Masteruppsats 30 hp
Vårterminen 2021
Musikpedagogik
Tobias Allvin

Musical interaction in online music education

Handledare: Bo Nilsson

Abstract

Keywords: actor-network theory, covid-19 pandemic, mediation, musical interaction, networks, online music education, reification, social constructionism, technology

The present study seeks to examine musical interaction in online education. Although the study focuses on how teachers have adapted their teaching methods to the new circumstances dictated by the still-ongoing covid-19 pandemic, the ambition has also been to investigate how a beneficial music education online could be conducted in order to promote a global teaching environment with sustainable travelling habits.

The research has been driven by a curiosity about how the human mind experiences time and uses tools in order to create meaning and social networks. Thus, the research questions are aimed at investigating the term 'musical interaction' and how it has been affected by online education. Since the study focuses on the teachers' point of view, another important topic is how the teachers have transformed their methods when teaching online.

As social connections are of importance for all kinds of interaction, and technology plays a major part in creating the basis for online education, social constructionist theories that combine these areas, such as actor-network theory, mediation and reification, have been chosen as a framework for the analysis of the empirical material.

The core of the empirical data consists of six interviews with teachers from different schools that have shifted to online education.

The results show that four themes stand out when describing what affects the decisions connected to musical interaction in online education have in this special context. The first theme is *the pandemic*, which by its unpredictability ruins all forms of continuity. The second is *the network*, which sets the premises for what is feasible when interacting online. Third is *online teaching*, which requires extensive planning and calls for a more passive attitude when conducting lessons. The final theme is the view of what *musical interaction* ought to be compared to what a broader definition is suggesting.

The final discussion considers new ways of looking at musical interaction, online education and the networks by which our society is constructed.

The study concludes with a brief presentation of new technology that has been spawned by lockdowns and restrictions and points towards a future where greater diversity in teaching methods will prove to be valuable even after the pandemic is over.

Acknowledgments

I wish to express my appreciation to my supervisor Bo Nilsson and to recognise the invaluable assistance provided by my most devoted reader Mike Hanson, who has been reviewing my English language.

Table of Contents

1. Introduction

In order to prevent the spread of infection during the rise of the covid-19 pandemic in Sweden, in the spring of 2020, all universities and upper secondary schools, by order of the Swedish government, switched to distance education. Shortly afterwards, a majority of the Swedish music schools concluded that their teaching could no longer ensure that the recommendations from the Swedish Ministry of Health were being followed and thus also moved to distance education. This meant that, for a period of time, a vast part of the music education in Sweden was taught online, through digital platforms mainly designed for online business meetings. This new technology and the teaching methods it required came with implications that this thesis will try to investigate.

1.1 A short background

Throughout my own music studies, the communicative power of music has always been my deepest motivation. I would rather rehearse with other musicians than practise on my own, and the music I like to listen to is above all rhythmical and based on collective efforts. When teaching, I try to emphasise interaction and have always encouraged my students to find peers to learn from as well as to share their skills with. The first law of 'the fifth discipline' (Senge, 2006) states that today's problems originate from yesterday's solutions. This description is certainly applicable to the limitations of online music education. With this in mind, combined with my affection towards rhythmical music based on collective efforts, I began to ask myself what consequences these limitations would have on the musical interaction between teacher and student. Considering the fact that our brains adapt to how we use them and the suggestion that new technology forces us to operate in new ways, it appeared likely to suggest that teaching methods have adapted to the new technology and that the teachers in many cases may have avoided situations that would cause difficulties online.

Music is an activity that involves practically every part of the brain, and the fast cognition required by modern technology stands in contrast to the elaborative decision making that occurs in human musical interaction (Levitin, 2008). As the period of distance education was prolonged, I soon found myself involved in extensive online discussions with colleagues and friends who in different ways were affected by the new restrictions. The assumptions we made generated my interest in solutions to the predicament of maintaining the musical interaction while teaching music online. My

intention is to explore this further through six in-depth interviews with teachers from different institutions and with different approaches to online education. These insights will then be compared with the material presented in the literature review, including two case studies. My hope is that the summarised material will provide facts for a reflective analysis and an illuminating discussion.

1.2 Composition of the study

This study is organised in chapters, beginning with a short introduction that brings up important issues and questions that will be discussed in the different parts that constitute the chapters. Each part is divided into a number of subheadings and, if necessary, additional paragraphs in order to facilitate reading.

The first chapter provides a background to the study and explains the motivation for investigating musical interaction in an online environment as well as the purpose of the research.

The second chapter deals with previous literature that elaborates the many disciplines involved in the concepts of music, interaction and online teaching. Attempts are made to explain how human perception handles time, timing and rhythm, and certain key issues are defined from social, psychological and technical points of view. The last part of chapter 2 describes two case studies investigating online education.

Chapter 3 presents the theoretical aspects that constitute the basis for analysis of the results, and examples are given in a musical context where possible. Drawing from social constructionism and related theories such as reification and actor-network theory, the chapter also opens up for sociocultural perspectives and creates a basis for the methodology adopted in chapter 4.

Based on the theoretical aspects presented in the previous chapter, chapter 4 describes the method and design of the study. The qualitative method is scrutinised and efforts are made to thoroughly present the design of the empirical part of the study with a focus on the qualitative interview and the sampling process. Further, the process of analysing the findings is described whilst the analysis itself is presented together with the data collected in the next chapter.

Chapter 5 provides the results of the analysis of the six interviews. Four important themes that constitute the supporting pillars of the empirical part of the study are introduced. These themes are: the pandemic, the network, teaching online and interaction.

Quotations from the teachers who participated in the interviews (the informants) are mixed with ideas and concepts that emerged during the analysis of the material.

The sixth chapter closes the study with a discussion about the conclusions presented in chapter 5 in a manner that opens up for more philosophical aspects of what musical interaction and online education may be as well as a comparison between interaction in music and dance. Whether the study measures what it claims to, whether the results are reliable and how the conclusions made could be used for further research are addressed in a special part before the chapter concludes with some suggestions for the future.

Finally, a seventh chapter has been added that presents new technology that has developed in the wake of the pandemic, together with a discussion about what these new technologies could mean for online education and musical interaction online in the future.

1.3 Purpose of research

The purpose of this study is to investigate whether online music education restricts the musical interaction between teacher and student and, if so, in what ways. The intention is also to explore what measures are being taken by the teachers to address problems that arise. Both of these issues are investigated from the teachers' point of view, a perspective that is valid both for the case studies referred to in the literature review and in the interviews presented in chapter 5, 'Results' In order to present a valuable analysis, efforts are made to investigate what the term 'musical interaction' means in different contexts. Additionally, the technology employed by the teachers will be presented along with technical solutions available but yet not applied. It is important to point out that the circumstances investigated are those prevailing after approximately one and a half semesters of distance education. Changes in these circumstances will most likely determine the outcome of other studies.

1.3.1 Theoretical framework and research questions

Kentnor (2015) states that, in order to improve the quality of education, it is of utmost importance to investigate the technology as well as the varied teaching methods. With this in mind and the use of social constructionism and actor-network theory as the main tools, the study will focus on teachers' experiences, gathered through six in-depth qualitative interviews. Four research questions were identified:

- What is implicit in the term 'musical interaction'?
- What elements are required in order to create an environment suited for musical interaction?
- In what ways is the musical interaction between teacher and student affected by online education in music?
- How do music teachers transform their methods when teaching online?

2. Review of literature and concept definitions

Thoroughly examining the relationship between the human mind and technology is beyond the scope of this thesis, but as the following parts developed, it seemed appropriate to provide a short introduction in order to put the main concepts of mind and technology in a musical context. In this part, the human perception of time, timing and rhythm will be presented in a way that will, hopefully, be accessible for the average reader. The information presented draws from both neuro- and music psychology but aims to describe the phenomenon from an educational point of view, which explains why technical and mathematical terminology to a certain extent has been avoided.

In order to facilitate an understanding of online education, a short description of online meeting platforms follows. Common traits of the platforms referred to in the coming parts of the study are presented and an explanation of the crucial concept of latency is given. To put these recent platforms in a historical perspective, the history of distance education is discussed next, revealing the close ties between distance education and other means of communication such as the early postal services at the beginning of the 17th century. Finally, a definition of 'musical interaction', as described in the social sciences, is presented. This first definition will work as a reference point for the description of the phenomena that will be presented by the teachers engaged in the study and in the discussions presented in the final chapter.

2.1 Time

With the intention to further understand musical interaction, the human perception of time is of crucial interest. Time constitutes the grid which the concepts of timing and rhythm both relate to. After having written about these important phenomena, it was difficult to resist doing a deeper investigation into the conundrum of time and its elusive nature. As expected, trying to navigate through the advanced research theories and finally deciding what would be suitable for this study was not done quickly. However, looking back at the process, it seems obvious that this part about time should introduce the review of literature and concept definitions.

2.1.1 Defining time

The Concise Oxford Dictionary (Fowler, Fowler & Thompson, 1995) describes time as the indefinite continued progress of existence and events in the past, present and future

regarded as a whole. In a musical context, the events would be sounds and intervals between sounds, referred to in western music theory as breaks. Although time has been a subject of study in religion, philosophy and science and is often considered the fourth dimension, along with height, length and width, all attempts to find a definition applicable to all fields mentioned above have turned out an unfalsifiable closed-circle argument (Carroll, 2010). In this context, the meaning of 'closed-circle argument' suggests that it is impossible to define time without using terms that are a part of the definition or assuming a prior understanding of the term being defined.

2.1.2 An operational definition

Nevertheless, a number of diverse fields, including music, have some notion of time incorporated in their measuring system. From a musical point of view, it is important to acknowledge that different musical traditions measure time in a variety of ways and that the terminology adopted by western music is not always accurate in describing musical phenomena in non-western traditions (Cariani, 2019). While the fundamental nature of time is elusive, an operational definition of time instead focuses on observing a certain number of repetitions of one or another standard cyclical events, for example, a beat or pulse in music, and investigating how different elements relate to an imagined standard unit such as a second, a grain of sand in an hourglass or a heartbeat (Carroll, 2010). This way of exploring time certainly fits the topic of this thesis and also works as a basis for conducting experiments with timing and perception of time. In modern music, expressing time and tempo has shifted from having emotional connotations such as lively (allegro) to a strictly unit-based system where beats per minute (BPM) measures and defines the tempo.

2.1.3 Clock counters and hourglasses

In recent research, two models explaining the perception of time prevail and they both fall back on earlier studies, such as James' (1890) study, where the author proposes that the experience of time's flow is discrete, and that that discreteness appears when old and faint brain processes overlap with recent strong ones so that the amount of overlap determines the feeling of duration occupied (James, 1890). This explains why eventful sequences give an illusion of representing a longer period of time.

The first model usually referred to when explaining the perception of time uses the conception of a clock counter (Ivry, 1996), a device which presumably measures a long interval by accumulating shorter intervals and keeping track of their number.

Furthermore, the clock's tick may or may not have a fixed or variable period, be serially dependant or independent, and may exhibit different statistical distributions (Madison, 2001). In opposition to the 'clock-counter theory' stands a theory that suggests that different durations are timed by distinct elements. Madison (2001) postulates that, just as with hourglasses containing different amounts of sand, time might, according to this point of view, be perceived differently from case to case and the elements could possibly be conceived as different neural structures or substructures (Moore, 1992). As a consequence, the brain's judgement of time is supposedly highly distributed, which means that several parts of the brain are included. Some of these are responsible for the circadian (daily) rhythm and some are capable of shorter-range (ultradian) timekeeping (James, 1890).

2.1.4 Perception of time in music

When discussing the perception of time from a musical point of view, scientists have focused on the shorter-range perception. Some neurological diseases such as Parkinson's disease and attention deficit disorder (ADHD) have been proven to impair both the sense of time and the ability to keep a steady beat, or what later in this study will be introduced as an isochronous rhythm (Levitin, 2008). Several theories argue that rhythm and especially timing are dependent on bidirectional and potentially causal links between auditory and motor systems in the brain (Rentfrow & Levitin, 2019). This means that the perception of time must be influenced or even determined by our physiology and body metrics which, if true, thus establishes a link between rhythm and movement, timing and implementation. Since the idea of timing is constantly referred to in all contexts containing rhythmical music and is also important for the understanding of certain predicaments produced by the digital aids used by the teachers in this study, this concept will be investigated next.

2.2 Timing

According to the Chambers Dictionary (Schwarz, 1993), timing is the 'fixing, choosing, adjusting, ascertaining, or recording of time: co-ordination in time'. Research in music psychology has shown that time as a subjective way to structure events in music differs from the concept of time in physics (Janet, 1985). Instead, temporal patterns in music combine two different time scales: rhythmic durations, in western music theory known as half and quarter notes on the one hand, and on the other, the continuous timing variations

that characterise a musical performance. Clarke (1999) emphasises that participants in musical activities recognise rhythmic categories that function as a reference relative to which the deviations in timing can be appreciated rather than perceiving rhythm on a continuous scale, which actually follows the idea that different durations are timed by distinct elements, as presented in part 2.1.3 ‘Clock counters and hourglasses’.

Madison (2001) concludes that human behaviour occurs in time due to capabilities that swiftly manage judging, estimating and discriminating time intervals. In a musical context, all kinds of performances are, to a greater or lesser extent, dependent on timing, and as Levitin (2008) points out, such a simple act as tapping the foot to a beat or rhythm is a game of expectation in the sense that the performer needs to predict what is going to happen next. In this game of expectation, mirror neurons have proven to be of utmost importance. A mirror neuron is a nerve cell that is engaged (fires) both when its owner (mirror neurons have been observed in humans, primates and birds) acts and when observing the same action performed by others. Thus, the neuron ‘mirrors’ the behaviour of others, as though the observer itself were acting (Keysers, 2011). The purpose of mirror neurons is presumably to train and prepare the organism for new movements, which can explain why musical rhythms move us both emotionally and physically (Levitin, 2008).

2.3 Rhythm

Both the capacity and the drive to find patterns are much more developed in humans than in other animals. Human minds are comparably quick and wired to respond without much hesitation. This evolutionary capacity has, according to Silver (2012), spilled over to a variety of aspects, one of them being the recognition of rhythms. When listening to music, most listeners can distinguish temporal aspects of music such as rhythmic pattern, metrical structure, tempo and timing (Rentfrow & Levitin, 2019).

Rhythm may be defined as the way one or more unaccented beats are grouped in relation to an accented one (Cooper & Meyer, 1960). It could also be defined simply as a sequence of events in time, in music adapted to a perceived scale and tempo. The temporal aspects of music are only rarely addressed by music theory, and if they are, the rhythmic structures are restricted to music as notated in a score (Rentfrow & Levitin, 2019). Despite these circumstances, a large part of a musical performance is about interpreting rhythms, and in this case, the musical interaction with fellow musicians or even the audience is of great significance.

2.3.1 Musical entrainment

When referring to the perception of periodicities in music, the beat is fundamental to musical behaviour and provides a framework to explore general entrainment mechanisms as embodied in the human brain (Nozaradan, 2014). Entrainment to music is a highly complex activity involving a large network of brain structures, and once a listener perceives a metrical structure, this structure has a tendency to become relatively stable over time (Rentfrow & Levitin, 2019). A large group of animals may walk rhythmically and experience the sounds of their mothers' heartbeats in the womb, but research has proven that only humans have the ability to be entrained to rhythmically coordinated activities (Jordania, 2011).

2.3.2 Isochrony

In studies of rhythmical coordination, participants are often asked to tap a finger in time with an isochronous meter while the relative frequencies between taps are analysed. 'Isochrony' was originally a term used in linguistics to explain the rhythmic division of time into equal portions by a language, but the terminology later found new usage in several disciplines, including music psychology and medicine. In music psychology, an isochronous pattern is a rhythm where all intervals between events are equal, much like those of a metronome. In addition to this there is a tendency to superimpose a grid to a rhythmic sequence which is commonly referred to as a beat or pulse. Humans are particularly good at producing and perceiving a stable periodicity, and although we share these abilities with a broad range of species, there are typical traits of an underlying pulse that are found only in humans and a few other animals (Ravignani & Madison, 2017).

2.3.3 Musical interaction and selection

The ability to musically interact by keeping a steady beat has played a crucial role in the development of humankind. None of the early civilisations could have been created without the means of making large numbers of individuals cooperate, and in this process the perception of a common and steady beat is not to be dismissed. Humankind's ability to work, march and dance to the beat has created the world as we know it, and it is only in the last century that manual labour has given way to new technology (McNeill, 1995). Forsman (2009) is one of the researchers who has examined the correlation between the perception of so-called isochronous meters and the concept of intelligence, finding that local interval-to-interval variability correlated more strongly with intelligence than

gradual tempo changes (drift). Could this mean that the correlation between rhythmical stability and what we call intelligence is a result of natural selection?

