

Musical play

Musical play

Children interacting with and around music
technology

Pernilla Lagerlöf



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The work reported here is a part of a large-scale international research project on children's technology-transformed music learning entitled, Musical Interaction Relying on Reflection (MIRROR), financed by the European Union FP7-ICT (Grant 258338). The trans-national project group is coordinated by Anna Rita Addressi (University of Bologna, Italy). The other partners and their national and technological project leaders are: Sony Computer Science Laboratory, Paris (Francois Pachet), University of Gothenburg, Sweden (Bengt Olsson), University of Exeter, UK (Susan Young), University of Genoa, Italy (Gualtiero Volpe), and University of Athens, Greece (Christina Anagnostopoulou).

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Abstract

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This thesis explores young children and music learning in the ecology of music technologies. The research is a part of an EU project called MIROR (Musical Interaction Relying on Reflection) that had the intention to develop software for music learning designed to promote specific cognitive abilities in the field of music improvisation. The overarching aim of this thesis is to explore activities where children (and adults) interact with and around the music technology MIROR Impro, and what this participation allows and supports children to learn, including musical learning. The research focuses on the participants' interaction with each other and in relation to the instrument connected to the software.

Participants in the empirical studies are 4-8-year-old (with an emphasis on 6-year-old) children in a Swedish preschool and in an afterschool centre. While the studies of the larger project are of an experimental kind, the empirical studies of the thesis investigate more interactive, teacher-involved activities

The theoretical framework is a sociocultural perspective. A point of departure is the understanding of learning as an act of participation in communities of practice rather than as an individual, cognitive process of internalizing knowledge. According to this perspective, learning is situated in a context and mediated by cultural tools (physical such as musical instruments as well as discursive ones) which are included in the unit of analysis. This sociocultural perspective provides a well-developed and systematic conceptual framework for making sense of observations and how these can be explained.

The results are presented in four empirical studies:

In “Exploring Turn-Taking in Children’s Interaction with a New Music Technology”, it is shown that many children need help to notice the turn-taking nature of the technology’s responses. When there are two users of the system at the same time, they use physical, visual and verbal resources to coordinate their playing and to achieve intersubjectivity in contrast to when a single child interacts with the technology. In “Engaging Children’s Participation with and around a New Music Technology through Playful Framing” it is revealed how two children become active participants when an adult took the role of a more experienced participant within a playful framing. The nature of the communication changed, resulting in a more engaging activity where the children were provided to discern musical aspects through the introduction of mediating tools. In “Playing, New Technology and the Struggle with Achieving Intersubjectivity” it is presented how activities involving two children, the music technology and with and without a present adult, developed into different types of play-based participation: make-believe and/or musical play. Even though the adult provided some structural resources to engage the children in a ‘musical dialogue’, they to a large extent engaged in uncoordinated activities. The results hence illustrate the creative and open-ended nature of participating in social practices. In “Musical Make-Believe Playing: Three Preschoolers’ Collaboratively Initiating Play ‘in-between’”, it is shown how a computer break-down opens up for other types of interactions on the children’s initiative. They develop mutual make-believe play and actualize and use experiences from other activities. In their play, the children are seen to express their cultural frames of references.

Together, these studies clarify that despite the technology being launched as self-instructive and work as an ‘advanced cognitive tutor’, in situations where a more experienced participant is engaged and interact with the children, their opportunities to learn in and about music is enhanced. In these contexts, the teacher is vital to help the children to conceptualize and identify musical possibilities. The make-believe play communicatively frames the activity in a way that creates meaningfulness and helps children make sense. By interacting verbally with the children as a co-creator, the teacher goes into dialogue with them about a musical content and thus provides opportunities for emerging music learning.

Acknowledgements

I am sitting on a hill as the sun has just set. Beautiful red-yellow palette as far as the eye can see. And the wind is so warm, it caresses my arm. I wish for nothing more than what I see right now. (Traditional children choir song, my translation)

On my final seminar, I was told to be more specific about the mountain I am standing on, in order to define from where my map is drawn. I interpret this as a metaphor for my assumptions as a former preschool teacher and as a researcher in LinCS and at the Department of Education, Communication and Learning at the University of Gothenburg, Sweden.

