section 4.1.), the outcomes of this observation study (chapter 9) suggest that further studies are needed on handedness effects on early stages of instrumental playing in the age group of 4-7. The findings show that children are vulnerable in terms of understanding sidedness in that stage of instrumental learning. Therefore, such discussion is needed that considers that the effects of left-handedness in violin playing may be more relevant and significant in the context of beginner pedagogy than in the context of adult musicians, who have already established their instrumental skills. Furthermore, the children participating in this study demonstrated difficulties in conceptualizing left and right when given contrasting verbal and visual cues, which comports with the findings of Piaget's studies on children's conception of left and right (McManus, 2002).

As already discussed, the findings of this study reveal that in violin pedagogy, increased pedagogical attention needs to be paid in the beginner education of children under eight years of age. As imitation is a key element in children's learning processes and a central part of the zone of proximal development (Vygotsky, 1978), it is relevant to acknowledge that demonstration and imitation may be more effective means for learning complex motor skills than verbal instructions. This phenomenon may have a connection to mirror neurons, which give readiness for imitation and the natural interpretation of movement, as presented in section 4.2.3. (Cohen in Hallam, Cross & Thaut, 2009; Eysenck&Keane, 2010, p. 140; Kalat, 2009, p. 237; Molnar-Szakacs & Overy, 2006; Reynolds & Reason, 2012). The results from this observation comfort these earlier findings.

11.4. Further ethical considerations to the freedom and rights of the invisible minority

Since the biological pre-requisites exist in violin playing, it is relevant to engage in an ethical discussion on equality and discrimination based on these prerequisites. In other words, whether it is justified to make left-handed violinists play right-handedly, since they no longer are expected to write with their right hand in schools, either. The respondents of this study promoted awareness and understanding to-

wards left-handedness in violin pedagogy, as well as openness for finding new ways for teaching and flexibility for the employed methods. In summary, Olamaa (2014) states:

The principle in classical music pedagogy should always be to do as how is best for the child.

How is that principle currently met in violin pedagogy? Teaching violin playing is a specialized occupation for supporting and scaffolding pupils and students in Vygotsky's (1978) zone of proximal development, and that comes with ethical responsibilities. Regelski (2011) argues that the ethical responsibilities are tied to both the practice of teaching and the student's abilities. If overlooked in teacher training, they may lead to a culture of *anything goes*-ethics and using *one-size-fit-all* didactics which assume that all pupils are alike and have similar interest and needs (pp. 223-226). As a result, pupils may lose interest in music-making and drop out of lessons. As the findings of this study suggest, young left-handed pupils, who are under development of their coordination and motor skills (see chapter 9), are especially vulnerable for the one-size-fit-all teaching strategies.

As mentioned earlier in chapter 3, the major problem for left-handed people in any society and in any form of education is invisibility, which leads the right-handed majority to not consider them. This view is supported by Coren (1993):

If left-handers were a visible, recognized minority with specific needs, could any changes be made in the environment and the design of the equipment without too much difficulty or expense? Clearly, the answer is *Yes* (pp. 261-262).

My understanding is that visibility creates awareness, which is necessary for scaffolding and supporting the left-handed pupils' learning by choosing the right kind of exercises and reconsidering the option of reversed left-handed violin playing. As has been stated, left-handedness stays unseen if violin pedagogues do not find out about the handedness of their pupils, and remain unfairly disguised as *clumsiness*. I will finish this ethical discussion with Blaszkiewicz's words (Pyykönen, 2010):

I hope that left-handed playing will become more common. There are no studies about it – except for yours now, but there have already been changes happening within the last 20 years. Even if some left-handers quit playing, a change is coming.

11.5. The academic accuracy of the study

The subjectivity of this study arises from me being inside the field of study as a researcher and as a practitioner. Therefore I carry with me reflected knowledge on the subject, and subjectivity is a relevant topic of discussion. As a left-handed violinist and a violin pedagogue it is clear that this subject is close to my own life-world and therefore this study has been colored by my own perspective even if I consciously distanced myself from it when conducting the empirical studies. However, I believe strongly that given the minority nature of the phenomenon in question, my subjective experiences may have brought such knowledge to the study that a right-handed violinist might not have been able to bring forwards.