2.3.4 Musical interaction and evolution

Darwin suggested that music has developed as a tool for what he refers to as 'sexual selection', stating that music may indicate biological and sexual fitness, serving to attract mates (Levitin, 2008). Since Darwin, various theories about the role and function of music and musical interaction have been presented. One obvious suggestion to help us understand how and why music was selected as an important human feature is social bonding and cohesion. Musical interaction may have served to promote feelings of benevolence and synchrony and may have been an exercise for other social acts such as turn taking (Levitin, 2008). Studies have shown that entrainment to a stable periodicity expands brain capacity and that musical activities such as drumming can induce synchronous activities in various areas of the brain and are thus beneficial for alleviating anxiety and stress (Rentfrow & Levitin, 2019). Musical interaction also creates a sense of bonding and connectedness from person to person in a community. This might explain why music has been widely used in ceremonial rites in most societies throughout history (Passion, 2021) It probably also explains why musical interaction is considered to be such an important feature in music education, according to the teachers taking part in this study.

2.5 Online meeting platforms

In distance education in general and online education in particular, the cognitive processes are, to a high extent, filtered through machines that increase our capacity for solving problems. The machines referred to in this study are, with few exceptions, digital meeting platforms designed to facilitate staff meetings and conferences. The prevalence of commercial meeting platforms such as Zoom, Skype and Google Meet is notable, but exceptions are to be found, as will be demonstrated in chapter 5, 'Results'.

2.5.1 Latency

As shown in previous parts, music as a means of communication is crucially dependent on timing, and any interference will inevitably complicate the musical interaction. Due to a technical aspect known as latency, a short delay between when an audio signal enters a system and when it emerges, the online meeting platforms obstruct the possibilities for precise musical interaction as practised in rhythmical genres. Although latency on these

platforms usually stays at around 10-15 milliseconds, a value apparently not too drastic on reflection, the human brain is capable of detecting the tiniest time discrepancies and incredibly subtle rhythmic variations (Snowman, 2009).

2.5.2 Tuning in to latency

As proven by Madison (2001), the human ability to time actions and to predict events on the basis of prior episodes indicates the existence of an internal timing mechanism. This means that timing in human communication in general and in musical interaction in particular is affected both by time and variables such as our perception of isochronous intervals in feedback loops stretching as far as a few seconds (Madison, 2001). With Madison's (2001) functional modelling of the human timing mechanism in mind and the fact that even slight timing inconsistencies can drastically change the entire feel of the music and indeed destroy the strict rhythmical patterns that are required in some genres, it is evident that the effects of latency are impossible to ignore. Furthermore, the level of latency is seldom constant, which makes it even harder to adapt to the limitations. On the whole, possibilities to orient oneself and interact rhythmically in an online environment are obviously questionable (Snowman, 2009). As a consequence, the platforms used for online communication need to resolve these issues. If these needs are not met, new technical solutions will appear, a prediction that will be proven in chapter 7, where new platforms for interaction are presented (Larsson, 2004).

2.6 Distance education

Distance education, or distance learning, is the education of students not physically present at a school. A distance learning programme can consist of distance education only or of a combination which also includes traditional classroom instruction. As will be shown in the first paragraph of this part, the initial forms of distance education all involved correspondence courses. In recent times, the correspondence of distance education has been conducted on the internet, and since this study focuses on musical interaction online, the term 'online education' will be employed in order to exclude all methods that do not involve the internet.

2.6.1 A short history

The history of distance education dates back to the 17th century, when for the first time a system for correspondence courses developed using traditional mail services. The practice was later picked up by established universities and became a cornerstone in the

new open universities of the modern age (1960s and onwards). The internet revolution and open educational resources laid the foundations for virtual universities, so-called MOOCs (Massive Open Online Courses), as well as for the means of education focused on in this study: online lessons (Moore, 1992). Regarding the evolution of distance education, online education is often considered the third generation of distance education with a clear focus on the role the internet plays in the process (Wännman & Toresson, 2002).

2.6.2 Implementation of the new technology

In the time before the pandemic, higher education in Sweden was generally poor at engaging new means of communication for educational purposes even though the availability of technology has been considered satisfactory (Hylen & Groth, 2003). According to the OECD's latest digital government index, which measures digital development in the governments of the OECD countries, Sweden is still rated amongst the lowest ten of the 33 participants (Hellgren, 2021).

Although distance education opens up for flexibility and increases accessibility, earlier research has identified some problematic issues that need to be taken into consideration. Research in distance education becomes just as much an investigation into the recent educational technology and the varied methods of using the latest innovations, and since older research tends to be outdated as soon as new standards are set, it is hard to rely on past findings (Kentnor, 2015). Another issue is the technical equipment added to the context, including microphones, speakers, headphones and similar acoustics in the rooms involved (Brändström & Wiklund, 2010). It is also vital to consider the social aspect, where research has shown that social exchange is a central issue (Evaldsson, 2020). Another interesting aspect to keep in mind is the gap in accessibility between the so-called digital natives, who grew up with the new technology at hand, and the digital immigrants, who usually represent the older generations and whose approach is more reluctant (Small & Vorgan, 2008). These circumstances are highlighted in chapter 5 of this study, where prior experience with online education proves crucial to the teacher's choice of methods and practices.

2.6.3 Synchronic and asynchronic teaching models

Considering practical instrumental lessons and masterclasses (in this context, the voice is regarded as an instrument among others), in distance education the practice differs between synchronic and asynchronic teaching models. The first method is equivalent to

real-time teaching online and requires a reliable internet connection and advanced technical platforms, whilst the latter is a matter of a filmed correspondence between the teacher and the student (Brändström & Wiklund, 2010). Most online meeting platforms permit both asynchronous and synchronous learning opportunities and, according to Johnson (2017), this seems to be a superior approach to online music education. However, this study will focus on synchronic teaching models since only those are working with musical interaction in a direct manner. Some examples of asynchronic teaching methods will be introduced in chapter 5, engaging pre-recorded video clips and exercises. Additionally, Brändström and Wiklund (2010) declare that lessons online have a tendency to be more intense and need to be carefully planned, which leads to the conclusion that a time limit of 30 minutes is ideal in online tuition, a statement that will be proven right by the teachers participating in the interviews presented in chapter 5.

2.7 Musical interaction

Interaction is the hub around which this entire study revolves. Although it is difficult to define it precisely, some facts are presented in this part that will serve as stepping stones for an expedition deeper into the phenomenon. As will be shown in chapter 5, 'Results', the results chapter, the definitions of musical interaction as presented by the teachers interviewed mainly consist of ideals that are difficult to fulfil even in a face-to-face situation. In order to pave the way for a broader definition, a review of research that has examined the matter is presented next.

2.7.1 Interaction in general

Generally speaking, interaction is any kind of action that occurs as two or more objects have an effect upon each other, contrary to causality, where one event, process, state or object contributes to the production of another (Pearsall & Trumble, 1996). Put in other words, this means that a cause leads to an effect in a predictable manner. The idea of a two-way effect is essential in the concept of interaction, and outside specific fields of science, interaction usually refers to some sort of communication between smaller or larger groups of people. Additionally, the feedback during the operation of an analogue or digital machine or a musical instrument can also be defined as a form of interaction between the human and the machine or instrument.

2.7.2 Musical interaction in particular

Musical interaction is a universal means of non-verbal communication that is achieved through specialised and codified forms of social interaction (D'Ausilio et al., 2015). These skills build on the human predisposition for musicality and musical training. As in more general forms of social interaction, musicians behave in complex but formalised ways that are constrained by the tools they use (musical instruments) and conventions such as genre-specific performance styles and leader–follower roles. Often a script, for example the musical score, is also part of process (D'Ausilio et al., 2015). Interaction in a music ensemble is a form of social collaborative behaviour that requires multiple individuals to anticipate and adapt to each other's actions, often with timing at the millisecond level. The same abilities are required by an individual interacting with a pre-recorded track or following a set tempo, but with a higher rate of predictability and thus affecting the disposition. D'Ausilio et al. (2015) suggest a taxonomy that describes the musical interaction in different contexts with respect to the impact on the music that each musician has under the proposed circumstances. The taxonomy suggests five different levels of interaction with varying levels of impact. These levels include an individual interacting with a recording (least impact), a computer-controlled virtual partner that responds to the individual, another individual in a duo and finally, multiple individuals in mixed ensembles in the presence of a live audience (most impact). Nevertheless, they are all examples of musical interaction.

2.8 Two case studies

As an example of what musical interaction in an online environment could look like, this part of the study explores two case studies situated at two different American universities. The first case deals with online piano tuition in a neglected and underserved part of the country, and the second investigates the transformation of teaching methods in an online course in music for undergraduates.

2.8.1 Online piano education

At Louisiana State University, Pike (2015) explored the potential for using a synchronous online piano course led by graduate pedagogy interns. Using the latest internet MIDI technology and FaceTime for communication, both students and teachers came to reconsider the role of music education in society and equally saw the possibilities to reach out for underserved populations in remote locations (Pike, 2015). The latest technology

in this case meant a hybrid acoustic-MIDI piano (Yamaha Disklavier) connected to an identical instrument over the internet. MIDI sensors captured all important details in the performance, such as pedal depression, key stroke and velocity and transferred this information to the connected piano so that when one instrument was being played the sound emanated on the receiving end, keys and pedals being depressed with the same weight and speed (Pike, 2015).

From the very start, MIDI was developed for keyboards, and ever since, the instrument has played a special role for the development of electronic music and music production in general. Accordingly, it is not surprising to find that keyboards take a lead also in online music education. At present, the technology exists to teach piano synchronously online and with an outstanding quality, and it has proven to be a convenient way of reaching underserved populations (Shoemaker, 2011). However, none of the teachers in Pike's (2015) study found a way to solve the obstacles caused by latency, or as it is called in the article, 'piano echoing in FaceTime' (Pike, 2015). Instead, the teachers invented other ways to work on musical interaction, such as recording accompaniment tracks and considering how concepts depending on timing and physical contact could be taught differently from the methods that they typically used in face-to-face lessons (Pike, 2015).

2.8.2 Framework for teaching music online

In the second case study, Johnson (2017) explores how teaching staff at a university music department transformed their teaching methods when instructing undergraduate courses online. She comes to the conclusion that creating opportunities for students to learn through interactive and social exchanges is the most promising method of engaging students in their learning (Johnson, 2017). Aiming to find what she refers to as a framework for teaching music online, Johnson (2017) highlights some parameters that are of concern for this thesis. Rather than developing pedagogical knowledge for incorporating technology in teaching, there is often a tendency among educators to focus on the technological skills and by doing so overlook the vast possibilities online education offers (Johnson, 2017).

According to Johnson's (2017) case studies, experienced teachers could use their music expertise to overcome problematic technical issues such as the ever-occurring latency. In spite of limited musical interaction, music courses online should still try to address the inherent dynamic communication exchanges (musicians performing with other musicians) that are being found in the performance and experimental foundations

of music (Johnson, 2017). Participants in Johnson's (2017) study expressed frustration with activities that are traditionally very dependent on face-to-face communication and in that way demonstrated a perceived understanding of what was possible in the online environment (Johnson, 2017). Further, she found that the instructors' backgrounds played an important role in how they approach online instruction and that the notion of authenticity was critical for teaching online, since music is both an art form and aural communication that is learned through practical application (Johnson, 2017).

3. Theoretical aspects

Drawing on literature in social constructionism and sociocultural theory, this chapter provides points of departure for interpreting both the material collected through the qualitative interviews and earlier research. The aim of this study is to use the theoretical toolbox to analyse the so-called artefacts, real or imagined, that in one way or another are created in educational contexts. Consequently, no effort will be made to investigate truth in a post-modern discourse or deconstruct the human perception of reality with intentions other than to shed a light upon the possibilities and difficulties that the new technology and teaching methods suggest.

3.1 Constructing the social

Social constructionism is a theory of knowledge about knowledge. It begins with the premise that the world of human perception is not real in an absolute sense, but mere interpretations and constructions and therefore must be studied differently (Patton, 2015). The claim that many aspects of the world around us only exist because we give them reality through social agreements also means that those phenomena do not exist in the absence of human society.

The ability to create social constructs has been a decisive feature in human culture ever since the cognitive revolution, which presumably occurred some 70,000 years ago. Imagination and social interaction allowed humans to transmit information about things that do not really exist, such as tribal spirits, nations and money, which led to a rapid innovation of social behaviour and facilitated cooperation among a very large number of strangers (Harari, 2014). Any notion of truth then becomes a matter of shared meanings among a group of people and not necessarily a supposed objective reality (Patton, 2015). Accordingly, meaning-making and realisation are developed in coordination with other human beings rather than separately within each individual (Leeds-Hurwitz, 2009).

3.1.1 A musical example

People make their social and cultural worlds at the same time as these worlds make people, in the same sense as language does not reflect reality but rather constructs it (Fairhurst & Grant, 2010). From a musical point of view, an example could be the habit of categorising different genres such as classical music or pop music. Most people agree on certain features found in the genres mentioned above, but this does not necessarily

mean that we should assume that there is anything in the nature of the music itself that means it must be divided up in that particular way. In that way, jointly constructed awareness of the world creates a basis for shared assumptions of how reality is being distributed and social agreements constructed (Burr, 2003). Returning to the example of musical genres, musicians belonging to a certain genre may be expected not only to play a certain kind of music but also to embrace special ideals, opinions and sometimes even looks.

3.1.2 A brief history of social constructionism

The roots of social constructionism are found in the phenomenology of, amongst others, Husserl (2002), but both Kant and Hegel used the term in their earlier work. According to Husserl's theoretical framework, most people view the reality we inhabit as something fundamentally separable from our objective experience of it. This allows us to turn our attention to the ongoing activity of consciousness and how our impressions are being filtered by our cognitive abilities and earlier experiences. Since phenomenology involves becoming aware of the basic structures of our lives, it is very applicable to all situations involving human interaction. This is usually accomplished by exploring so-called natural attitudes instead of taking them for granted (Husserl, 2002).

3.1.3 Natural attitudes

Within the natural attitude, the world is experienced as perpetually present, even prior to our reflection upon it, and as having no relation to us other than as a context or a container for other objects of interest. The classification and description of these objects is one of the characteristics of phenomenology and is also consistent with human societies constructing the categories into which facts can be classified. As will be shown in chapter 5, the music teachers interviewed all express a kind of natural attitude to the phenomenon of musical interaction. The interaction becomes a social reality, but in order to understand the social reality, it is crucial to explore how this reality is generated (Berger & Luckman, 2011).

3.2 Reassembling the social

In educational psychology, the theory of social constructionism is applied to explore meaning-making processes and their connection to different kinds of created artefacts. According to these assumptions, people work together to construct artefacts, including, as in the case of this study, cultural artefacts. Cultural artefacts are a subgroup of social

artefacts and as such they do not need to have a physical form or be of historical value. Online educational platforms and interactivity on the internet are typically referred to as concrete phenomena, and just like money, they have overridden other methods of communication and data collection (Harari, 2018). As mentioned earlier, social constructs rely on the human perspective and knowledge that is constructed by society. As the social constructs become fundamental for the development of a community, the artefacts (physical or abstract) become inseparable from society as a whole and are even capable of taking an active part in new constructs.

3.2.1 A monetary example

A common example of such a social construct is, as mentioned earlier, money or the concept of currency. The concept of money is not equivalent to coins or banknotes. Instead, the artefacts used to represent value have changed throughout history; the first coins were produced as recently as 600 BCE. To give some perspective, even today, coins and banknotes are a rare form of money. More than 90% of money is virtual, which means that it exists only on computer servers. The development of money required no technological breakthrough but was rather a purely mental revolution, involving a new inter-subjective reality that only exists in people's shared imagination (Harari, 2014).

3.2.2 Mediation

Sociocultural theory was developed from the works of Vygotsky as a response to behaviourism in the early 20th century (Smidt, 2009). The essence of the theory is that human interaction and cultural features form our mental abilities and that learning cannot be reduced to simple conditioning (Phillips, 2014). Consequently, learning starts as a social activity, and sociocultural aspects are decisive for development (Dysthe, 2003). Furthermore, the human ability to gain and retain knowledge is dependent on tools in order to transmit our experiences (Säljö, 2005). These tools are not exclusively technological inventions that have a physical impact but are just as much symbolic and cognitive tools such as languages (spoken or written), pictures, symbols and mathematical equations (Säljö, 2005). In sociocultural theory, mediation refers to cultural tools or signs to bring about qualitative changes in thinking (Smidt, 2009). Our culture and the artefacts and cultural tools representing it actually shape the way we think and how we imagine the world around us (Säljö, 2000).

The nature of an artefact or tool is decided based on how an individual chooses to use it, a statement that will prove important when investigating how different digital aids are

viewed by the teachers taking part in the study. Throughout history, the significance of mediation has grown with the number of artefacts that are overriding human competences. In order to understand the cognitive processes required in modern society it is crucial to involve artefacts and the networks created between objects and humans (Säljö, 2000). These networks are in fact human knowledge positioned in an interpersonal context. Distinguished artefacts often work in ways that make the technology invisible and only become noticeable once they stop working as intended (Säljö, 2000). This is, above anything else, noticeable in a connected society where the underlying premise of all online activities is a functioning network.