To start, I am very happy for succeeding to climb the top of this mountain. Many times during the expedition hike I have experienced (metaphorically) that my supervisors have run up the steep, carrying me in a royal chair. I am so glad to be guided by my dear friends, colleagues and supervisors, Cecilia Wallerstedt and Niklas Pramling, my more knowledgeable peers and great scholars that have scaffolded me in my learning processes.

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My husband Fredrik, thank you for making me believe in myself. I would never have had the courage to do this without you pushing me to figure out what I really wanted to do with my life. Linnéa and Emma, this thesis is dedicated to you as a reminder to never doubt that you can fulfil your dreams. Jag önskar inget mer än det jag just nu ser...

Pixbo, March 2016

Pernilla Lagerlöf

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PART TWO: THE EMPIRICAL STUDIES

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- I. Exploring turn-taking in children's interaction with a new music technology
- II. Engaging children's participation in and around a new music technology through playful framing
- III. Playing, new music technology and the struggle with achieving intersubjectivity
- IV. Musical make-believe playing: Three preschoolers collaboratively initiating play 'in-between'

APPENDICES

- A. An overview of the Empirical Data
- B. Consent form

1. Introduction

The present thesis concerns children's interaction with and around music technology in Swedish early childhood educational institutions. The thesis is a part of a large-scale and interdisciplinary EU-funded project called Musical Interaction Relying on Reflexion (MIROR, <http://www.mirrorproject.eu>). The primary aim of the project was to develop a music technology, which is an example of IRMS (Interactive Reflexive Musical System), to be beneficial in early childhood music education. The project was based on a spiral design approach involving the technological partner developing a new technology and the research partners (psychological and pedagogical ones) conducting empirical research on children in early childhood education settings such as preschools, the first years of primary schools, and after-school centres using the technology. The technology is a prototype for implementing computer-assisted music improvisation, now called MIROR Impro (previously entitled The Continuator) (Pachet, 2003). It consists of a computer program that is connected to an instrument (typically a keyboard/synthesizer). The child plays on the keyboard; when he or she stops playing (resulting in a silence of a certain duration that can be set), the system plays back a variant, but allegedly stylistically consistent, response to the child's playing. In this way, the system takes turn with the child, premised to result in an interaction between the user and the system in the form of a musical dialogue. IRMS technologies are presented as "real-time interactive musical instruments that are able to produce stylistically consistent music" (Pachet, 2003, p. 2). MIROR Impro differs from more traditional software since it is not a computer game, with rules, where you get credit or having winners and losers. It does not have a connection to the Internet, which means that the user cannot go on-line and meet other MIROR-Impro players. The user is claimed not to need any particular prior skills, the software is supposed to 'learn' his or her playing style regardless of the user being a skilled musician or someone with no musical experience. Even if it is seen as a musical instrument, it still needs to be connected to a computer with the software installed, but it is no screen-based software. The designer, Pachet (2006), explains why: "Users engaged in creative music-making cannot afford have their attention distracted from the

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instrument to the computer, however well designed the interface may be” (p. 6).

The issue of implementing new technologies in educational practices has been studied from various perspectives for many years and “has been shown to be a trying mission” (Lantz-Andersson, 2009, p. 15; cf. Crook, 1996). One common concern is that the use of different computer programmes in goal-oriented practices and what children will learn from these often land in normative judgments about what is considered to be ‘good’ and ‘bad’ learning methods (for a critical review, see Peterson, 2014). The MIROR project in itself is in this thesis used as an illustration of the many different assumptions held about *children, learning, music* and *new technologies*.

Depending on what fields of interest scholars work within, different claims and aspects are emphasized. The studies proposed by the multidisciplinary project MIROR proved to be complicated when viewed from the tradition of pedagogical research. In the present study, an ambition is to supplement previous studies of the IRMS system, by taking a different theoretical perspective on the learning processes, having implications for how to study children’s (and teacher’s) interaction with and around the technology.