For example, in the interview study Strand stated that he has always felt proud of being left-handed, and that he takes pride in mastering violin playing after years of working wise as hard on the bow-hand technique. I can relate to what he means, as

I have gone through the struggles of mastering the bow-hand as well, and feel victorious when told that my bow-hand today is very agile and my sound is healthy. I think that I can therefore represent what he said in this study with understanding of what he really meant to say. In short, even if the subjectivity of the study is apparent, it has been beneficial to the aim of bringing new knowledge to the field of violin education, which as it now seems, is heavily dominated by right-handedness and generally disregards left-handedness as a topic of developmental discussion all together.

I have done my best to represent the data I have collected in the most objective way. I have followed the chosen research steps and operated within the theoretical framework of the cultural-psychological perspective. Therefore, I regard my own experiences and personal relationship to the study as a resource to the research. Also, some of the findings that arose from the interview data were against my pre-understanding, and therefore the findings have led to further reflection on my own understanding. For example, my pre-understanding was that left-handed methodological material would be needed for violin pedagogy the same way it is considered needed in non-classical guitar playing. However, none of my respondents or correspondents thought that would be necessary.

12. Continued studies

My understanding is that the subject of this study is on the cutting edge of the inter-disciplinary knowledge of music education, music psychology, biological, cognitive and developmental psychology. Therefore, in order to verify scientifically that hemispheric dominance and handedness play a role in the musical learning of left-handed beginner violinists, it would be needed to perform further studies in together with a researcher from the field of psychology. A possible subject of such study would be duplicating Kopiez et al. (2010, 2011) studies on young children in the beginner stage of instrumental learning, as well as to compare the performance in the tasks between right-handed children playing right-handedly, left-handed children playing right-handedly, and left-handed children playing left-handedly.

For continued study on the topic of orchestral playing, it would be beneficial to conduct a survey on the percentage of left-handed violinists playing in Sweden's professional orchestras, and how many of them play left-handedly. Moreover, it would be necessary to ask orchestral musicians and conductors about their conceptions on left-handed violin playing in orchestras in order to gain insight on the culture of orchestra playing in relation to handedness. Another possible direction of continued study is conducting a longitudinal study on the motivation to continue violin playing among right-handed and left-handed pupils. How long do they carry on with their violin playing and what kind of factors lead to quitting violin playing?

Moreover, the subject of study leaves room for more biographical studies among left-handed professional violinists building on case studies and narrative interviews, or for a conducted comparative study including left-handed violinists in the classical music environment and non-classical left-handed violinist and fiddlers from other musical traditions. Lastly, there are recent German language publications on left-handed music making by Walter Mengler, such as *Musizieren mit links* (2010) which unfortunately has not yet been translated to English and therefore is out of my access language-wise.

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14. Figures

Figure 1: Hemispheric lateralization, cortical representation. Pearson Education, Inc. (2000).