McLuhan (2001) refers to the relationship between humans and artefacts in a more poetic manner when he claims that the wheel is no less than an extension of the foot, the book an extension of the eye. Beyond each innovation lies a hidden environment of services that are embedded in the artefacts as such. It is these hidden environments, not technology, that change people, which leads to the slogan 'the medium is the message', coined by McLuhan himself (McLuhan & Fiore, 2001). What this means in an educational context is that online learning and online musical interaction create effects that lie beyond the artefacts themselves. These effects can, for example, be new ways of creating music, new forms of music and new possibilities to cooperate across cultures.

All of the effects mentioned will alter the society and promote certain behaviours. Sooner or later, these new ways of interacting will be transformed into natural attitudes, as described in part 3.1 'Constructing the social'. A more drastic example than online learning could be firearms. NRA (National Rifle Association) supporters are often cited as stating that firearms are neither good nor bad in themselves, and that it is how they are used that determines their value. According to McLuhan (2006), statements like this ignore the nature of the medium, which in the case of firearms of course would be to kill.

3.2.3 Reification

Inspired by Marx's theories of commodity fetishism, Lukács (1989) coined the term 'reification' to describe a system based on strict standardisation and quantification that necessarily had to override all previous systems of commodity exchange. The impact of reification is described as the individual turning from the master of the process to become yet another part of the mechanical system (Lukács, 1989). When the concept was developed, it described both how humans were turned into objects in the wake of the industrial revolution and they became alienated from society, which is described as an

entity impossible to interact with and that could only be known as an unfamiliar power. With the information revolution in mind and the further development of the internet and artificial intelligence, it is obvious that the mechanical system, as described above, can appear in many different shapes and that the theory of reification is applicable to digital technology. From a social constructionist perspective, reification can also be employed when it comes to institutions being perceived as physical objects (Alvesson & Sköldberg, 2017).

3.2.4 The copy- paste syndrome

From a musical point of view, the new digital technology developed for recording and composing has in many ways changed the interaction between musicians, composers and technicians (sound engineers), making the distribution of roles uncertain, sometimes resulting in one person operating all areas and in other cases a large crew where each person is focusing on particular details (Hull, Hutchinson & Strasser, 2010). The new technology has also affected the creative procedures surrounding the musical craft, resulting in new expressions where the advantages in speed and performance of digital aids has led to what sometimes is referred to as the copy-paste syndrome (Kulathuramaiyer & Maurer, 2007). By reusing (copying and pasting) already recorded or composed material, new musical genres have been created and software has learned to imitate and even compose new pieces of music (Aroesti, 2016). New composing techniques that rely on algorithms and computer programs have evolved, along with methods for recycling old material (Hull, Hutchinson & Strasser, 2010). To some degree this has made both certain musicians and musical expressions obsolete while putting more focus on the producers and the computer programs employed. Instead of interacting musically, a large part of the human input is used to make it easier for the the new technology to communicate without obstacles.

3.2.5 Actor-network theory (ANT)

In the early 1980s, Latour (2005) became a figurehead for the actor-network theory (ANT), which proposes that everything in the social and natural world only exists in constantly shifting networks of relationships. This spawned a second wave of social constructionism where the technical artefacts were also considered capable of taking an active part in the construction of society. Artefacts are embedded in all social forms of communication, and without their existence there would be no social life as we know it. Consequently, human agency is not limited to the body but reaches further with the help

of material aids (Fejes & Thornberg, 2019). In conclusion, this means that objects, ideas and processes are regarded as just as important in creating social situations as humans are, which more or less equates with the arguments that were presented in the sociocultural theory of artefacts as referred to by Säljö (2000).

3.2.6 When the artefacts resist

What the object does to the human is just as important as how the human uses the object (Fejes & Thornberg, 2019). One example of this is how new technology and digital aids sometimes resist recognising certain kinds of information that the applications have not been programmed to process. While the analogue solution to such problems would be to educate the person at the receiving end, in a digital society, the transmitter has to learn how to behave according to the premises put up by the application. Needless to say, this creates a different kind of social structure and, as Latour (2005) points out, when it comes to the social structure, it is not a force that ties us together, but rather a phenomenon that is tied together by different actants.

3.2.7 A theory and a method

ANT is just as much a theory as a method in the sense that it affects how data is collected and analysed. The purpose of using ANT is not to deconstruct a phenomenon but rather to reassemble it, that is, to analyse the different elements involved and to analyse how they cooperate (Fejes & Thornberg, 2019). This advocates a strictly empirical analysis in order to describe social phenomena and insists on the capacity of non-humans to act or participate in both systems and networks (Latour, 2005). ANT affords all actants within a network with an equal amount of value and agency, which in online synchronous teaching of music would mean that the digital aids being used all have the same amount of agency and are as important to the network as the people whose interaction they support. The principle in ANT is that researchers use the same language when analysing all actants, humans as well as artefacts. This approach is called the principle of general symmetry (Fejes & Thornberg, 2019). The methodology of ANT relies on different ways to describe the networks, and it follows the actants by means of interviews and ethnographic observation: what seems to be technical is partly social and vice versa. This creates a different form of narrative that primarily focuses on which actants are connected, what they do and what emerges as an effect of their connections (Fejes & Thornberg, 2019).

3.3 A multitude of aspects

As a perspective, social constructionism is broad and full of contrasts, and even though the roots of the theory are common to those of phenomenology, social constructionist theories have, since the 1980s, been closely associated with post-modernism (Alvesson & Sköldberg, 2017). According to Gergen (1994), important theories that have defined and largely controlled our common attitudes have offered convincing ideas about central social issues rather than proven scientific data. Apparently, there are reasons other than scientific ones as to why some ideas gain importance. One decisive aspect for the status of a new theory is whether it challenges established attitudes and attracts attention in popular culture. Gergen (1994) accentuates the manipulation of attitudes and identity in a society with ever-accelerating technical progress. Social coordination is the basic foundation for all human activities, and as cultures become more pluralistic and multiple realities emerge, it seems short-sighted to single out one direction as unparalleled, especially in a changing environment.

3.3.1 Four degrees of radicality

Generally speaking, there are four different positions of social constructionism with varying degrees of radicality. According to Wenneberg (2010), these degrees are connected and there is a tendency, when using social constructionism to investigate a social phenomenon, to start by presuming that some aspects of society are socially constructed and others are not but then to end up with the idea that even reality is a social construction. Alvesson and Sköldberg (2017) describe it this way: the first position involves simply accepting that some aspects of social life are constructed and not naturally given. Music could serve as an example, which then leads to an investigation in order to find out where music derives from. The next step is to construct a social theory, for example, one similar to the theory mentioned earlier, in part 2.3 ‘Rhythm’, which stated that music may have been an exercise for other social acts such as turn taking (Levitin, 2008). With a social theory and the adaptation of this theory in a certain society, it is tempting to continue to ask whether all knowledge in society follows the same pattern as music and whether all kinds of knowledge are somehow constructed. This might lead us to the conclusion that knowledge is indeed a social construction, and if so, we might wonder if the very source from which we gather our knowledge could also be a social construction. Thus, we have reached the fourth degree of radicality, the ontological standpoint, which proposes that reality in itself is a social construction (Alvesson &

Sköldberg, 2017). With this in mind, it is tempting to offer social constructionism a taste of its own medicine by claiming that, according to the presumption that reality is a social construction, the whole idea of social constructionism must be a social construction as well.

4. Method and design

This part of the study introduces the empirical material gathered through six in-depth interviews with music teachers from three different types of institutions: upper secondary schools (gymnasium), a conservatory (musikhögskola) and music schools (musik/ kulturskola). Employing a qualitative methodology, the aim has been to focus on social constructions of reality, described by Kvale & Brinkmann (2009) as the 'traveller approach'. According to this approach, the 'traveller' is a metaphor for an interviewer who finds knowledge in interaction with the informants, which subsequently leads to new conversations about the results, conversations that again will generate new knowledge (Kvale & Brinkmann, 2009). For consistency, all issues dealing with validity, reliability and generalisation will be discussed in chapter 6, part 6.6.

4.1 Qualitative method

The main way to categorise and construct theories in qualitative research is by collecting and inducting data. Qualitative data generally takes the form of words, and although these words of course could be quantified for statistical purposes, it is the process of collecting the data and the approach when analysing it that in the end determine what kind of data (qualitative or quantitative) is being presented (Lichtman, 2006). Choosing an approach also determines the focal points for analysis (Kvale, 2009). This procedure is not free from bias from the researcher's point of view and to some extent also depends on his or her preunderstanding of the given subject. Furthermore, empirical data cannot be selected without a critical review, which in this case means that the researcher is obliged to maintain an inner dialogue and by doing so ensure an open approach to the issues presented in the study (Ruud, 1995).

4.1.1 Open approach and objectivity

An open approach is one of the most significant features of qualitative methods, and it is decisive from a constructionist point since knowledge, as presented in previous chapters, only exists in the relationships and interactions created by humans. From a post-modern perspective, knowledge derives from the linguistic and communicative aspects of the interview, which also include the differences between oral discourse, written text and the narrative constructed within the conversation (Kvale, 2009). The choice of method will have implications for the result and the concept of objectivity, but since objectivity is

somehow inconsistent with the idea of a constructed reality, qualitative methodology actually allows subjectivity on the role of the researcher (Lichtman, 2006). However, Kvale (2009) points out that, although the task is to interpret meaningful relations in order to be able to develop theoretical concepts, the researcher constantly has to fall back on epistemology, which in this case means a concern for the perception of knowledge and reality. The question at stake is whether or not epistemology is to be used to justify a certain result as valid from a scientific point of view (Lichtman, 2006), a discussion that will be continued in part 6.6 'Validity, reliability and generalisation' in chapter 6 of this study.

4.3 Qualitative interview

'Qualitative interviewing' is a general term that describes engagements in a dialogue or conversation with a clear purpose, usually directed by the researcher (Lichtman, 2006). Different forms of interviews serve different purposes, and although the qualitative interview is a typical conversation between two or sometimes more participants, its purpose is typically to produce knowledge (Kvale, 1997). However, interviews may differ in the openness of their intentions, their degree of structure, the extent to which they are exploratory or hypothesis-testing, whether they seek description or interpretation, or whether they are largely cognitive-focused or emotion-focused (Cohen, Manion & Morrison, 2011).

4.3.1 Different types of interviews

The use of theories of knowledge as a reference is to some extent dependent on which type of interview the researcher employs. The strengths and weaknesses of different types of interviews are outlined by a range of sources, but to facilitate matters, the four types outlined by Patton (2015) will be used in this study. Accordingly, 'informal conversational interviews' are characterised by a free conversation with questions emerging from the immediate context. In this type, there is no predetermination of question topics or wording. On the other end of the spectrum are the 'closed quantitative interviews', where all question and response categories are determined in advance, which means that the respondent chooses from a list of fixed responses. Somewhat more open in its approach is the 'standardised open-ended interview'. In this type, all informants are asked the same basic questions in the same order. Since the purpose of this study is to gain knowledge through conversations on a topic closely related to the researcher's own

profession and the fact that some of the informants are personal or distant friends, it proved beneficial to decide the sequence and wording of questions in the course of the interview. This type of interview, which Patton (2015) places in between the 'informal conversational interview' and the 'standardised open-ended interview', is called the 'interview guide approach'. Likewise, Kvale (2009) refers to a type of interview where the informant guides the process but uses the term 'semi-structured' to describe its features.

4.3.2 The interview guide approach

The advantages of having topics and issues covered in advance but allowing the informant to guide the conversation are that the comprehensiveness increases and that logic gaps in data can be anticipated and closed (Cohen, Manion & Morrison, 2011). The interviews also remain fairly conversational and situational. The disadvantages of this type are that important and salient topics may be inadvertently omitted and that the flexible form can result in different responses due to the sequencing and wording of each question. If that happens, the comparability of the responses is reduced compared to the more fixed types of interviews.

4.3.3 Insider/outsider

Another problematic issue is what is usually referred to as the insider/outsider dichotomy. Being a music teacher myself and also struck by a sudden change in teaching conditions puts me in the same situation as the informants and thus makes me an insider. As an insider, there are certain challenges to be faced, such as the potential blurring of roles, assumptions being made based on prior knowledge and the impression that the researcher might already know the answers. On the other hand, the benefits of an insider position include a better understanding of the shared culture, which in turn increases legitimacy and leads to swifter acceptance by the informants. In ethnography, the terms 'emic' (for the insider) and 'etic' (for the outsider) are used, and although the differences between these two approaches have been the topic of many debates, both sides seem to agree that the task of the researcher is to balance a commitment to catch the diversity, variability, creativity, individuality, uniqueness and spontaneity of social interactions (Geertz, 1973).

4.3.4 Leading questions

One of the most anticipated objections to qualitative interviewing is that there is an evident risk of affecting the responses by asking leading (or misleading) questions. A

leading question is a type of question that pushes the respondents to answer in a specific manner, based on the way it is framed. Additionally, the questions may contain information that the creator of the study wants to confirm rather than develop. Even if the question involuntarily points the informants in a certain direction, it is often an overlooked fact that leading questions are a necessary part of most types of interviews. For example, in a strict survey where the options are restricted to 'yes' or 'no', the informant is obliged to accept the dichotomy dictated by the design of the questionnaire (Kvale, 2009). From a social constructionist point of view, the task of the interviewer is not to avoid asking leading questions but rather to admit to their existence and make them explicit to a point where the receiver gets an opportunity to evaluate both how the questions might have influenced the research results and their validity (Kvale, 2009). With this in mind, topics and guiding questions for the interviews in this study are presented in the appendix.

4.4 Design

In this part of the study, different methods of sampling are discussed and the sampling concepts found beneficial with respect to the research questions are presented. How the interviews are staged and implemented are two important features that are investigated next, and before the informants are described, ethical considerations, vital for every study containing observations and interviews, are introduced and considered.

4.4.1 Sampling

Choosing informants is of crucial importance for the outcome of the research, and doing so strategically ensures a contribution of relevant knowledge and experience (Alvehus, 2019). Qualitative inquiry typically focuses in depth on relatively small samples, selected for a specific purpose. The term 'purposeful sampling' describes the most suitable method for finding informants for this investigation. The idea is to approach informants who can provide rich information about the specific topic, in this case musical interaction. The online aspect is new for all of the teachers in the study, and this is also necessary since the aim to some extent is to study changes in teaching methods (Patton, 2015).

4.4.2 Main sampling concepts

As mentioned earlier, the empirical part of this study consists of six in-depth interviews with experienced teachers who have tried to adapt to the sudden changes in teaching conditions. Among the many purposeful sampling strategies presented by Patton (2015),

‘comparison-focused sampling using key informants’ and ‘chain sampling’ are both concepts that describe the procedure used in selecting informants for this study. ‘Comparison-focused sampling’ is all about selecting cases to compare and contrast factors that explain similarities and differences. Key informants are people with specific knowledge, for example, due to long-term employment in the field studied. In the case of this study, all of the music teachers have considerable experience as both educators and musicians. All teachers approached are to some degree active as musicians and all have qualified experiences of musical interaction through ensembles, orchestras and choirs.

4.4.3 Chain sampling

Considering the four research questions presented in part 1.3 ‘Purpose of research’ and the ambition to investigate different teaching environments, the selection fell on teachers from three different levels of music education: conservatory (musikhögskola), upper secondary school (gymnasium) and music schools (musik/ kulturskola). Four of the six informants were selected through personal connections and contacted directly by me for a brief review of the study and my intentions. The two remaining informants were in turn suggested by one of the other participants because of their special insight into digital tools and ongoing research in musical interaction in online communities. Creating such a chain of informants is especially fruitful when investigating social issues such as interaction, since the informants being suggested by other participants in the study make up a distinctive social network on their own. Patton (2015) calls this strategy ‘snowball or chain sampling’.

4.4.4 Staging the interviews

The interviews were staged according to the instructions suggested by Kvale (2009), consisting of an introduction (initial phase), where the researcher defines the situation and guides the informant towards the core of the matter in order to start the actual interview and collection of data. As a complement, the sessions concluded with a brief casual conversation about the overall situation and the possibility of adding or elaborating upon ideas brought up earlier in the interview. The length of the interviews varied from 35 to 50 minutes, but a whole hour was set aside to facilitate smooth transitions between the introduction and the actual interview.