The musical ecology of children’s lives in information societies is considerably different from what it was only a few decades ago, with learners today having instantaneous access to varied music resources and an immense amount of musical choices through, for example, Spotify and YouTube. This situation, according to O’Neill (2012), leads to unique opportunities for young music learners, since “[t]echnology has created an unprecedented amount of autonomy in their musical lives, and it has explored the boundaries of what music learners are capable of achieving” (p. 170). Craft (2012) and Livingstone (2009) argue that with the rapidly shifting technological landscape, the nature of contemporary childhood is also changing. This might be the reason why discourses on childhood in the digital age according to Craft (2012) display two contrasting worldviews: the child as being at risk and the child as empowered by new media technologies.

The fact that technologies have become a prevalent part of young children’s everyday world has thus prompted various debates of their perceived pros and cons. Digital technologies can no longer be defined as new since they for quite some time now have been used in an increasing number of areas of different kinds and constitute important parts of globalization. Even if digital technology as such is no longer a novelty, there are new aspects

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to consider in relation to educational settings and not least what the incorporation of such technologies implies for the role of the teacher. It is also important to keep in mind that many arguments around new technologies in educational settings originate in commercial interests, which makes it important to always have a critical stance towards results that point to the alleged effects of different technologies on children's learning (Crook, 1996; Cuban, 1986; Lantz-Andersson & Säljö, 2014; Peterson, 2014). Furthermore, research has had a tendency to focus on the outcome of learning as a product, rather than studying the processes of learning, for example teacher-child communication and coordination (for a discussion, see Pramling & Pramling Samuelsson, 2011). Since, in this study, a sociocultural perspective is adopted, this point is of major significance. From this theoretical point of view, learning is conceived as an act of participation in communities of practice rather than as an individual, cognitive process of internalizing knowledge. From this perspective, there is a need to analyse processes of participation and communication.

The reason for choosing to use the word “around” (that children are interacted with and *around*) the technology is related to a discussion raised by, for example, Crook (1996) who argues for the necessity to include a broader perspective when analysing collaborative learning as “configurations of computers *around* which social interaction may be organised” (p. 190, italics in original). To clarify the idea of such configurations, Crook points to a concern for the material environment that will constrain and facilitate the collaborative encounters between the participants. The intention is to also include other participants such as peers and teachers in this facilitating and/or constraining environment. This concern is based on the theoretical tradition underlying this thesis where cognition is understood “in terms of a human subject located in relation to mediational means” (Crook, 1996, p. 190).

Studies of preschool children's music activities have been conducted within several fields and disciplines, which Campbell and Wiggins (2013) argue has contributed to an understanding of children's making, knowing and valuing of music. A number of researchers have for example studied children's musical play where popular music has been shared among peers and where they have been engaged in spontaneous and informal collaborative musical activities (Barrett, 2006; Campbell, 1998/2006; Marsh, 2008; Trawick-Smith, 2010; Vestad, 2010, 2014). Despite this, Campbell and Wiggins (2013) suggest that a

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largely overlooked area of research is a child-centred approach to musical childhoods that gives voice to the children.

Since music is such an important part of our everyday lives and as it becomes more readily accessible through streamed on-line services, even for young children, the importance of studying children's musical cultures as intertwined in their musical play occurring at preschool and after-school centres is emphasised in research (Harwood & Marsh, 2012). For this reason, it is essential to study children's perspectives on musical play activities.

There are few concepts that are as ambiguous as children's play. Within the field of early childhood education it holds a central position, but how it is defined varies and according to Flear (2013) "most views of play draws from biological or maturational theory of development" (p. 73, cf. Wood & Attfield, 2005).

In the present study play is understood as a social activity rather than the expression of the individual child. The social interactional aspects of play activities are hence in focus "as *collective cultural productions*" (Evaldsson & Corsaro, 1998, p. 380, italics in original; cf. Björk-Willén & Aronsson, 2014; Björk-Willén & Cromdal, 2009; Goffman, 1978; Vygotsky, 1933/1966). Even if play has been considered to be important in children's development and have been used as pedagogy in early childhood education, the role of the teacher has predominantly been conceptualised as passive in children's play (Flear, 2015). For a long time, the rhetoric regarding the value of play for children's learning have been raised, even if most claims have lacked convincing grounding in empirical research. In contrast, a Vygotskian perspective on play provides a consistent conceptualisation of playful learning and a basis for empirically investigating the role of the adult in children's play (Flear, 2015; van Oers, 2013).