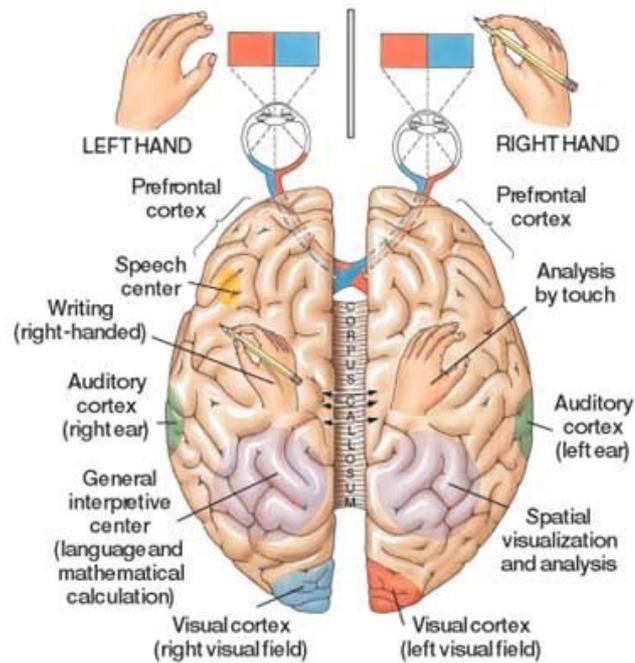


Figure 2: The Fisherman Playing the Violin. 1630.



Figure 3: The parts of a violin to be altered when reversing the instrument (Nelson, 2003: 247)

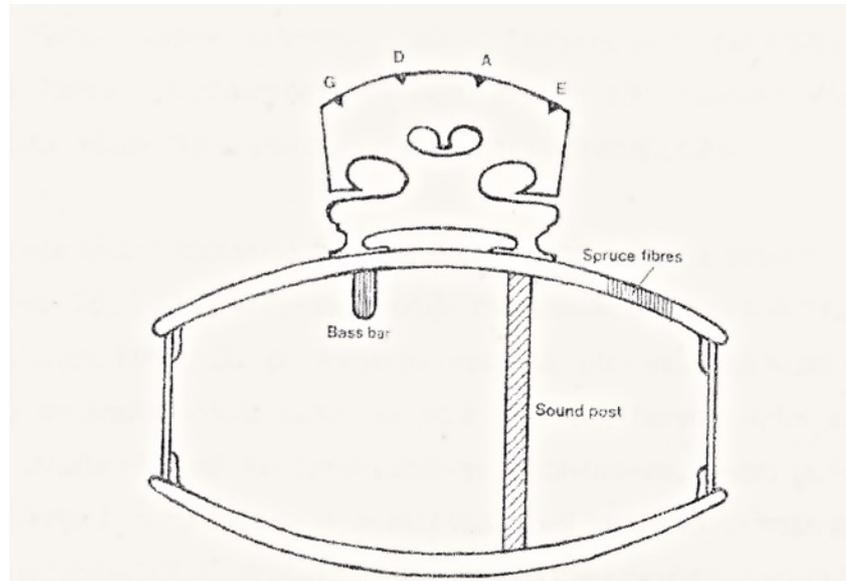
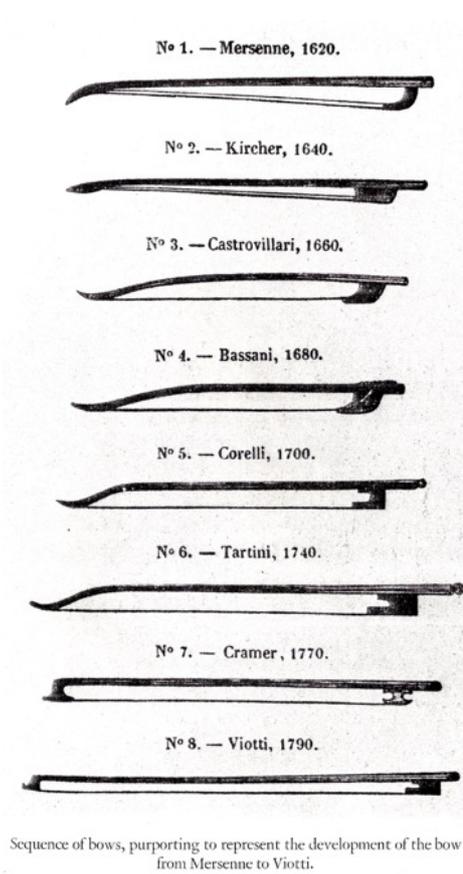


Figure 4: The development of the bow. (Boyden, 1965: Figure 35)



Sequence of bows, purporting to represent the development of the bow from Mersenne to Viotti.

Figure 5: The cortical representation of the specialized manual skills of instrumental music training. Schlaug, et al. (2005: 221).