4.4.5 Implementation of the interviews

All interviews were implemented from home, both due to the restrictions following the pandemic and the convenience of recording through the digital platform Zoom, which was used on all occasions. Although the informants were guiding the interviews, following the earlier described 'interview guide approach', the session started with a series of set questions focusing on the background of the informants and their interest in, and experience with, digital tools. When the context was established, the rest of the conversation usually slid from the technical aspects of online teaching to the teaching methods employed and, finally, to a wider and sometimes more philosophical discussion about musical interaction and the evolution of music as an art form along with technical development. Several times during the process, the informants' innovative ideas changed the direction of the conversation and served as an eye-opener for the multitude of aspects of musical interaction. Some interviews included a balancing act of avoiding certain questions but still trying to obtain complete and comprehensive answers. In order to secure a variety of answers, a conscious effort was made to preserve the language and expressions used by the informants in describing technical and cognitive issues while not giving away the proper terminology (Cohen, Manion & Morrison, 2011). A more exhaustive description of how the material was transcribed follows in part 4.5 'Analysis'.

4.4.6 Ethical considerations

In studies based on observations and interviews it is essential to inform the participants about the purpose and design of the investigation and explain actions taken to hinder identification of the contributors (Vetenskapsrådet, 2017). Before the interview, all informants were sent a request letter with information about ethical considerations. All informants were granted anonymity and were promised that the material collected and then transcribed was to be assigned to this study only and stored on a private server and later destroyed. The informants were also informed about their right to cancel their participation at any time, all according to the ethical guidelines put up by the Swedish Research Council (Vetenskapsrådet, 2017). After giving their formal consent and agreeing on a suitable time, the informants received an email with a link to the online platform that would host the interview.

4.4.7 A short description of the informants

The following part introduces the informants, their current employment and background. A more comprehensive compilation of the interviews and an interpretation of the data

collected will be presented in chapter 5, 'Results'. In order to protect the anonymity of the informants, age, gender and names of the different workplaces have been omitted, but for the record, four of the six informants identified themselves as female and the other two as male. The age span ranged from 30 to 60 years of age. Since age and gender appeared to be of nominal importance, none of these features are noted.

4.4.8 Striking similarities

The music teachers interviewed for this study have a number of similarities. All six informants have an education ranging from four to six years from a Scandinavian academy of music. They all have a solid background with several years of teaching experience and in some cases additional academic merits. All of them were proficient in using digital tools, although the methods, as will later be revealed, differed from teacher to teacher. When discussing digital competence, a general agreement seemed to be that age was the most important divide when considering the approach to new technology. Naturally, there are various examples of older music teachers who have embraced the new technology, but according to the informants, knowledge among the younger generation was more evenly distributed. In addition to digital competence, another feature common to all participants was their interest in alternative teaching methods and concern about students who seemed to suffer from being compelled to isolate at home. When it comes to individual distinctions in background and competence, those will be listed in the personal descriptions below.

4.4.9 The upper secondary school teachers

First informant (#1)

#1 is educated in Dalcroze eurythmics and has a background as a secondary school music teacher and as a singing teacher in a music school. Additionally, #1 has a complementary education in ESTILL voice training and CVT (complete vocal technique). For the last four years, #1 has been employed at a private upper secondary school. #1 is competent with digital tools used for recording, such as Logic and GarageBand. The main platform for interaction with the students during the pandemic has been Soundtrap, which is a free music recording application that also works as a platform for communication.

Second informant (#2)

#2 has a drum teacher education and is currently working at a public upper secondary school specialising in music. Earlier, #2 was employed as a music teacher in a secondary

school with a focus on pupils with special needs, and as a drum and piano teacher at a music school. #2 is proficient in digital tools used for recording, such as Logic Pro X and Pro Tools. The upper secondary school where #2 is employed has a policy of using Microsoft Teams as a platform for interaction with the students, but when it comes to teaching music, Zoom has proven to have a superior capacity of reproducing sounds, and thus an exception has been made.

4.4.10 The conservatory teachers

Third informant (#3)

#3 is employed as a lecturer and course administrator at a Swedish academy of music, teaching instrumentalists as well as ensemble, music theory and music-profession- related courses. In contrast to many colleagues, #3 has used digital tools for administrative and communicative purposes ever since the turn of the century and has used several platforms through the years. When distance education became mandatory for the practical courses, Zoom was the chosen platform. #3's engagement as a teacher has shifted over the years, with teaching now occupying approximately half-time employment, whilst the other half is spent as a freelance musician and composer.

Fourth informant (#4)

#4 has a background as a musician and teacher and additionally holds a doctoral degree in artistic research. Currently, #4 is employed as a professor and researcher at a Swedish academy of music and is also engaged as a freelance musician. #4 has experimented extensively with digital tools in the process of creating music and live performances. The main platform for interacting with students during the pandemic has been Zoom.

4.4.11 The music school teachers

Fifth informant (#5)

#5 works as a clarinet teacher at a music school and part time as a freelance musician. With a degree in classical music and experience both as a soloist and as a musician in an orchestra, #5's contact with digital tools prior to the pandemic consisted of recordings of their own compositions and arrangements using the application PreSonus Studio One and composing in MuseScore. #5 has explored several platforms (Zoom, WhatsApp and FaceTime) for interaction, depending on the pupil's needs and the platform's accessibility. In order to record and transmit lessons and homework, the application Acappella has been the preferred choice.

Sixth informant (#6)

#6 has a background as a secondary school teacher, especially in schools for pupils with special needs, but is educated as a piano teacher and currently employed at a music school. Applications such as GarageBand and LaDiDa have served as digital aids when working with children with learning disabilities, while administrative platforms such as Google Classroom have been employed for interaction. Since the pandemic started, #6 has relied on Zoom for communication with the music school pupils and Acappella for recording lessons and homework.

4.5 Analysis

The quality of the original interview is decisive for the quality of the analyses, verification and reporting to such an extent that statistics and theories based on interviews with a dubious standard could just as well be revealed as magnificent castles built on sand (Kvale & Brinkmann, 2009). In order to guarantee the quality of the analyses, this part will reveal the methods and ideas behind how the material has been scrutinised and analysed. As a consequence of my intention not to separate the statements in the interviews from my interpretation of their meaning, the actual analyses will appear in chapter 5, 'Results'.

4.5.1 Transcription and coding

Transcribing interviews is naturally a process of interpretation, which raises a number of practical and principle-related questions (Kvale & Brinkmann, 2009). Consider non-verbal aspects and contextual features of the interview, such as where the conversation takes place and what may occur before and after the recording is in progress. Is this supposed to be written out in the transcript? Not necessarily (Cohen, Manion & Morrison, 2011). A proficient transcription could constitute the empirical foundation of the investigation but will still just represent a translation and, as Kvale (2009) points out, to translate is sometimes to betray the true source. With this in mind, it seems beneficial to start with describing the coding and analysis, since this is what sets the standards for how the material was initially written down. There are, however, no generic codes or forms designated for how transcriptions are to be utilised, and instead of accounting for all the possible choices available and potentially getting lost in different aspects and strategies, the procedure henceforth will be to describe the process of recording, transcribing, coding and interpreting the material in the consequent order (Kvale & Brinkmann, 2009).

4.5.2 The process

The interviews in this study were all recorded on video, employing the Zoom platform and the recording equipment included in the program. According to Kvale (2009), video recordings offer unique possibilities to analyse interpersonal interaction since not only the spoken word but also body language and other visual features are registered. Due to the special circumstances during the pandemic and with the governmental decrees regarding social distancing in mind, video recording was as close as the interviewer could get to the informants. In other words, a certain measure of convenience, and not only the possibilities mentioned earlier, was considered when choosing the means of conducting and recording the interviews.

4.5.3 Particularities

When transcribing the recorded material, the intention was to create a verbatim conversation, with syntax and semantics maintained, even in cases where sentences seemingly made no sense. Written language, colloquial language and dialects were without exception spelled correctly and consistently, even in cases where pronunciation differed from standard Swedish. Furthermore, all quotations appearing in chapter 5, 'Results' have been translated from Swedish to English with the purpose of mediating both colloquial aspects of the language used and the message. This proved to be a complicated task and, in some cases, expressions had to be altered to make sense in an English context.

4.5.4 Transcription conventions

A set of transcription conventions, as set out by Cohen, Manion and Morrison (2011), have been observed. Recorded hesitations, pauses and silence have been marked with three dots (…) in the transcripts. Three dots in the quotations may also represent parts removed in order to maintain consistency, and additional words needed to understand the context have been added in square brackets. Recorded inflections and tone of voice have been described in parentheses, especially in cases where melodies or sound effects are used to imitate timbre or sound quality. Affirmative humming has been transcribed as 'Hmm'. In addition, each speaker has been identified by a number to protect anonymity, as discussed in part 4.4.6 'Ethical considerations'. Since the video recordings are also a source for analysis, no effort has been made to transcribe non-verbal activities or the mood of the informants.

4.5.5 Reference points in the transcript documents

In order to create a structure with reference points in time, each statement has been provided with a time code in brackets. This has been done by importing the recorded audio in the online program Amberscript and thus creating a form that has helped with transcribing the material more accurately. Moreover, each line has been numbered in the final Word document to facilitate the reference procedure and quotations.

4.5.6 Coding

Classifying and coding qualitative data produces a framework for organising and describing what has been collected during the interviews (Patton, 2015). In order to be immersed in the material and let the mind digest the collected data, a method used in this study entailed listening to the interviews intuitively, in the way that a musician listens to a piece of music he or she is about to perform and therefore has to learn by heart. This includes repeating complex parts out loud and memorising the context of the interview with mnemonic learning techniques, in this case visualisations, described by Brown (2007) as 'the journey method', until all six interviews can be viewed as parts of the same mnemonic landscape. In this manner, similarities between the interviews stand out when trying to recall an overall view of the conversation and, like constructing the index of a book, the first partition is made without yet consulting the written material.

4.5.7 Finding themes

By making associations, labels are given to similar passages. Sometimes a passage can illustrate multiple labels, and these makeshift labels are noted as comments in the document (Patton, 2015). The exposed passages are then cut out and pasted into a new document. In the case of this study, four new documents were generated and investigated in search of a common narrative and with the aim of developing coding categories for different themes. Those four new documents constitute the material presented in chapter 5 'Results', as the themes: *the pandemic, the network, teaching online* and *interaction*. The unused parts remaining in the original documents were given a second investigation to cross-check whether new categories could be found in what was previously considered unusable filling. This process is described by Patton (2015) as extension, bridging and surfacing and involves making new connections, proposing new categories and going deeper into the patterns already identified. During the whole process, analysing, as described in the coming part, has been an ever-ongoing activity, but only once the sources

of information were exhausted did the work of transforming notes and concepts into running text begin.

4.5.8 Qualitative analysis

Qualitative analysis is typically inductive in its early stage, which in contrast to deductive analysis means that from the start there is no existing framework or hypothesis to guide the process. Instead, the aim is to generate and interpret new concepts, and possibly theories, from the data of a specific study (Patton, 2015). New dimensions of well-known phenomena can be visible when placed in a theoretical framework and investigated more thoroughly, but there might also be a risk of predisposing the results. An option to avoid the possible distortion caused by an exaggerated use of the theoretical framework is to make the analytical principles that form the basis of the interpretation explicit from the start (Kvale & Brinkmann, 2009). This is the intention with the following part, where interpretation and coding will be discussed from a theoretical point of view, drawing from aspects of social constructionism and actor-network theory.

4.5.9 Purpose of the analysis

The kind of analysis performed on the data is determined by the decided purpose. Since this study focuses on how musical interaction between teachers and students is affected by online education but only takes into account the teacher's point of view, the information gathered has to be explored thoroughly in order to discover underlying patterns and themes that will make an interpretation possible (Cohen, Manion & Morrison, 2011). Differences and similarities will be discussed and efforts will be made to examine the issues found in a different context. In addition to investigating the research questions, there will be attempts to encircle the networks built up by actants that may facilitate solutions for musical interaction in future online education. All together, the properties described above are some of the aspects of a nomothetic approach, as set out by Miles and Huberman (1994). The ambition in this study has been to combine a number of types of qualitative analysis and to search the data for patterns and themes without entering the analysis with preconceived categories and subsequently interpreting the findings from a theoretical point of view, as described earlier in this part. This somewhat more eclectic approach to analysing interviews has become known as 'bricolage' and involves mixing methods and adapting different technical discourses (Kvale & Brinkmann, 2009).

4.5.10 Indigenous concepts and content analysis

Concepts developed by the informants, referred to by Patton (2015) as *indigenous concepts*, will be especially valuable for the survey since they facilitate the understanding of methodical choices made by the informants and fit well with the type of analysis known as 'content analysis'. Content analysis is the general term for identifying, organising and categorising the content of a narrative text (Patton, 2015). With this in mind, it is of course important to acknowledge that organising data by issues and themes comes with the risk of losing the coherence and integrity of each individual respondent and may result in a framework that is unresponsive to additional relevant factors emerging in the data (Cohen, Manion & Morrison, 2011). The idea with the narrative in this study is to bring the information to life, and it stands in contrast to coding-derived analysis and retains the integrity of the people rather than fragmenting the information into predetermined formulas (Cohen, Manion & Morrison, 2011).

5. Results

This chapter presents the results of the analysis of the six interviews conducted. The material has been divided into four themes in order to strengthen the narrative, but conclusions written in different parts may be extracted from the same responses. It is therefore possible that some overlapping information is presented, or that analysis in one part also reviews the other three. The four themes that became noticeable during the analyses were: *the pandemic, the network, online teaching* and *interaction*. Numbers in brackets in the quotations refer to the continuous line numbers in the documents that constitute the transcriptions.

5.1 The pandemic

Somewhere in the midst of coding and analysing important parts of the transcribed interviews I was struck by a sudden insight that made me re-evaluate some of the premises for this study. Patton (2015) describes how a comprehensive, holistic, qualitative inquiry must attempt to understand both the signal and the noise, since sometimes the noise *is* the signal. With a focus on online education, musical interaction and teaching methods, one of the main actants in the network about to be examined was invisible for a long time. Information about this phenomenon was regarded as small talk towards the end of the interviews or even brought up after the recording was finished and thus was interpreted as what Patton (2015) refers to as noise. The actant, neglected yet present in every aspect of the interviews, is of course no less than the pandemic itself.

5.1.1 Expected briefness of the pandemic

It is obvious from the collected data that the severity and expected briefness of the pandemic strongly affected the choices and actions taken by music teachers involved in this precarious situation. In a society based on the idea of every individual's inviolable value, small sacrifices made to save lives or even to ease the burden of health care professionals are inconsequential in the context of a global disease. As expressed by one of the music school teachers:

> Some of my colleagues really want to go back to physical teaching and are having a hard time with the current situation and so on. I understand and accept it, but part of me also wonders whether it matters on the whole. People are dying, people are ill, people have to stay at home (#6, 983-989).

The pandemic has forced us to change our ways and, as with all sudden changes, there is small comfort in the promise that, one day soon, everything will be back to normal. This idea apparently prevents the music teachers in this study from looking harder for possible solutions to the predicament of lost musical interaction, at least to a certain extent. One of the academy teachers contemplates the situation with a typical statement:

> Well, it (musical interaction) is almost impossible to implement in distance education (#3, 272-275).

Or put more bluntly by one of the upper secondary school teachers:

> No, but I gave up from the very start! It is not possible to play together. It is even hard to conduct ear-training lessons. They (the students) have to mute their microphones when they are singing with me (#1, 178-180).

Apparently, the informants did not value their efforts to promote musical interaction, but as will be shown later in this chapter, musical interaction has been present in the lessons conducted, just in a quite different manner.

5.1.2 Changing directives and contradictory recommendations

A contributing factor that discouraged the teachers from exploring alternative solutions to the loss of interaction has been the many changes in directives from the heads of the departments when trying to navigate through the, often contradictory, recommendations from the Swedish public health authority. Several of the informants expressed frustration about not being able to plan ahead and said that they would have appreciated a more distinct policy.

> I would have suggested that our management would have told us to shut everything down until the Easter holidays (#6, 988-989).

As the situation evolved, the teachers changed location a number of times and for a period of time were even asked to conduct some lessons from home and others from their place of work, which amongst other things required moving material and setting up home studios suitable for teaching and recording videos.

5.1.3 A cog in an unwieldy system

From one perspective it almost seems as if teaching conditions suddenly depended more on the whims of the management than on methods suggested by experienced teachers, and a situation appeared that seems to justify the theory of *reification* as presented in chapter 3, ‘Theoretical aspects’. Humans are no longer masters of the process but rather cogs in an unwieldy system where education is no longer the main driving force. From

another perspective, the expected briefness of the pandemic made these hasty changes acceptable, and 'good enough' became a guideline for the efforts being made. The possibility that this new reality might be here to stay was not reflected upon during the interviews.

5.2 The network

This submitted description of the material and non-material parts making up a network of actants will constitute the basis for further analysis and, in compliance with the guidelines suggested by Latour (2005), will always look for the connections between persons and objects and how these affect each other.