In this thesis, music is not seen as an object, something that *is*. Instead, the focus is on what people do and the ways they interact with music technology and each other. These musical activities will be studied. A background of this research interest is the Vygotskian idea of seeing where and how far a more experienced participant (an adult or a peer) can take the children in playing with, in this case, sound-making. In this study, the term playing will be used in two senses, that is, as playing (performing) music and as make-believe playing.

The music technology prototype that the children interact with in the present study will be referred to with three different designations: IRMS technology (referring to the kind of technology that the Continuator/MIROR

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Impro is an example of), the Continuator (the original name) and MIROR Impro (its current name). In this thesis, these terms refer to the same system, even if the first one is more overarching.

Aim and research questions

The overarching aim of this thesis is to explore activities where children (and adults) interact with and around music technology and what this participation allows and supports children to learn, including musical learning. The research will focus on the participants' interaction with each other and in relation to the instrument connected to the software (MIROR Impro). More specifically, the following research questions are investigated in the four empirical studies:

- I. (1) Do the children participating in the technology-mediated activity identify and align with the basic turn-taking rationale of the technology; (2) What characterizes the turn-taking between child, technology and/or another child or an adult; and (3) If, and, if so, how do the responses from the technology scaffold the child's musical playing?
- II. (1) How do the children interact with each other, the technology and the teacher when the teacher communicatively frames the activity as a playful activity in two senses of the word (i.e., as playing music and pretend playing); (2) What are the children provided the opportunity to learn, and (3) How do they respond to these opportunities?
- III. (1) What practices develop when the children interact with and around the music technology of MIROR Impro, with and without an adult taking the role of a more experienced participant? (2) What is the nature of the participants' communication, that is, what structuring resources are introduced and used, and do – if so, how do – the participants establish intersubjectivity?
- IV. (1) How do the children communicate and negotiate in and about (i.e., meta-communicate) the play activity? (2) How do they scaffold each other in their musical performances?

On the basis of the findings of the four empirical studies, in the final section of this introductory part of the thesis, will be discussed:

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- * How do children, in pairs with a peer and/or in triads with also an adult participating, interact with and around the technology?
- * What is the teacher's or peer's role as a more experienced participant in the analysed activities?
- * What are the implications for a technology-transformed early childhood music education?

The aim of the thesis differs from the overarching projects in significant ways. On the internet homepage for the project (<http://www.mirrorproject.eu>, accessed 16-02-09) it is argued that:

The MIROR project aims primarily at developing the potential of IRMS for the benefit of music education. This includes the design, implementation and validation of concrete pedagogical scenarios in which these IRMS organize and stimulate the learning/teaching processes.

Hence, the overarching project is more about dealing with the development of the IRMS system, but the present thesis is not an effect study or evaluation of the technology as such; instead the focus is on empirically studying participants' actions with and around the technology. The study is empirically driven and the thematic pattern constituted by the four empirical studies emerged after initial analysis of the video data. In the overarching project experiments have been conducted with individual children aged 4 and 8 years old. In my studies the emphasis is on six-year olds interacting together and in some cases also with an adult taking the role of a more experienced participant. The reason for focusing on this group of children is that the video data on children in interaction, not only with the technology but also peers and in some cases an adult, generated *play activities*, which are the interest of this thesis. All empirical material for the present thesis was generated during two month in the spring of 2011.

Guidance for readers

This thesis consists of two parts. The first part continues with a review of the fields of research that the study will be related to. Particular attention will be paid to previous studies with the MIROR technology (primarily an earlier version of the technology called The Continuator). A reason for this is that the interdisciplinary nature of the overarching project reveals several different perspectives on how to understand the child-and-machine interaction. This means that the present thesis can also be seen as a meta-study of the MIROR project as such, since an ambition is to elaborate on what claims are made in different studies on this technology, and on what basis. This further means that the review provides a frame of references to, and presents an argument for, the theoretical basis of the present study. As a basis for making sense of the observations I have made, and how these can be explained, a sociocultural perspective on human learning and development will be taken. This part is followed by a presentation and discussion of the method and methodology of the research. The first part of the thesis concludes with a summary of the empirical studies and a discussion of recurring and overarching issues. The second part of the thesis consists of the empirical studies:

- I. Wallerstedt, C., & Lagerlöf, P. (2011). Exploring turn-taking in children's interaction with a new music technology. *He Kupu*, 2(5), 20-31.
- II. Lagerlöf, P., Wallerstedt, C., & Pramling, N. (2013). Engaging children's participation in and around a new music technology through playful framing. *International Journal of Early Years Education* 21(4), 325-335.
- III. Lagerlöf, P., Wallerstedt, C., & Pramling, N. (2014). Playing, new music technology and the struggle with achieving intersubjectivity. *Journal of Music, Technology & Education* 7(2), 199-216.
- IV: Lagerlöf, P. (2015) Musical make-believe playing: Three preschoolers collaboratively initiating play 'in-between'. *Early Years*, 35(3), 303-316.

2. Background

This chapter presents a research review in order to map different views of technology-mediated music learning in early childhood education. Emphasis will be on previous research in connection to IRMS technology (the Continuator) and to scrutinize the approaches of these studies, that is, to clarify the relation between the premises and perspectives and the knowledge claims made. Alternative approaches to children and childhood will be presented and also different aspects to consider when it comes to new technologies in educational practices.

The overarching MIROR project

As already mentioned, the research presented in this thesis has been part of a larger research project into technology-mediated early childhood music education, entitled Musical Interaction Relying on Reflexion (MIROR). The project was conducted 2010-2013 and consisted of participants from universities in Italy (Bologna and Genoa), Sweden (Gothenburg), Greece (Athens) and the UK (Exeter). In addition, two companies, Sony Computer Science Laboratory (Paris, France) and Compedia (Israel) were technological partners in the project. The project was based on a spiral design approach, involving the technological partner developing a new technology and the research partners (psychological and pedagogical ones) conducting empirical research of how children (and to lesser extent, adults including teachers) interacted with the technology.

Previous studies on the IRMS technology

The MIROR Impro technology was in its initial version called The Continuator and there are empirical studies of children interacting with it, for example Pachet, (2003), Addressi and Pachet, (2005, 2006), and Ferrari and Addressi (2014). In this section some of the previous studies made in connection to the Continuator will be presented. Some conclusion drawn

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from these studies could, however, be questioned on the basis of the relationship between empirical observation and theoretical claims, something that will be further elaborated in the text.

The main focus of the Continuator project that commenced in 2000 was to design a system for adult users. Pachet (2003), the chief designer of the system, reports how he came to develop an interest in testing the system also with very young children when his daughter (at the time three years old) for the first time showed some musical interest when she together with him tried the Continuator system. Pachet therefore started some preliminary experiments with the Continuator at a kindergarten in Paris. In 2003, the University of Bologna in Italy and Sony Computer Science Laboratory in Paris collaborated in a project based on psychological and pedagogical experiments in connection to the interactive reflexive music system (IRMS) and these studies can be seen as pilot studies for what later became the MIROR project. It is from these findings that the assumptions and hypothesis underlying the project of Musical Interaction Relying on Reflexion (MIROR) were developed. The experiments were conducted in an Italian kindergarten and included 27 children aged 3-5. The result is presented in the form of two case studies and it is suggested that the situations where the children were interacted with the Continuator led to interesting and creative musical processes. Three sessions a day for three days in a row were studied. In every session, the children were given four tasks: to play with the keyboard, to play with the keyboard connected to the Continuator, to play keyboard with also a friend, with and without the keyboard connected to the Continuator. Five kinds of data collection were made: Video observations, audio recordings, drawings from the children made one week after the experiment, questionnaires for the children's parents and the teachers' "psycho-pedagogical profile" of the participating children.

After reviewing the video data of the sessions, two children were singled out for closer analysis. These two children (Tom and Jerry, both 5 years 10 months old) come from particular musical backgrounds. For example, "Tom's father is an expert in rock music, whereas Jerry listens to classical music" (p. 42) and he has "knowledge of musical instruments uncommon in children of this group" (p. 29). Describing the two children's interaction with the technology, we are told that:

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Tom often imitates his friend. They discover that the system repeats what they play and learn how to make the system imitate them: the most exciting game is to produce strange sounds (brief sequences of strong, fast and irregular clusters) for the pleasure of hearing the Continuator repeat them – just like laughing at your funny faces in the mirror. *The moment of excitement also becomes the moment of learning (learning by ‘immersion’*: Maragliano, 1999). (Addressi & Pachet, 2005, p. 35, my italics)