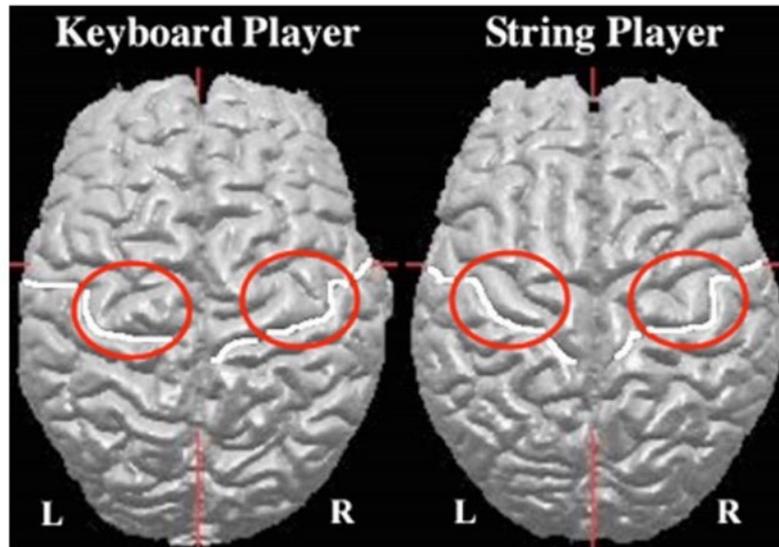


FIGURE 2. Within-musician, instrument-typical, gross-anatomical differences are seen in the precentral gyrus.

Figure 6: Cortical representation of specialized manual skills of instrumental music training. (Bangert & Schlaug, 2006.)

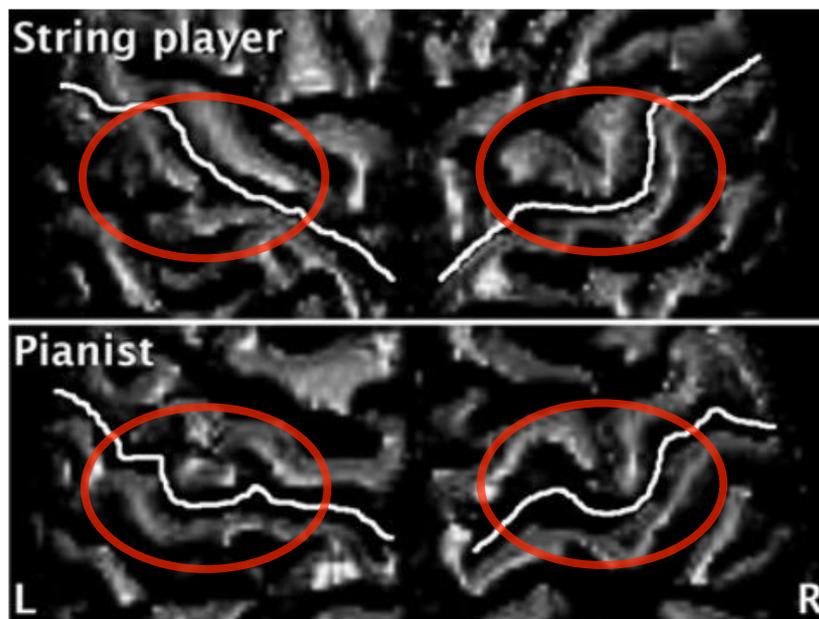


FIG. 1. 3D-surface renderings of the perirolandic region in a string-player (top) and a keyboard-player (bottom). A white line marked the location of the central sulcus, which was meant to serve as an orientation help for the blinded raters. While the string-player displays a prominent OS on the right hemisphere only, the keyboard-player shows a left more than right prominence of the OS.

Figure 7: Rudolph Kolisch (right) playing the left-handed violin in a string quartet (Smits, 2012: 90)



Figure 8: Representation of suggested arrangements for left-handed orchestra playing. (Thomson 2003: 15)