5.2.1 Persons in the network

With the framework dictated by the pandemic, the teachers had to adapt quickly to new circumstances and, without any guidelines, find a method and a platform that would allow them to create a network for teaching online. The actants in this new network consisted of persons such as the teachers, the students and the management of the different institutions. In the music schools, the students' parents or caregivers can be added to the network, since, as will be noted later on, those may play an important role as actants in the new educational environment.

5.2.2 Meeting platforms

Objects described as transmitters are crucial for online education and, according to ANT, they are actants whose agency is just as important for the outcome as that of the persons mentioned above. One example of this is how certain platforms of communication, such as Zoom, Google Meet, FaceTime and What'sApp, all come with distinctive characteristics that affect latency and timbre of voice or instrument in ways that encourage the teachers to transform their methods when teaching online.

As the following statements show, the informants presented somewhat different opinions about the advantages and disadvantages of the different platforms and their audio features.

> We agreed on using Zoom because of the function called 'original sound', which allows you to cut out the background noise, something I appreciated together with the piano, guitar and singing teachers at my place of work (#2, 110-113).

> When teaching singing, normally, I try to push the students to, for example, sing louder and then I initiate this by inviting them to sing together and playing the piano accompaniment louder and then I use my body language to encourage them even more. But in this case [when teaching through Google Meet] I am muted and volume is cut out and if we sing together, we tend to interrupt each other and the flow is all gone (#1, 160-169).

In one of the academies of music, a group of teachers and sound engineers analysed all possible choices of digital platforms with the aim of finding the best solution for an upcoming admissions test. Unfortunately, none of the platforms performed well enough to enable an online admissions test and the applicants instead had to submit videos recorded with their own equipment.

> Some of my colleagues decided to go all in and tried a lot of different platforms: What'sApp, Messenger, FaceTime, Zoom and so on, and then they had a professional musician playing live on the transmitting end, but when we listened to it [via Zoom] it sounded as if he almost couldn't handle the instrument. The sound quality was poor, it kept disconnecting and so on (#3, 125-130).

Considering the last chapter in this study, which deals with new technology, it is rather surprising that none of the teachers at this particular academy of music were familiar with the new platforms designed for musical interaction with a low level of latency.

5.2.3 Objects in the network

Instead of producing a tedious list of components that all influence the chain of communication and thus the teaching conditions, a setup that roughly represents the technical equipment used by the teachers will be presented next. Imagine a music teacher working from home with a laptop connected to an audio interface using an external microphone and one or two cameras, one capturing the teacher in action and, if possible, an additional camera aimed at the instrument being taught. Another scenario excluding the computer employs only an iPad (none of the teachers referred to other brands of tablets) or mobile phone with the internal microphone and camera handling the audio/video part. Depending on the topic being taught, different applications or programs add further agency to the network and, finally, the quality of the internet connection on both ends of the wire will affect the teacher's ability to conduct the lesson. On the student's side, the quality of the connection may depend on which internet service provider they are using.

At the upper secondary schools, every student is provided with a computer, but in the music schools and music academies, the means for internet communication may vary from computers, tablets and smartphones. To add further to the variety, some of the students/pupils have their own home studios, sometimes with far superior technical equipment than what may be found in the teachers' workplace. In order to even out the discrepancy in technology, both upper secondary schools represented in this study conducted an investigation to map the technological needs among the music students.

> During the periods of distance education, we made a number of inquiries among the students in order to investigate what kind of resources they had at home. Partly because it allowed us to allocate equipment to those who needed it the most, but also because there was not enough [equipment] for everyone (#2, 71-74).

Included in the student setup is, naturally, the instrument of choice and a microphone to capture the sound. Most students tend to use the built-in microphone in their communication devices, which needless to say cannot be compared to an external one.

In some cases, the instruments, or to be more precise piano keyboards, found in the homes of the music school pupils were of poor quality and lacked attributes such as pedals and weighted keys.

> Some of the students play on mini-keyboards without pedals connected. I have a student who is playing pieces with octave stretches that require the use of a pedal and he can't practise properly. He says that there's nothing to worry about, that he understands how it is supposed to be performed. It is all very sad (#6, 325-326, 334-339).

While some instruments, such as woodwinds and brass, are available for hire at the music schools represented in this study, piano students have traditionally been expected to have a piano at home. This was possibly true half a century ago, and it makes sense considering the effort required to move an acoustic piano. However, as indicated in the quotation above, the keyboards nowadays can be lightweight (even when they are full size and include pedals), and what then are the arguments for renting out a tuba but not a lightweight full-size keyboard?

5.2.4 Abstract actants

Outside the persons and objects involved in the network, there are also abstract actants. The pandemic has already been presented as a kingpin in the context, but other important abstract actants include the physical and mental environment in which the teaching and learning take place. Obstacles such as lack of space or insufficient lighting may

complicate both teaching and learning. Add parents, partners, pets and siblings occupying the room where the action takes place, and maybe even a reaction from neighbours, and it is not difficult to imagine how a lesson of 20-40 minutes could easily be ruined. One of the informants even refers to the new circumstances for private instrument lessons as 'a family event'.

> Well, sometimes I notice that siblings are running past while we're having a lesson online. But in some ways, it's the best scenario when this little lesson with me on the screen becomes some sort of family event (#5, 438-441).

On the other hand, the classroom situation could be just as chaotic, and in the case of younger pupils, private lessons could actually gain from having parents present, as long as they do not interfere with the teaching.

> This guy [referring to a certain student] has never developed as much as he has been doing now when he sits at home. His dad has received exact copies and instructions, explained for him, recorded his progress and his abilities have skyrocketed. At last, he's been able to focus (#6, 249-252).

When listing the abstract actants it is important to highlight that expectations and notions held by teachers, students and other persons in the network also play a significant role in determining how the lessons turn out. Expectations about how the musical interaction in an ensemble is supposed to occur differ a lot depending on whether the ensemble is conducted by ear or by scored music.

5.3 Teaching online

The sudden changes in teaching conditions have certainly challenged the teachers taking part in this study, not only by forcing them to invent new teaching methods but also by requiring them to re-evaluate their roles and attitudes towards their profession. As will be shown in this part, the intention to carry on as usual, with the exception that the classroom or studio has been transferred to an online environment, proved to complicate matters even further. For most of the teachers the summer holidays presented a space where old attitudes and teaching methods could be reconsidered, and the second time online teaching was commenced, the experiences from the spring term made adaptation easier.

5.3.1 Trying their best

It is evident from the interviews that none of the participants are pleased with the circumstances given. The teachers express a longing to be back with their students,

colleagues, and even miss their workplace and such trivial matters as the commute to and from work.

> So that [to go back to normal circumstances] is what everybody wishes for. This way [of teaching] destroys the passion and the engagement. This education is not meant to be online (#2, 425-427).

This does not mean that the teachers have fought against restrictions and new regulations. On the contrary, each and every one has made sure to conduct lessons according to the scheme, and although the quality sometimes has not lived up to the old standards, all students have been guaranteed enough knowledge and skills to enable them to catch up once the schools reopen. With a focus on technical solutions, there has been little time for the teachers to reconsider the possibilities to flip the traditional approach to teaching and develop fundamentally new models. Still, it may be suggested that all of them have transformed their teaching methods and developed new skills when adapting to the new circumstances, or as one of the teachers points out:

> The limitations that come with online teaching have developed me as a teacher (#5, 525-526).

5.3.2 This is not what we signed up for

That planning, implementation and communication come with new requirements when teaching online is confirmed in all interviews. It is as if online teaching becomes a genre of its own. Regardless of the technical innovation and the quality of the transmission, each student still sits alone and the teacher has to adapt to new solutions, both technically and socially. One of the teachers claims that to some degree the new situation has been a state of emergency in the sense that there is already a master plan which cannot be followed, or as another teacher points out:

> This is not what we signed up for (#2, 425-427).

Naturally, there have been implications, but all informants attest that some moments actually work better when teaching online. One striking difference is an increase in attendance in all school forms, but most notably in the academies of music, where, in general, there is no duty of attendance, and some students live far from campus. Another reason for the high rate of attendance is probably that students can attend lessons even if they are sick at home or kept in quarantine.

> Generally speaking, I must admit that the attendance has increased. People who struggle with being on time, getting out of bed and so on, seem to have fewer difficulties under these circumstances (#3, 264-266).

All activities that involve theoretical knowledge and individual assessments that can be accounted for by the performer seem to work just fine in an online environment. Along with the focus put on every individual, equality in group lessons increases to the advantage of students who, either due to personality or habit, are shy or introverted. Not surprisingly, there have been a few who wish for a continuation of online education even when the restrictions begin to ease.

> When the spring term [which was conducted online] was over, two of my pupils expressed a strong wish to continue with online education. My impression of these pupils is that they benefitted mentally by having some distance between me and them. Seeing me on the screen made them feel more comfortable (#5, 301-326).

The question for the future is whether this opportunity will be given to students who, for whatever reasons, prefer to be taught online.

5.3.3 The key to success when teaching online

Meticulous planning seems to be the key to success when teaching online with the side effect that spontaneity, which often is an experienced teacher's trump card, has a poor effect in an online context.

> Well, you need to be significantly better organised and have a much more carefully planned lesson. I can't be as spontaneous as I usually am, because otherwise I have a whole archive of experience to pick from which allows my planning to be more flexible and, in that situation, I can choose to suddenly pull out a rabbit from my hat [talking about the trump card], but that won't work in online education. You've got to have a plan (#5, 825-851).

On the loss of spontaneous interaction, one of the teachers comments:

> What has been lost in the larger online seminars is the interactivity… it is difficult to butt in and add something or ask a simple question. I used to bring in activities in my lecturing, presenting a song, introducing a warm-up exercise and so on, but that has not been possible (#4, 390-397).

Altogether, this results in a loss of flexibility and student influence, but apparently works well with introverts and students who require a rigid framework. As a result of the extensive planning, efficiency increases. All forms of one-way communication and certainly online meetings with the aim of communicating information benefit from being

conducted online. Consequently, lessons built on the same premises tend to work fine as well.

> Lately, we have in some ways given up on the idea of teaching in ensembles with the aim of obtaining some kind of musical interaction. It has become more of a theoretical method, bordering music on theory or group psychology and other topics that are suitable for lectures (#3, 68-70).

This has led to an emphasis on theoretical lessons, especially in the upper secondary schools where students' performance in these subjects had to be assessed and passed in order for them to graduate. The idea was that since the distance education would only last for a short period of time, it seemed beneficial to postpone lessons in instruments, ensemble and ear training.

> First off, we dealt with all theoretical subjects and the specific requirements that the students needed to manage (#1, 68-70).

Apparently, teaching becomes predictable when it is conducted online, a conclusion that could be used to plan for long periods of time, allowing motivated students to study ahead, for example, during vacations and holidays.

5.3.4 A passive attitude when conducting a lesson

If planning online teaching demands an increased amount of activity, the opposite seems to be the case when the lessons are conducted. Some teachers acknowledge that they take a more passive stance when teaching online, and that this has proven to be more effective in order to let the students take control over their own learning process.

> I became much more passive. There's more listening and less coddling. It has been very useful for me to teach online because I noticed that the majority of my pupils develop much faster [now] than when I taught them live. And then I started to question my methods and found out that in a live situation I play along with them all the time. The advantage with this is that my pupils have good ears and are able to stick to their parts when playing in harmonies… so there are advantages as well, but the advantage with online teaching is that I can't help them by playing their parts or filling in missing notes. They have to handle the situation themselves and I am just standing there listening. To be an active listener, that makes a big difference. They would notice if my mind was drifting or if I was occupied with something else, but I'm listening and I give them feedback (#5, 506-518).

As mentioned above, the side effects with this increased responsibility are that the teachers play less together with the students, which in the long run might lead to uncertainties in intonation, even if it is not noticeable at the time. With the students being more active, the teacher assumes another role and becomes more of a game master,

someone who distributes the attention and decides who is supposed to play and what parts they are going to perform in a group lesson or ensemble.

> According to my experiences, the process becomes more democratic. Everyone gets the same amount of space and it is easier to distribute the discussion so that no one takes over on behalf of the others (#4, 417-422).

As the teacher takes a step back, the student is obliged to fill the gap and take more responsibility.

5.3.5 Competing with online tutorials

As suspected, the practical aspects of teaching music online appeared to be a tougher nut to crack. This mainly has to do with the lack of musical interaction, or to be more precise, with the unconventional ways of interaction that will be thoroughly examined in the following part. This is where traditional teaching methods are no longer sufficient and, as a result, a lot of the material handed over to the students was in the form of pre-recorded video clips with musical material and instructions. The disadvantage with this approach is of course that it is hard to adapt the material to the students' skills and that it requires some experimenting before a model suitable for multiple users is found. Since video clips for some instruments and genres such as pop and rock music exist in great numbers on sites such as YouTube and Ultimate Guitar, a discussion soon emerged about whether there was any point in recording new material instead of conducting an inventory of the material already found online.

> Well, one thing that has been discussed a lot among the piano teachers is the fact that in our online teaching we are suddenly competing with YouTube tutorials, and I believe that there are several pupils, above all pianists, who would rather search for a tutorial on Google (#6, 935-938).

In the end, a small number of these clips were used while the lion's share consisted of the teachers' own recordings. In some cases these were quite elaborate creations with several frames (a separate window in the recording) depicting the score, the teacher in full figure and close ups of the instrument.

One of the music school teachers relates the procedure of creating on-video material.

> I have a collection of roughly 145 videos that I have recorded in the application Acapella. That's for the beginners, so I need three frames and this takes time to record. The clips are, at their longest, ten minutes, but I can use a clip for the entire lesson by reusing parts of them as warm up and then I have introduced my sidekick [a second teacher] in one of the frames, and the sidekick can comment what's going on in the lesson, figure out second voices or a bassline and so on. In the first frame, I'm playing the

> melody and then the focus is on my fingers, usually very slow in the beginning, but then I speed it up. The third frame focuses on the score, which I follow with a pen. Every lesson is then sent to the pupil as an internet link so that they can watch it on their smartphones as much as they want (#5, 344-371).

Creating one's own teaching material can be very beneficial but, as shown in the example above, it takes a lot of effort, technological knowledge and creativity, not to mention sociability.

Some students have expressed discomfort with recording themselves due to reasons that can be related to a lack of self-confidence or in some cases perfectionism. Singers tend to judge themselves harder than other musicians, and possibly the change in timbre and intonation caused by technical limitations is one of the main reasons for this.

> There are many students who hate themselves [have low self-confidence] and have a hard time recording both audio and video and that makes a live situation more convenient. My experience is that it's demanding for the students to listen to their own voice all the time and to know that there are things to be fixed. It can really put you off to record, especially when it comes to singing (#1, 226-227, 380-384).

No reports were made about students being unable to handle the technology or refusing to record themselves on video. The video files being sent back and forth between teachers and students caused both frustration and innovation, and the limitations were developed into some interesting concepts. Patton (2015) names a concept *indigenous* when it is developed by a small group of people under certain circumstances. The correspondence of video clips is just one example of such a concept. More will be presented in the following part.

5.4 Interaction

Musical interaction can be described in a number of ways. The fact that all interactions are social constructions, as described in chapter 3, and thus follow social patterns, complicates the matter even more. The use of ANT as a kind of devil's advocate has broadened the perspective and raised questions about whether a rigid definition of what musical interaction is or is not, is even desirable. The impact of the participants in a musical exchange differs from context to context, according to D'Ausilio et al.'s (2015) *taxonomy* presented in part 2.7 'Musical interaction', and it could be argued that there is an extreme where the musician is reduced to being just a part of the mechanical system the way Lukács (1989) describes it in his theory of *reification*. This situation has not

necessarily been the result of recognising the agency brought in by objects and artefacts. In a big orchestra with a strictly predetermined and scored performance, a conductor can reduce the impact of the individual musicians to such an extent that whole sections can be exchanged without any noticeable effect on the music.

5.4.1 Musical interaction as a holistic experience

According to the teachers in this study, musical interaction is a holistic experience that requires several elements linked to each other in a seamless way. Most important among the elements mentioned is a direct connection, both auditory and visual and preferably established at the same location, but musical interaction is also crucially dependent on an environment where the participants feel confident and comfortable.

> Playing music together is in many ways a holistic experience. You notice it in a recording studio when you can't see your fellow musicians the way you're used to. That alone can be disturbing. Even if the sound is good you notice how much is lost when not sitting together in the same room (#3, 141-418).

One teacher poetically calls this 'sharing the same air', which is a good expression since music ultimately is airwaves hitting the human eardrums.

> I never think this [new technology that makes musical interaction online possible] one day will replace the interaction that occurs when we're seated in the same room… because that is something different, sharing the same space, the same air (#4, 469-474).

The idea of feeling confident and comfortable certainly has to do with the physical aspects of music where interaction and decision making are extremely fast processes based on operations by our brains, so swift that they are usually referred to as a 'feeling'.

> There are so many swift decisions on a micro level being made when interacting musically in the same room. And as a teacher, I notice this and I like that teaching environment, having music all around me happening here and now (#2, 297-299).