Since what is observed in the last quote is commented in terms of learning, it would be interesting to have a clarification of *what* is learned by the child and what analytical distinctions that are used to account for learning. When reading this quote it becomes clear that the authors have an assumption that the children are learning since they show some excitement. This is one example of the different assumptions the researchers in the MIROR project have as points of departure when analysing data. In the following will be presented some conclusions drawn from the earlier studies made in connection to the IRMS technology. From these, it is possible to point out the (implicit) assumptions that the earlier studies are based on as a contrast to the theoretical framework that will provide the foundation for the present thesis.

When further describing the case of Tom, Addressi and Pachet (2005) suggest that:

Tom gets up, jumps from the computer to the keyboard, and his movement is mimicked in the music he and the system play [...]. Delightful and amusing to see, it is truly a moment of *genuine creativity*. Tom is *no longer exploring* the system, they are making music together – a real jam session. (p. 38, my italics)

The way the child is observed moving to the music is here used to make claims about “genuine creativity”. It is not clarified what is meant by this expression in this context. What are the indicators of creativity and how does it differ from merely exploring the instrument, sound etc. or simply playing or interacting with the system? Hence the analysis would benefit from making explicit what concept of creativity is referred to.

Summarizing the two case studies, Addressi and Pachet reason that:

The two case studied would suggest that the Continuator is able to develop interesting child/computer interaction, very similar to that between humans. This phenomenon seems to have its origins in the ability of the system to replicate *the musical style of the children*. The interaction based on repetition/variation allows the children to organize their musical discourse,

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passing, as in the case of Tom, *from exploration to genuine musical invention.* (p. 40, my italics)

Thus, as in the previous excerpt, the issue of what is “genuine musical invention” (or previously, “genuine creativity”) on the one hand and mere “exploration” on the other is used to make sense of what has been observed. However, it still remains unclear what are taken as indicators of “genuine musical invention” (or creativity) and how this could be ascribed to “the ability of the system to replicate the musical style of the children” or indeed what their “style” is. In what sense do the children have a musical style? Furthermore, it is unclear what is meant by style in this context and what are the empirical indicators for its identification.

Addessi and Pachet (2005, 2006) also point to the fact that the system seems to have the ability to maintain the children’s attention for relatively long periods of time, despite their young age. These findings, together with the children appearing to be surprised and engaged make Addessi and Pachet suggest that “while interacting with the system the children reach high levels of well-being and creativity, similar to those described in the theory of flow (Csikszentmihalyi, 1996)”. The most significant result from Addessi and Pachet’s (2005) point of view, is that they interpret that the Continuator helps the children to develop “very attentive listening skills”, “creative musical conduct” and “a personal music improvisation style” (p. 43). The authors therefore conclude that the experiments with the Continuator show that this system has a strong potential in the field of music education.

The same Continuator project from 2003 is the basis for Ferrari and Addessi’s (2014) study, which focus more on the teacher’s role when the system is used in an Italian kindergarten. The aim of the study was “to analyse if and how the Continuator can be used in the daily school activities and the role of the teacher in free play and in guided activities with the system” (p. 172). The data differ from the protocol used in the pilot study, since there the children interacted individually or in the company of a friend, and the teacher’s role was only to prepare the software. In the later study, which was carried out in 2005, the teacher instead has a more participating role and there are in total 18 children aged 3-5 participating. Three sessions were video recorded with only eight of the children completing all three sessions. Each session was introduced by the teacher as a kind of play. The first, called ‘Exploration’, was about, in a playful manner, exploring the keyboard. The second session included two games, one was about finding a chair when the

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answer from the Continuator stopped playing [in Swedish: “Hela havet stormar”]. The third session was about engaging children in portraying a story with different kinds of instruments. All three sessions also contained free play. The results from the previous studies with the Continuator are, according to the authors, confirmed by Ferrari and Addessi’s (2014) study: The children are interpreted as experiencing flow during their interactions with the system, described as: “We can underline how the Continuator promotes a state of well-being within the group, characterized by a high level of intrinsic motivation, control of the situation and excitement, very similar to the state described in the Theory of Flow” (Ferrari & Addessi, 2014, p. 181). The teacher’s role, while the children are exploring the system, is indicated to be more of an encouraging observer: “When working with the Continuator, the role of the teacher is not to teach, but to observe and to encourage children to imagine situations that allow music to be played” (p. 181).