When asked which elements are required to create an environment suited for musical interaction, one of the music school teachers replies:

> In general. Trust, confidence, making the pupil feel at ease. That's absolutely it. And in a group, being the leader, one must make sure that the atmosphere in the group is good (#5, 600-602).

In many musical contexts, 'feeling', as referred to earlier, has become one of the most important ingredients, and as a well-established concept it no longer only describes interaction or decision making but also the qualities of a recorded performance.

5.4.2 Ideal circumstances for musical interaction

This part starts with a sample of statements describing the musical interaction as non-existent.

> I gave up the idea of musical interaction online from the start. We can't interplay (#1, 178).
>
> Concepts that don't work straight off are the physical aspects of music (#2, 291-291).
>
> It [musical interaction] is almost impossible to contrive in online education (#3, 272).

At the heart of the matter, the assertion seems to be that musical interaction in its purest form consists of two or more musicians interplaying in a manner that gives all participants a possibility to lead or follow according to their own wishes and thus affect the result in a way that would not be obtained if any of the musicians in question were to be removed or exchanged. When the teachers in this study refer to musical interaction as non-existent, their arguments mostly revolve around ideal conditions such as in the example above. But how often are these conditions really met when musicians interact in real life? The answer to this depends to a great extent on who you are asking. I dare to suggest that there is no situation in which every participant in a musical interaction has the same amount of impact on the result. Since musical interaction is all about communication, and communication is a social construction involving, amongst other activities, turn taking and social positioning, much of the course is already given in advance. The reason why this is so evident when interacting with artefacts is that the limitations of an artefact are commonly well known to us and thus easy to confront or adapt to.

5.4.3 The problem is latency

According to the teachers, latency is the super-villain in the fight for musical interaction online.

> There is always a certain delay [latency] from the moment you strike the note until it appears at your fellow musician's ear. This makes it very difficult to create some kind of decent live music, at least digitally. So that's why I haven't even dreamt of using it that way (#3, 71-74).

That this is a well-known fact is proven by the next statement.

> The problem is latency. There is a delay by a second, a millisecond. I don't know. But I knew this all along because once I tried to sing in harmonies over the phone with my friend… and then we found out that it didn't work (#6, 789-795).

Latency due to limited technical resources, bad internet connections or inefficient software is a common and sometimes feared event in recording sessions and even more prominent in larger networks. With the technical equipment described and used by the teachers in this study it is probably a completely correct assumption that trying to interact musically, the way musicians usually do in real life, would result in a confusing and discouraging situation, but with other platforms and new kinds of interfaces, latency would no longer be an issue. Instead, latency must be seen as a part of the musical interaction, which one can learn to deal with as long as the effect is no more than a couple of milliseconds. Big orchestras or musicians placed far from each other, for example on big arena stages, also experience latency, but the solution traditionally has been to employ a conductor or monitors.

If these new teaching conditions were to last for years, it seems likely that schools and academies would invest in new technology so that latency would not be of concern for online interaction, but as already noted, no such change seems warranted in view of the expected briefness of the pandemic. One of the teachers contemplates the matter with the following words:

> I suppose there are no technical solutions efficient enough to beat latency (#2, 355-356).

A response to that assumption will be given in chapter 7. Until then, it might be beneficial to ponder the suggestion that, from Latour's (2005) point of view, even latency is a part of the musical interaction, as an abstract actant in the network.

5.4.4 Turning off the microphone

The fact that latency restricts musical interaction as referred to by the teachers does not mean that there was no musical interaction in the lessons conducted. One example of this is an *indigenous concept* that has been used independently by the teachers in this study in order to let the students play along with, for example, well known warm-up exercises, long notes or even simple pieces. The students simply turn off or mute their microphones while they try to follow the teacher, whose sound of course comes with a delay of some

milliseconds. This approach was presented earlier in part 5.1.1 ‘Expected briefness of the pandemic’, but that quotation represented a somewhat different perspective. Here is the method introduced in a more positive way:

> So, when I’m teaching a group, everybody [except me] turns off their microphones. I start with a well-known warm-up exercise and they play along. Then they hopefully play it right and then I listen to them, one after the other (#6, 469-471).

The teacher makes a visual estimation of the timing and touch/timbre with the intention to determine whether further instructions are needed. Any corrections in timing and intonation are made first when the teacher responds to the videos sent in by the participants.

5.4.5 Timbre and intonation

Another issue that complicates the musical interaction is the distortion of timbre caused by the technical limitations in the digital platforms or by poor receivers or transmitters, in most cases microphones and loudspeakers. Timbre is an important quality in music, and some instruments and genres require more effort when producing a sound than others. As expected, both the woodwind teachers and the singing teacher in this study emphasise the problems caused by the digital platforms employed and their impact on the timbre.

> For teachers working with classical music, where the timbre is of great importance and you tend to be picky about every detail, all of this is very difficult (#3, 198-199).

When singing, the inferior sound quality affects both intonation and output since the sound changes when the dynamic becomes too extreme, due to compressors and filters in the programs used to amplify and clarify the spoken word. In this case, there seems to be no consistency in how the different teachers handle the predicament. Two teachers choose to work with other aspects of the instrument (#3, #1) while the third has found a way to adjust to the timbre produced and, with the help of the visual appearance, imagine the actual quality of the sound.

> I can notice if the timbre has a core even though it sounds crappy. I’ve managed to adapt my ears to the way it sounds online just like you can adapt to the sound of a distorted electric guitar and still hear the timbre of it and in some cases, if the equipment and the connection is good, it might even sound good or realistic. I practise technique a lot with my pupils, and when we play long notes I don’t need to hear the quality of the tone, I focus on whether it is consistent, if they have support from the diaphragm (#5, 251-262).

This is, needless to say, not a perfect method, but it works as a guide for beginners when, for example, practising the production of long notes. As Patton (2015) concludes, each person who participates in a study brings his or her own assumptions, beliefs and perspective, which means that consistency is not always desirable. With that said, all three teachers also use pre-recorded clips when working with sound production, asking the students to imitate the sound of the recordings and send back video clips with their own efforts.

6. Discussion, considerations and future research

In this chapter, the results of the analysis will be discussed from a broader perspective, where more philosophical aspects of musical interaction will be considered. The first part deals with the classic narrative of person versus machine and highlights the belief in human qualities. Next up is a discussion about how knowledge has traditionally been transmitted and why this method seems to be incompatible with online teaching. In the following part, the danger of leaving data and teaching material in the hands of big tech companies is considered, and the relationship between the human mind and tools is debated next. The conclusion that musical interaction must be approached from different viewpoints and that musicians with an inclination towards live performances are not given precedence of interpreting the phenomenon opens up for a comparative process in which other art forms could play an important role. Thus, the suggested differences in musical interaction will be compared to differences in interaction in dance.

Validity, reliability and generalisation are three important tools for examining the results and conclusions of a study. An extensive discussion about these tools and how they could be used in a post-modern context will also be conducted in this chapter.

The last part consists of some ideas on how future research about musical interaction could be implemented.

6.1 Human qualities

Beyond all the statements collected in the interviews as well as in parts of the literature review, there is an underlying narrative that goes as far back as the ancient Greek myths about Talos and Prometheus in the year 700 BCE (Mayor, 2018). It is the narrative about human versus machine, where the human in the end always stands as the winner thanks to qualities that are impossible to imitate artificially. Even if machines are generally created to facilitate human life, there are several examples of how they have been turned into the human's adversary. In 1997, the first chess computer, Deep Blue, beat the ruling champion Gary Kasparov, and since then computer learning has developed into artificial intelligence, which some people see as a threat and others see as a salvation.

Without pondering deeper into the future, at least one thing can be established. The narrative of human superiority prevails and offers comfort in times of change. Musicians who have been fostered in musical interaction consisting of a close interplay where they share the same 'air' as fellow performers and, in the best of all worlds, also an audience,

will probably never give up the idea that this form is superior to all other kinds of musical interaction. This is expressed in the interviews with statements such as: 'the human quality brings rapture to the interaction', 'the importance of physical contact' and 'the energy being released creating an atmosphere that is easy to experience but hard to put in words'.

> I trust the unmentionable, the qualities you can't describe, the energy that emerges between musicians on a stage and a live audience. We can never take away that feeling. It's about energies and frequencies and I wonder if it ever could be replaced. Of course, you could have wonderful digital experiences as well, but there is something else with a live audience and these joint creations… (#5, 696-701).

If it had to be put in words, my suggestion would be 'magic', a concept far from the theoretical point of departure for this study. Although I fully agree with the teacher quoted above, I've started to contemplate whether the new generation of musicians who have grown up in a digital and connected world are experiencing the same alienation when it comes to musical interaction online. Considering that most pop music today is programmed and many producers regard the computer as their first instrument of choice, it seems likely that musical interaction is a concept that needs to be both questioned and broadened.

6.1.1 A broader definition of musical interaction

Analysing the statements about musical interaction in online education, as presented by the music teachers in this study, has made me realise that we have all had a very limited idea of what actually could be included in the concept. According to the teachers, musical interaction has been set aside in favour of other aspects of music more suitable for online teaching. Some teachers even proclaimed that no musical interaction has been possible in the new environment due to technical limitations and lack of guidance from the management, but when they were allowed to elaborate their thoughts, another picture emerged. The teaching methods developed during this period have been both innovative and full of *indigenous concepts* as described by Patton (2015). Sometimes these concepts have developed through discussions between colleagues and sometimes they have appeared spontaneously while planning sessions or during lessons. With a broader definition of what musical interaction can be and bringing in the agency of the artefacts, no lack of interaction can be suggested, yet it is interaction in a way that diminishes participants' possibilities and impact.

6.2 New methods to deliver knowledge

From the teacher's point of view, as represented in this study, the concept of distance education is entered into with presumptions related to how knowledge is transmitted in a traditional sense, namely, being handed down from the knowledgeable to the unknowing. This concept is certainly a social construction or even a *natural attitude,* the way Husserl (1969) describes it. The concept has deep roots in a hierarchical society where gatekeepers have complicated the transition between different positions in the community. Although these hierarchies have undergone a tremendous change in the last century and theories of learning have promoted equality both in the modern Swedish school system and in society at large, the old ideas of what it means to be a teacher prevail and are put to the test in times of change.

As seen in the previous chapter, conducting lessons online requires careful preparations and a different mindset than that required in face-to-face education. The digital setup mediates another teaching environment where new approaches have to be employed. Using the ideas promoted in actor-network theory, the artefacts are given a higher degree of agency while the human actants take a more passive role, conducting the planning and implementation but not with the spontaneity and presence that most teachers in the study value as one of the most attractive features of the profession. This puts education in a context where learning somewhat becomes equal to following a manual, a practice that is still common in many contexts where students are not encouraged to think for themselves, such as schooling in religion or certain types of vocational training. In traditional music, the vocational aspects have always been of importance, and the long-established procedure with apprenticeship, once the predominant way of learning how to play an instrument, is still practised in many cultures. It seems that online teaching, as performed by the teachers in this study, is somewhat similar to apprenticeship traditions in the sense that different teaching methods that are partly made up of what Patton (2015) refers to as *indigenous concepts* exist side by side. The phenomenon mentioned above was highlighted in chapter 5, when investigating the concept of playing along with the microphones turned off and other precautions taken to avoid latency. In spite of this comparison, it must be pointed out that apprenticeship, although still following a tradition of predetermined steps, represents the total opposite of what future online education may offer. Instead of following the master's well-trodden path, the students in an online environment are, for better or worse, left to their own devices.

In the long run, the prepared material in online teaching affects the students' influence, which opens up for new teaching methods where the idea of the teacher handing down knowledge might be replaced by a game master who provides the student with the right material and inspiration. As such, online education is ideal for a flipped approach to learning, where the active part is conducted by the student alone with the teacher changing roles between provider of material, mentor and role model.

6.3 Owners of the online material

Could data gathered by the big tech companies be considered a kind of trade commodity? The four biggest tech companies, Amazon, Apple, Facebook and Google, collect a tremendous amount of data from their users and now dominate many facets of our lives. In the case in the so-called Cambridge Analytica scandal, for example, personal data from millions of Facebook users was used for political advertising that allegedly changed the course of important referendums such as Brexit and the American presidential election (Cadwalladr & Graham-Harrison, 2018).

In a society where online education becomes the new norm, the question of who the collected and created information connected to the online platforms belongs to becomes vital. It is obvious that lessons, planning and documentation are taking place on applications and platforms that, by their general agreements, claim the rights to everything created. Thus, the owner of the material is none other than the company running the services. This means that informant #5 may have no rights to the 145 video clips created in the application Acapella and, furthermore, that all information entered and collected on the online platforms being used belong to big tech companies and will most likely be employed when developing new products or, as in the case of Cambridge Analytica, sold for political purposes. By just summing up all the actions taken on the internet by the informants participating in this study it becomes obvious that a vast quantity of material is uncontrollable by teachers and could even be used as a future commodity in a society constructed on the premise that the actants that hold the information also hold the power. That points out a direction where Lukács' theory of *reification* (Lukács, 1989) is set in a new context and where humans unintentionally become part of, if not a mechanical system, at least a digital one.

6.4 The human mind and tools

New technology forces us to operate in new ways, but it also compels us to reinvent our past. Although the teachers participating in this study express discontentment with their results, their teaching concepts prove an innovative force that in many cases goes beyond what the technology employed was developed for. I find it reasonable to suggest that the teachers have forced the technology to act in new ways just as the technology has challenged the teachers. It is easy to imagine that new tools are developed to solve old problems in a more efficient way, but as the social world is an ever-changing construction, the new tools become actants in the social construct and, as analysis has shown, *indigenous concepts* (Patton, 2015) appear without the participants having shared ideas about them. As new networks evolve, some connections will prove to be stronger than others. Judging from the methods that actually worked better online, greater freedom of choice when it comes to decisions about which kind of teaching could benefit from staying online will probably be natural in the future. In that sense, it seems likely that the digital tools employed will not only change the preferred teaching methods but to a certain extent also define which methods will be worthless in these new circumstances. The fact that online education is apparently becoming more predictable and linear will most likely stimulate certain students, while others will be discouraged.

Just as there is a tendency to judge new solutions by yesterday's standards, there is a will to reinvent the past in order to adapt the usage of artefacts to our current situation. When McLuhan (2001) philosophises about the wheel being an extension of the foot, he also implies that the roads were a part of the concept of the wheel, when it actually was a medium or an effect of it. The truly revolutionary aspect of the wheel when it was invented was as a transmitter of power, making it one of the six simple machines that comprise the foundation of mechanics. The wheel's function as an extension of the foot was not perceptible until a sufficient road network was contrived. Probably McLuhan (2001) is aware of this too, but chooses to focus on the wheel's ability to transport people on a larger scale, which is its main function in the present time and which also makes a better slogan for the idea the author is promoting. This is just one example of how new inventions have a tendency to become re-evaluated when given a context different from the one in which they were invented.

The use of tools broadens the human mind and helps us push the boundaries for our creative powers further, and suddenly technology is taken for granted in a way that makes us reconsider the reasons why it was invented in the first place. An argument to support

this idea is the recent archaeological findings which prove that humanoids started constructing simple tools as early as half a million years before certain human species developed bigger brains. With this in mind, perhaps it is time to reconsider the old assumption that humans constructed tools because they grew more intelligent, and propose an alternative view: new technology was what made humans smarter, and thus, superior intelligence is a consequence of using tools (Berg, 2005).

6.5 Ever-changing ways of interaction

Social and musical interaction can serve both as a progressive force and as a maintainer of the hierarchies necessary to support the social constructions that constitute the foundation of groups and societies (Alvesson & Sköldberg, 2017). With the help of new technology as a tool, new ways of interaction may reconstruct society, allowing the weak to become strong and the slow to become fast by means of new inventions and changing standards. These changes affect all parts of society and naturally also affect different forms of art. It could be argued that art itself is one of the strongest motivational powers for change, but in some cases the opposite might be just as true. Cultural conviction is, for better or worse, holding progression back. I dare to propose that musical interaction, as defined in its traditional way and as performed by the average musician, has been a staunch concept in modern society compared to, for example, interaction in dance. Now I am fully aware that there are several experimental forms of dance and that the following example might stand out as a bit simple-minded, but it is used to put the discussion about musical interaction in a new light and not to accurately describe the evolution of contemporary dance, about which my knowledge is limited.

6.5.1 An example of interaction in another art form

Try to imagine a citizen from the beginning of the last century watching the pre-pandemic crowd ‘interact’ on a present-day dance floor. Would it be fair to even call it interaction when most participants move to the music all by themselves, with no other connection to the surrounding dancers than possibly the beat or the tempo? There is almost nothing reminiscent of dancing as it was performed at the turn of the 20th century: no choreography or dance steps, no turn-taking, no one leading and no one following. The action is taking place in an environment deliberately created to limit all other kinds of interaction by means of loud volume, smoke and strobe lighting. Still, this is what most people in western countries refer to when they go for a night out on the dance floor. In

fact, the traditional forms of dancing are nowadays seen as an awkward cultural expression that sometimes clashes with ideas about equality and social norms.

There is nothing that indicates a change in musical interaction towards a scenario similar to the one described above. One striking difference is that musical interaction performed by amateurs has, by tradition, lived up to the ideal circumstances as sketched by the music teachers participating in this study, while the implementation of technology has long belonged the recording industry. With recording technology becoming cheaper and more available and the role of the DJ becoming more diverse and creative, this division is no longer representative. Using new digital technology as an instrument no longer points towards a certain style or genre of music but rather opens up for a multitude of possibilities, each of them involving musical interaction to some extent (Prior, 2012).

6.6 Validity, reliability and generalisation

Having reached this far in the discussion it might be suitable to introduce the concepts of validity, reliability and generalisation. How do we ascertain that the results and conclusions of this study are valid, reliable and reproducible by other researchers? According to Kvale (2009), the terms ‘validity’, ‘reliability’ and ‘generalisation’ are crucial for the quality of social sciences and they will be investigated in subsequent order in this part.

6.6.1 Validity

Validity tells how accurately a method measures something. If a method measures what it claims to measure, and the results closely correspond to real-world values, then it can be considered valid. In social sciences, the concept of validity has been used to confirm that a certain method actually lives up to its assertions (Kvale, 2009). Thus, the measurement tools for this study have primarily been interviews and a brief summary of earlier research filtered through a theoretical framework in order to determine which concepts or characteristics can be observed when investigating the phenomenon of musical interaction from a music teacher’s point of view. The fact that the students’ experiences are not included in this study is a circumstance that will be accentuated in the coming part about future research, but since the teachers’ perspective was favoured already in the purpose of research, the study actually never claimed to involve the students’ point of view.

6.6.2 Objectivity

When conducting and analysing interviews, it is important to be free from bias in the sense that the researcher has no preconceived opinion or hidden agenda in relation to the topic being investigated. This once again brings up the subject of objectivity. Kvale (2009) questions whether knowledge derived from interviews can actually be considered objective since the idea of objectivity is first and foremost a moral concept. But objectivity can also mean that the object (in this case the interaction between teachers and students in an online environment) is adequately mirrored in the results of the research. According to this perspective, the way to obtain objectivity is to allow the object to object to any interventions (Latour, 2000).

6.6.3 Bias and sample

As noted in part 4.3 'Qualitative interviewing', the likelihood of bringing bias to the investigation when being an insider (emic) is considerable. This has unfortunately been the case in this study, not only because I brought with me a narrow-minded definition of what musical interaction ought to be but also because the sample for the interviews was too limited. Most of the teachers were of the same age, living in the same part of Sweden and thus, in many cases, educated at the same academy of music. Some of the informants knew each other well and some of them are even personal friends of mine. This might have had more of an impact on the results than I first imagined. Even though the informants teach different kinds of instruments and appreciate different kinds of music, they are all spontaneous musicians with a big repertoire and a penchant for live music. My motivation for asking them to take part was that this fondness for live music probably meant that their experiences of musical interaction (the way I saw it then) made them suitable for the study.

6.6.4 Second thoughts

At this point it seems worth considering whether it would have been wiser to gather a more diversified group of teachers. What complicates matters is that music teachers educated at academies of music are schooled in an instrument (the voice included), often from an early age, and in this schooling musical interaction has been an interaction where the participants have shared the same space and air. In order to invite teachers with another point of view, it might have been beneficial to include producers and teachers with a background in exclusively electronic music. Unfortunately, the last group is a rare species at the academies of music and even more infrequent among music teachers. Age

is another factor that seems to matter when considering attitudes towards the online environment. The youngest informant in this study is in his early thirties and thus is the only one who grew up in a society and culture dominated by the internet. It would certainly have made a difference if more of the informants belonged to the internet generation.

6.6.5 Reliability

One of the most important aspects of reliability is the presumption that a result should be reproducible by other researchers, which in the case of qualitative research guarantees that the informants stick to their statements (Kvale, 2009). The consistency in information given by the informants is dependent on several factors. To start with, the circumstances described by the informants in this study are not likely to be consistent since the evolution of the pandemic is the key to many of their statements and the expected briefness of the situation hinders the establishment of a new order. Over time, the teachers have adapted both to the new conditions and to the new technical aids available and thus it seems likely that their views on musical interaction in online education have changed accordingly. These changes in the participants are expected and taken into account.

6.6.6 Dependability

In qualitative research, researchers look for dependability, in wiev of the fact that the results will be subject to change and instability. With that in mind, the aim of the study from the beginning was to investigate attitudes emerging during the first phases of distance education, and it is most likely that while this part is being written, some three months after the interviews were conducted, the views might have shifted slightly. Therefore, this study cannot be considered reliable in the sense that other researchers would be able to replicate the same result. Instead, the transparency in how the study was investigated and the dialogue between researcher and informants is what brings reliability to the results. Kvale (2009) concludes that, from a social post-modern point of view, the quest for absolute truth is no longer desirable. Instead, communication of knowledge grants the aesthetics a platform in the scientific discourse. Suddenly the craftsmanship of the researcher is put in focus, and the validity and reliability become part of the entire research process instead of being centred around the results (Kvale, 2009).

6.6.7 Generalisation

Generalisation is a form of abstraction that determines if the results of a certain study could work as a conceptual model and thus be applicable to other informants and situations (Kvale, 2009). In this case I find it fair to presume that the views and results presented in this study would be relevant for future research. However, from a strict social constructionist point of view, this assumption is of course a fallacy, since it supposes that knowledge is a fixed entity without a connection to the social and historical context in which it was contrived. As presented in chapter 3, 'Theoretical aspects', there are different degrees of radicality when it comes to social constructionism, and having reached this far in the study, I find it necessary to express an opinion on the subject matter. It seems to me that social constructionism applies well to the social world of humans but maybe not so well to the natural world, which makes it hard to determine the results from an investigation in social sciences by the standards set by natural sciences. Thus, the main aim of this qualitative study is not to generalise but rather to provide a rich, contextualised understanding of some aspects of human experience through the intensive study of a particular phenomenon. As Kvale (2009) points out, this could be regarded as a form of generalisation if the knowledge produced by the research could be applied to other relevant situations. Among the different aspects of generalisation, the one most suitable for this study is defined by Kvale (2009) as analytic generalisation, which means assessing the extent to which the results of one study might coincide with the outcome of a similar situation. In a reader-based analytic generalisation, the detailed and contextual descriptions of a study allow the reader to estimate whether or not the results are generalisable to new situations (Kvale, 2009). This has been the intention with how the interviews were being reported and the analysis described.

6.7 Future research

The conclusions of this study have only skimmed the surface of future online education and the role it will play for musical interaction in a connected but more sustainable global society. To investigate the matter more thoroughly, the perspective of the internet generation should be examined, and students should be included as informants when discussing online musical interaction in an educational context. Another interesting issue is how new recording and composing technology has affected musical interaction and music as an art form. With the new low-latency platforms becoming widely available, the musical landscape and educational premises may change radically, making it possible to

interplay and learn from musicians and teachers from every connected corner of the world. This would possibly break cultural boundaries and allow new forms of live performance where the audience could interact with the performing artists. It also opens up for musicians, students and teachers from disadvantaged backgrounds or remote areas to connect with new target groups.

6.7.1 New investigations - new results?

This study was conducted after approximately one and a half terms of distance education. As of the spring of 2021, both the music schools and upper secondary schools have partly reopened with a recommendation to open up completely from the 1st of April 2021. Since then, there have been some deviations due to local virus outbreaks, but in the current situation it seems likely that schools will stay open until the summer holidays, starting in the middle of June. As for the academies of music, the distance education continues until the end of this semester with a plan to gradually reopen in the autumn. It would of course be interesting to investigate which new kinds of teaching methods for musical education online have developed in the meantime and whether some schools have shown a willingness to invest in the new low-latency technology. It is a fair guess that more studies like this one have been implemented during this period and possibly the results combined can point out even more suggestions for future research.

6.7.2 Sharing the same air

As for sharing the same air with fellow musicians, whether jamming in the kitchen at a house party or spontaneously picking up a tune with strangers in an informal session, I can see no reason why these forms of musical interaction would become obsolete in the future. My belief is that new technology opens up new possibilities and that all forms of interaction undergo constant changes. It is tempting to invoke the spirit of the times when examining social and cultural changes, but I suggest that the driving force in this evolution is primarily propelled by groups of brilliant individuals. Seen from a social constructionist point of view, ideas that seem to derive from brilliant individuals are actually shaped by and depend on paradigms of knowledge that are socially constructed and then enforced through group consensus. What we commonly call ‘the spirit of the times’ is in fact the temporary winner in a series of power struggles between different world views. With that in mind, I leave further questions about musical interaction online for the future and wish that very soon concerts, rehearsals and on-site learning will once again be a part of daily life. There is, after all, plenty of air left to be shared.

7. New technology

Several times in the previous chapters of this study there have been hints at new technology that cancels, or at least profoundly reduces, the effects of latency. This new technology was investigated with an initial intention to add new knowledge to the study, but when the interviews were completed the obvious conclusion was that most of the participants were unaware of the existence of low-latency online services, and only one of them (#4) had first-hand experience with it. In addition to these insights, the information gathered was not considered to meet the research questions as presented in part 1.3 'Purpose of research', and at that point it was decided to focus on the teachers' experiences and instead place some of the information shared by informant #4 in this last chapter of the study.

As the research progressed, my interest in these new solutions grew and I kept collecting material about them while writing the study. Through one of my informants I was notified about a research project in a new Swedish audio operating system and hardware interface, conducted by the Royal Academy of Music in Stockholm in cooperation with the developing company ELK. An online seminar was held in February 2021 presenting the new technique and encouraging students to borrow and test a complete setup with interface, outboard mixer and microphones adapted for live sessions. Since then, there have been new updates that have made the outboard mixer redundant, leaving the control to an application which also provides the communication and video feed from other participants (Vincent, 2020). As a participant in the seminar, I had the opportunity to interview the technicians from ELK as well as the head of the research, Susanne Rosenberg. Unless stated otherwise, the information below is partly taken from that seminar and partly from ELK's website, www.elk.audio.

This part about new technology also includes two examples of how the new technology could be implemented. These examples are based on interviews, blog posts and internet magazines and do not live up to the strict requirements put upon peer reviewed case studies published in academic contexts. This is why the examples are brought up in the discussion part and not as a part of the literature review presented in chapter 1.

7.1 ELK audio - Aloha

ELK audio is a completely new, ultra-low-latency audio operating system, developed to deliver real-time audio performances. With the Aloha hardware interface, the setup

allows musicians to play in sync in an online environment. At the moment, the setup is dependent on the existing wired network, but as soon as 5G becomes the new standard of cellular network technology, Aloha will be wireless. Aloha differs from the other low-latency platforms that will be presented in the next part in that it makes sure that the level of latency is at a constant low. Due to the operating system and hardware, the only latency that exists is that of the internet connection itself. In order to maintain a level of latency lower than 5 milliseconds all audio signals must pass through the Aloha interface. This means that musicians must wear earphones, just as they do in most studio recording sessions. With a fibre-optic internet connection, the levels of latency are reduced to as low as 1-2 milliseconds, which according to one of the users is experienced more like a reverb in a medium-sized hall. The beta version of Aloha presented at the seminar has a limitation of three units and a range of approximately 600-700 kilometres. With a user-friendly interface and an affordable price, the ELK Aloha is likely to emerge in future Swedish online environments, and judging from comments on different internet forums about new technology and music education, there seems to be a huge interest internationally as well. The commercial release is set for autumn 2021.

7.2 Jamulus, JamKazam, Steinberg VST and more

As internet connections became faster and more reliable, several companies started to experiment with musical interaction online. The platforms described below have existed for many years and all try to work their way around the latency issues by using existing third party operating systems combined with the fastest internet connections.

7.2.1 Jamulus

Jamulus is a free software designed for playing music online with a high-quality, low-latency sound. It was initially released in 2006. Jamulus is an open-source platform using a peer-to-peer audio network, which means that interconnected nodes or ‘peers’ share resources amongst each other without the use of a centralised administrative system, a solution employed in the latest updates of ELK Aloha as well. Since it is harder to guarantee the standards in a peer-to-peer network due to the risk of network overload and bad connections, the setup is crucial. This includes everything from the audio setup to installing correct audio drivers and lowering the buffer size to reduce latency (Fischer, 2015). According to Fischer (2015), the stringent requirements combined with latency levels of around 30-70 milliseconds and occasional audio drop-outs are the main reasons

why musicians abandon the platform. These issues can be dealt with in a number of ways, but the rather high levels of latency are something that has to be accepted and that Fischer (2015) claims to be a matter of adaptation and to a certain extent acceptance.

7.2.2 Additional low-latency platforms

Along with Jamulus, other platforms have been developed using similar premises. Of course, each one has its own features and peculiarities, but since a thorough review of online musical platforms is not the subject of this study, I am content with mentioning the most popular ones judging by the number of followers. JamKazam and Steinberg VST allegedly present a lower level of latency than Jamulus and are known for a more stable connection. They also come with a video streaming feature, and Steinberg VST can be used as a communication hub for the company's recording software. Sonobus is another popular open-source online platform with features similar to Jamulus'.

7.3 Implementation

Although the new technology described above was developed some ten years ago, it is only in recent times and largely owing to the pandemic that usage on a large scale has been possible. Since the topic is new and the research report from the project conducted in Stockholm has not even been written yet, the following assumptions about the implementation of online platforms in real-life contexts are based on first-hand information (interviews) and articles from different sources on the internet. It might be argued that this part about new technology is a diversion from the issues presented in part 1.3 'Purpose of research', but since all teachers involved in the study express doubts about the use and even the existence of low-latency platforms for musical interaction online, I find it valid to conclude with two brief examples of how the platforms JamKazam and ELK Aloha (still the beta version) have been tried out in an educational context.

7.3.1 Muhlenberg College

At Muhlenberg College in Pennsylvania, the music department explored ways to encourage online musical interaction in their music education during lockdown by employing JamKazam for certain lessons and ensemble rehearsals (Milkis, 2020). With a new internet connection installed at the college, technology works much faster than before, but the lagging of audio and video is still unavoidable. As mentioned earlier,

JamKazam has a bit of latency and the setup can take some time depending on the device it is being used from, but the level of latency is minimal compared to platforms such as Zoom (Milkis, 2020). The positive attitudes to JamKazam's solution for reducing latency is unfortunately not shared by all music teachers. Katie (2020) points out that, from a teacher's point of view, there are numerous problems with the program such as high minimum technical requirements and the fact that the program will not work on school computers such as Chromebooks. The program also appears to need maintenance, which has led many users to abandon the platform, leaving many servers empty (Katie, 2020). Another problematic issue is the weariness of both teachers and students caused by looking at a computer screen or device for hours and the frustration of not being able to interact physically or use body language for communication (Milkis, 2020).

7.3.2 The Royal Academy of Music, Stockholm

The research project at the Royal Academy of Music in Stockholm has allowed both students and teachers to scrutinise the ELK Aloha program and, according to participants interviewed during the seminar, the interface is indeed user friendly, efficient and as good as free from latency.[1] The students compare the experience with that of recording in a studio, with the only downside being that, so far, no video features are available and thus the communication while interacting musically is only auditive. The ELK Aloha has been used for improvisations and scored music, with and without the use of a metronome and for a demanding experiment in a folksong project called 'folk song lab' consisting of several sessions with free-metric improvised vocal music. Reportedly, none of the participants in the 'folk song lab' project experienced any problems with the musical interaction. The 'folk song lab' ensemble has experimented with music in and out of time, sudden changes in tempo and intricate interplay all without losing the feeling of tight musical interaction. The minimal latency was experienced as a studio delay, and the lack of visual communication was fixed by participating in an ongoing Zoom meeting where the performance could be discussed in between the sessions. The ELK Aloha is designed for live sessions, and even though the performances can be recorded through the software, for now, there are no intentions to cooperate with certain third-party programs such as digital audio workstations (DAW) or other recording software.

[1] A. Gefvert, personal communication, 8th of February, 2021

7.4 Keep calm and carry on

‘Keep calm and carry on’ was originally a motivational message printed on posters in preparation for the Second World War. Almost forgotten for more than a half a century, the injunction has gained new popularity and has lately been used during the pandemic both in its country of origin, the U.K., and elsewhere. When a crisis occurs, the first measures taken are likely to be focused on preserving the standard of living and ways of communication. A similar behaviour as that experienced during the pandemic is visible on a larger scale when it comes to the ominous effects of climate change. In the society sprung from the information revolution, trust in technical innovations is exceptionally high and yet belief in the future is getting weaker, especially amongst the younger generation. The idea of a global society assumes that a large number of individuals travel around the world to share ideas and maintain businesses. It might just be that the global society as we know it is over and that new findings and innovations will allow us to spend our days in a less erratic manner. This would mean that we can maintain the exchange of knowledge and the flow of information while staying at home. The high status of being on the go will eventually be transformed into a lifestyle where travelling for pleasure and not for work will be considered a sign of success.