The assumption here that the teacher should take a step back to let children explore their music playing on their own, is a common rhetoric, particularly in aesthetic domains where it is seen as children’s “free expression” (Bendroth Karlsson, 2011, p. 85). In next section these assumptions will be more elaborately discussed.

Musical interaction

In this section is presented an elaboration on the assumptions underlying the concepts of Musical Interaction in the MIROR project. It is important to be aware that depending on what point of departure that is taken in a study, different assumptions about learning, music and views of children’s development are implied. The assumptions behind the system have been discussed in all of the previous studies in connection to the Continuator. It is presented as primarily emanating from development psychology studies on infant/mother interactions (e.g., Imberty, 2008; Stern, 2004) and to the Theory of Flow (Csikszentmihalyi, 1996, 2014). In a recent article, Addessi (2014) further probe into the assumptions that are supposed to explain the alleged success of the child-machine interactions that have been reported. In the article, Addessi (2014) introduces and discusses the theoretical perspective of the reflexive interaction paradigm, which she indicates is the basis of the MIROR project.

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One of the basic rationales behind the IRMS is the idea of mirroring. Addressi (2014) finds much evidences in previous studies about the importance of repetitions and variations in musical development as it is manifest in infant-adult interaction, a relatively well-researched area of development psychology (e.g., Imberty, 2008; Stern, 2004). However, it is mainly the work of Malloch and Traverthen (2009) that provides the foundation, and their concept of Communicative musicality (the concept will be further elaborated in the following chapter). Addressi (2014) bases her theoretical assumptions on the turn-taking aspects and the dialogue between the child and the caregiver. By analogy, the software of MIROR Impro is expected to replace human communication between the infant and the caregiver, and the same musical development is considered to be promoted by the interaction between the computer and the child: “What happens is that during the reflexive interaction the children are pushed to manipulate their (musical) Self by the dialogue with the mother/father/adult or, in the case of the IRMS, with a machine” (Addressi, 2014, p. 219). Addressi do emphasize that the dialogue established between the child and mother is not directly applicable to the child-machine interaction, but as she says: “The metaphor nevertheless helps us understand the interactive mechanisms that underlie human reflexive interaction with an IRMS” (p. 219). She suggests that there are complex processes going on while children interact with the IRMS. For example “the children are expected to form differentiated judgments about ‘self’ and ‘others’” (p. 219), which are forms of awareness crucial for the development of the child’s identity – their “musical self”. She here refers to Sherry Turkle (1984/2005), an influential scientist who during the 1980s studied children’s programming on computers based on a psychoanalytical and developmental psychology perspective. Turkle’s studies did not explore ‘musical selves’ and she did not use the same methods of observations, as her main methodology was an ethnographic approach and she was mainly interviewing children. Hence, arguably, there is no possibility to explain and investigate IRMS merely on the basis of previously studies which built on different paradigms and had different aims. Addressi (2014) therefore argues for the necessity “to create new and original tools of investigation, notably observational grids, to observe and measure young children’s creativity in a reflexive environment” (p. 222). Addressi and Pachet suggested, as already mentioned, that the theory of flow (Csikszentmihalyi, 1996; 2014) is useful in this context, “as it offers new

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assessment criteria that capture the creative processes in child-machine interaction” (Addressi, 2014, p. 222).