Keeping calm is never a bad idea. ‘Carrying on’, on the other hand, could have multiple meanings depending on the context. In times of war, it could mean keeping up business as usual, stiffening the upper lip and never giving in. In another context, carrying on could prompt us to close our eyes to the inevitable and keep sliding towards the abyss, hoping for a ‘deus ex machina’ (help from above) to appear and re-establish the old order. Fortunately, it is not possible to ‘carry on’ forever, and as has be discussed earlier, research has succeeded with not only speeding up the process of completing vaccines but also developing new technology for online interaction, thus bringing us one step closer to a global society with resident citizens.

References

Alvehus, J. (2019). *Skriva uppsats med kvalitativ metod: En handbok*. (Upplaga 2). Stockholm: Liber.

Alvesson, M. & Sköldberg, K. (2017). *Tolkning och reflektion: vetenskapsfilosofi och kvalitativ metod*. (Tredje upplagan). Lund: Studentlitteratur.

Aroesti, R. (2016, 17 November). Copy-and-paste songwriting for a switched-on world. *The Guardian*. https://www.theguardian.com/music/musicblog/2016/nov/17/copy-paste-songwriting-interpolation-sampling-beyonce

Berg, L. (2005). *Gryning över Kalahari: Hur människan blev människa*. Stockholm: Ordfront.

Berger, P.L. & Luckmann, T. (2011). *The social construction of reality: A treatise in the sociology of knowledge* [Electronic resource]. New York: Open Road Integrated Media.

Brown, D. (2007). *Tricks of the mind*. (Pbk. ed.) London: Channel 4 Books.

Brändström, S. & Wiklund, C. (2010). Distance music education in northern Europe. *Music and music education within the context of socio-cultural changes: Proceedings of the 18th EAS congress 26–29 April 2010, Bolu - Turkey*. (S. 81-82).

Burr, V. (2003). *Social constructionism* (2nd ed.). London: Routledge.

Cadwalladr, C. & Graham-Harrison, E. (2018, 17 March). Revealed: 50 million Facebook profiles harvested for Cambridge Analytica in major data breach. *The Guardian.* https://www.theguardian.com/news/2018/mar/17/cambridge-analytica-facebook-influence-us-election

Cariani, P. (2019). Musical intervals, scales, and tunings: Auditory representations and neural codes. In P.J. Rentfrow & D.J. Levitin, D.J. (eds.), *Foundations in music psychology: Theory and research* (pp. 149-218). Cambridge, MA: The MIT Press.

Carroll, S.M. (2010). *From eternity to here: The quest for the ultimate theory of time*. New York: Dutton.

Clarke, E.F. (1999). Rhythm and timing in music. In D. Deutsch (ed.), *Psychology of Music*, (2nd ed.) (pp. 473-500). San Diego, CA: University of California.

Cohen, L., Manion, L. & Morrison, K. (2011). *Research methods in education*. (7th ed.) Milton Park, Abingdon, Oxon, England: Routledge.

Cooper, G.W. & Meyer, L.B. (1960). *The rhythmic structure of music*. Chicago, IL: University of Chicago Press.

D'Ausilio, A., Novembre, G., Fadiga, L., & Keller, P. (2015). What can music tell us about social interaction? *Trends in Cognitive Sciences 19*(3), 111-114. From: https://www.sciencedirect.com/science/article/pii/S1364661315000066

Dysthe, O. (ed.) (2003). *Dialog, samspel och lärande*. Lund: Studentlitteratur.

Evaldsson, R. (2020). *Distansundervisning inom musikämnet: En kvalitativ studie om distansundervisning inom musikämnet på gymnasiet* (Diss). From: http://urn.kb.se/resolve?urn=urn:nbn:se:lnu:diva-95931

Fairhurst, G.T. & Grant, D. (2010, 1 May). The social construction of leadership: A sailing guide. *Management Communication Quarterly.* Thousand Oaks, CA: SAGE Publications.

Fejes, A. & Thornberg, R. (eds.) (2019). *Handbok i kvalitativ analys*. (Upplaga 3). Stockholm: Liber.

Fischer,V. (2015). *Performing band rehearsals on the internet with Jamulus.* From: https://jamulus.io/PerformingBandRehearsalsontheInternetWithJamulus.pdf

Forsman, L.J. (2009). *Neural correlates of individual differences in personality and intelligence: studies using an isochronous timing task and voxel based morphometry*. Diss. (sammanfattning) Stockholm : Karolinska institutet, 2009. Stockholm.

Fowler, H.W., Fowler, F.G. & Thompson, D. (eds.) (1995). *The concise Oxford dictionary of current English*. (9th ed.) Oxford: Clarendon Press.

Geertz, C. (1973). *The interpretation of cultures: Selected essays* [Electronic resource]. Basic Books.

Gergen, K.J. (1994). *Toward transformation in social knowledge*. (2nd ed.) London: Sage.

Harari, Y.N. (2014). *Sapiens: A brief history of humankind*. Vintage/ Penguin Random House UK.

Harari, Y.N. (2018). *Homo deus: kort historik över morgondagen*. (Första pocketutgåvan). Stockholm: Natur & Kultur.

Hellgren, P. (2021,13 January). Digital brist visar att vi är illa ute. *Aftonbladet.* https://www.aftonbladet.se/debatt/a/7KVkJo/lofvens-digitala-brist-visar-att-vi-ar-illa-ute

Hull, G.P., Hutchison, T.W. & Strasser, R. (2010). *The music business and recording industry* [Electronic resource]. (3rd ed.) New York: Routledge.

Husserl, E. (2002[1931]). *Ideas: General introduction to pure phenomenology* [Electronic resource]. London: Routledge.

Hylen, J. & Groth, J. (2003). *IT vid universitet och högskolor* (Delrapport till ITPS utvärdering av den svenska IT-politiken). Östersund: Institutet för tillväxtpolitiska studier.

Ivry, R.B. (1996). The representation of temporal information in perception and motor control. *Current Opinion in Neurobiology, 6,* 851-857.

Jackson, J. L. & Michon, J. A. (1985). *Time, mind, and behavior* [Electronic resource]. Berlin, Heidelberg: Springer.

James, W. (1890). *The principles of psychology (Vol.1)*. New York: Holt.

Johnson, C. (2017). Teaching music online: Changing pedagogical approach when moving to the online environment. *London Review of Education*, https://doi.org/10.18546/LRE.15.3.08

Jordania, J. (2011). Why do people sing? Music in human evolution. Tblisi: Logos, International Research Center for Traditional Polyphony; Melbourne: The University of Melbourne.

Katie. (2020, 19 September). Midnight music, https://midnightmusic.com.au/2020/04/dear-music-teachers-you-cant-run-a-live-rehearsal-online/

Kentnor, H. (2015). Distance education and the evolution of online learning in the United States. *Curriculum and Teaching Dialogue*, *17*(1-2), 21-34.

Keysers, C. (2011). *The empathic brain: How the discovery of mirror neurons changes our understanding of human nature*. Lexington, KY: Social Brain Press.

Kulathuramaiyer, N. & Maurer, H. (2007, October). Coping with the copy-paste-syndrome. *ResearchGate*, https://www.researchgate.net/publication/228765078_Coping_With_the_Copy-Paste-Syndrome

Kvale, S. (1997). *Den kvalitativa forskningsintervjun*. Lund: Studentlitteratur.

Kvale, S. & Brinkmann, S. (2009). *Den kvalitativa forskningsintervjun*. (2. uppl.) Lund: Studentlitteratur.

Larsson, G. (2004). *Från klassrum till cyberspace: [att undervisa på distans]*. Lund: Studentlitteratur.

Latour, B. (2000). When things strike back: A possible contribution of science studies to the social sciences. *British Journal of Sociology, 51*, 107-123.

Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory*. University Press, Oxford.

Leeds-Hurwitz, Wendy (2009). Social construction of reality. In S.W. Littlejohn & K.A. Foss (eds.), *Encyclopedia of communication theory*. Thousand Oaks, CA: SAGE Publications.

Levitin, D.J. (2008[2007]). *This is your brain on music: Understanding a human obsession*. London: Atlantic.

Lichtman, M. (2006). *Qualitative research in education: A user's guide*. Thousand Oaks, CA: Sage Publications.

Lukács, G., Marcus-Tar, J. & Tar, Z. (eds.) (1989). *Georg Lukács: Theory, culture, and politics*. New Brunswick, NJ: Transaction Publishers.

Madison, G. (2001). *Functional modelling of the human timing mechanism*. [Dissertation, Uppsala: Univ]. 2001. Uppsala.

Mayor, A. (2018). *Gods and robots: Myths, machines, and ancient dreams of technology*. Princeton, NJ: Princeton University Press.

McLuhan, M. (2006). The medium is the message. In M.G. Durham & D.M. Kellner (eds.), *Media and cultural studies*. Blackwell Publishing Ltd.

McLuhan, M. & Fiore, Q. (2001). *The medium is the massage: An inventory of effects*. Corte Madera, CA: Gingko Press.

McNeill, W.H. (1995). *Keeping together in time: Dance and drill in human history*. Cambridge, MA: Harvard University Press.

Miles, M.B. & Huberman, A.M. (1994). *Qualitative data analysis: An expanded sourcebook*. (2nd ed.) Thousand Oaks, CA: Sage.

Milkis, D. (2020, 17 September). How low latency conferencing software is revolutionizing music education. *Muhlenberg Weekly.* https://muhlenbergweekly.com/arts-culture/jamkazam-how-low-latency-conferencing-software-is-revolutionizing-music-education/

Moore, J. W. (1992). A mechanism for timing conditioned responses. In F. Macar, V. Pouthas, & W. J. Friedman (eds.), *Time, action and cognition* (pp. 229-238). Dordrecht, The Netherlands: Kluwer.

Nozaradan, S. (2014). *Exploring how musical rhythm entrains brain activity with electroencephalogram frequency-tagging.* Philosophical Transactions of the Royal Society B-Biological Sciences, 369(1658). doi:ARTN 2013039310.1098/rstb.2013.0393

Passion Jun, M.D. (2021, 19 January). Music, rhythm, and the brain. *Brain World.* https://brainworldmagazine.com/music-rhythm-brain/2/

Patton, M.Q. (2015). *Qualitative research & evaluation methods: Integrating theory and practice*. (4th ed.) Thousand Oaks, CA: SAGE Publications, Inc.

Pearsall, J. & Trumble, B. (eds.) (1996). The Oxford English reference dictionary. (2nd ed.) Oxford: Oxford University Press

Phillips, T. (2014). *Pedagogiska teorier och praktiker*. (1. uppl.) Malmö: Gleerup.

Pike, P.D. (2015). Using a synchronous online teaching internship to develop pedagogical skills and explore teacher identity: A case study. *Journal of Music Technology & Education, 8(3),* 227-242. doi:10.1386/jmte.8.3.227_1

Prior, N. (2012). Digital formations of popular music: Producers, devices, styles and practices. *Réseaux*, *172*(2), 66-90. https://www.cairn-int.info/article-E_RES_172_0066--digital-formations-of-popular-music.htm

Ravignani, A. & Madison, G. (2017). The paradox of isochrony in the evolution of human rhythm [Electronic resource]. *Frontiers in Psychology* (8). From: http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-142245

Rentfrow, P.J. & Levitin, D.J. (eds.) (2019). *Foundations in music psychology: Theory and research*. Cambridge, MA: The MIT Press.

Ruud, E. (1995). Kvalitativ metode i musikkpedagogisk forskning [Qualitative method in music education research]. In H. Jörgensen & M. Hanken (eds.), *Nordisk musikkpedagogisk forskning.* Oslo: Norges Musikkhögskole.

Schwarz, C. (ed.) (1993). *The Chambers dictionary*. (Rev. ed.). Edinburgh: Chambers.

Senge, P.M. (2006). *The fifth discipline: The art and practice of the learning organization*. (Rev. and updated ed.). London: Random House Business.

Shoemaker, K. (2011, July). *Mud huts, MIDI, and light bulb moments.* Paper presented at the national Conference on Keyboard Pedagogy, Lombard, IL.

Silver, N. (2012). *The signal and the noise: The art and science of prediction*. London: Allen Lane.

Small, G.W. & Vorgan, G. (2008). *iBrain: Surviving the technological alteration of the modern mind*. New York: Collins Living.

Smidt, S. (2009). *Introducing Vygotsky: A guide for practitioners and students in early years education*. New York, NY: Routledge.

Snowman, R. (2009). *Dance music manual.* Oxford: Elsevier Ltd.

Säljö, R. (2000). *Lärande i praktiken: ett sociokulturellt perspektiv*. Stockholm: Prisma.

Säljö, R. (2005). *Lärande och kulturella redskap: om lärprocesser och det kollektiva minnet*. Stockholm: Norstedts akademiska förlag.

Vetenskapsrådet. (2017). *God forskningssed*. Vetenskapsrådet. From: https://www.vr.se/download/18.2412c5311624176023d25b05/1529480532631/God- forskningssed_VR_2017.pdf

Vincent, R. (2020, December). ALOHA hits beta: This box could make online jamming a reality. Gearnews.com. https://www.gearnews.com/aloha-hits-beta-and-could-make-online-jamming-a-reality/

Wenneberg, S.B. (2010). *Socialkonstruktivism: positioner, problem och perspektiv*. (2. uppl.) Malmö: Liber.

Wännman Toresson, G. & Östlund, B. (2002). Ny roll, ny kompetens för distansläraren, In M. Gisselberg (ed.), *Distanslärare och distanslärande. En antologi*. Härnösand: Distansutbildningsmyndighetens rapport 6: 2002.

Appendix

Appendix 1, Letter of request

This letter of request with information about the study and its implementation was sent to the participants before the interviews were conducted. Note that the letter was originally written in Swedish and that this is an English translation.

Request for participation in a study about online education

My name is Tobias Allvin and I am working on a study about some aspects of online education, employed to a different extent since the rise of the pandemic.

By profession, I am a music teacher educated at the Malmö Academy of Music and currently employed at Malmö University, where I teach pre-school teachers, after-school club teachers (fritidslärare) and music teachers. I am looking for teachers with insights into the conditions of online education willing to take part in an interview. My ambition is to conduct six interviews: two with teachers from music schools, two with teachers from upper secondary schools and two with teachers from academies of music.

It would mean a lot to me if you would consider taking part in an interview concerning your experiences of online education. The interview is a part of a bigger study that will result in a master's thesis at the Malmö Academy of Music (Lund University).

The interview will take place on the online platform Zoom and should last approximately 30-40 minutes. The main topics will be how your teaching methods have changed while conducting lessons online and how this has affected musical interaction with the students. The material will be used exclusively for research purposes and you will be anonymous in the study. At any time during the interview, you can choose to cancel your participation. In addition, the ethical guidelines presented by the Swedish Research Council (Vetenskapsrådet) are being followed. If you are interested in taking part in an interview, please contact me by email.

Please feel free to contact either me or my mentor Bo Nilsson (email addresses below) if you need any further information.

I hope for your cooperation,

Tobias Allvin

Email addresses:
tobias.fejne.allvin@mau.se
bo_l.nilsson@mhm.lu.se

Appendix 2, Questionnaire

This questionnaire served as a stepping stone for the interviews conducted according to the interview guide approach (Patton, 2015). The document has been translated from Swedish to English.

Background

1. Say a few words about yourself and your musical background (both as a teacher and as a musician), and state your current position and employment.
2. Tell me a bit about your experiences with digital aids, personally and as a teacher.

Online education

1. How was the transition to online education in your place of work?
2. From where was the teaching conducted?
3. How did your teaching methods change during the time that online teaching has been conducted?
4. What are the advantages and disadvantages with online education from your point of view?
5. Are there any specific parts that work better or worse now than when you met your students face to face?
6. Does online education suit some students better than others?
7. Can you see any changes in motivation amongst the students?
8. Is the musical interaction affected by the fact that the lessons are conducted online? If yes, please specify.

Digital aids

1. Which digital platforms do you use to communicate with the students?
2. Which digital aids do you use in your teaching?
3. Is there a policy regarding which digital aids are supposed to be employed at your place of work?
4. What are the conditions when it comes to technology at your place of work, and do the staff have an impact on the situation?
5. What are the conditions when it comes to technology amongst your students?
6. How is the musical interaction affected by the digital aids being used?

Further questions

1. What is important to obtain in order to promote musical interaction, in your opinion?
2. How would you rate the level of knowledge about digital aids amongst your colleagues?
3. Does new technology lead to new musical expressions, and if so, in what ways?