One could question these assumptions about flow theory as more applicable than other theories, since also the originator of this concept in psychology, Mihály Csíkszentmihályi, have had different paradigms and aims. When reading the collected works of Csikszentmihalyi (2014), *Flow and the Foundations of Positive Psychology*, it is obvious that different methods and samples have been used for measuring flow experiences. The methods have actually been one of the most important concerns in Csikszentmihalyi’s (2014) work, and great effort has been made to develop the Experience Sampling Method (or ESM), a kind of questionnaire that adult participants were supposed to fill in at random occasions throughout whole days. The adults measured their experiences during their ongoing activity and they answered questions, such as what they were doing and with whom. Csikszentmihalyi (2014) argues that merely observing another person does not say anything about how they experience the situation. The only thing that can be detected by an observation is a description of what he/she is doing. But if one is experienced and is able to verbalize those experiences, it is possible to report how one feels during a specific activity. Flow is characterized by the presence of high levels of several different variables, such as focused attention, clear-cut feedback, clear goals, pleasure, control of situation, high awareness, absence of anxiety of failure, loss of self-consciousness and change of the perception of time. Of great importance is to have a clear goal to achieve. This is something that Pachet and Addressi (2004) discuss, since improvising with an IRMS has no goals: “There is, however, one flow characteristic that does not apply directly to the Continuator experiments: Clear goals. No explicit goal was given to the children, except to play until they were bored. Indeed, improvisation is generally not goal-oriented” (p. 15). Nevertheless, the designer of both the system and the experiments protocol, Pachet and Addressi, still argue that the Continuator/MIROR Impro can be characterized as a “flow machine”, because of its ability to imitate human playing style on the keyboard and to uphold children’s attention for extensive periods of time (Addressi, 2014; Pachet, 2004b).

To summarize these previous studies in connection to the IRMS systems of the Continuator/MIROR Impro, the results of the experiments (Addressi & Pachet, 2005, 2006) and what is called didactic experiences (Ferrari & Addressi, 2014) have been interpreted by the researchers themselves as very promising.

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It is these results that “led to the creation of the MIROR Project, an EU-ICT Project aiming to develop an innovative system for music learning and teaching in early childhood music education” (ibid., p. 182), the project that initially financed the present study.

This critical review aimed at presenting some of the claims made in the previous studies in connection to the Continuator, and is one of the reasons for the pedagogical partners of the project finding the experiment protocol hard to follow. According to the rationale of the system, the MIROR technology is ‘mirrored’ on the interactional architecture of caregiver-child proto-musical communication (see e.g., Imberty, 2008; Stern, 2004). In addition to these developmental-psychology assumptions there are also some psycho-therapeutic features attributed to this technology (cf. Turkle, 1984/2005) and the psychological concept of “flow” (Csikszentmihalyi, 1996; 2014). Different methods and samples have however been used in the studies, referred by Addressi and Pachet.

In many of the Continuator studies the authors refer to Jean Piaget, for instance when it comes to the experimental protocol. Also their notion about the learning individual child in connection to the IRMS and the role of the teacher as observing and not disturbing the child can be derived from a Piagetian view on development as occurring through the child’s own activity. From this view, the support from an adult is mainly seen as interfering with children’s spontaneous development, since according to this view it is through the child’s own exploration that learning occurs (see Säljö, 2015, for a critical discussion of this assumption).

In the next section there will be a more general review of research concerning young children and musical experiences. This review will for example present a view of children and childhood more corresponding with the assumptions that the present study aligns with.

Musical development

The perception of children and childhood has changed in line with changes in society. In the middle of the last century, psychology as a research discipline dominated this area. Vallberg Roth (2002) argues that the image of children from an individual constructivist view assumes that they follow a general course of development, for example in terms of Piaget’s stage model, which is still visible in recent discussions about the development of the MIROR tech-

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nology (see above). The developmental process is crucially considered to be something that happens within the child. This psychological approach is particularly noticeable when it comes to research on children's musical development from the 1960s through to the 1980s, where the interest for most parts was on the early stages of child development. From this perspective, human learning is assumed to be an individual cognitive process which means that the nature of a person's brain explains the ability to become or be musical (also meaning that children born with an a-musical brain will never learn to be musical). This research tradition premises "experimental designs, modelling development in single modalities outside musical instruction" (Kullenberg, 2014, p. 14). In relation to this approach, experimental music researchers to a large extent look for effects of different music instruction and not seldom is this research focused on children's errors in their singing (cf. Brand 2000; Szabo, 2001). Kullenberg (2014) also discusses another stance among music researchers in relation to children's learning where "learning to sing is a matter of nurturing the expressions of curiosity displayed by the naturally creative child, that is, *the maturational view*" (p. 17, italics in original). It is interesting to compare this view with the one described by, for example, Addessi in the previous section, where learning is implied to be a consequence of children's natural and spontaneous play with a minimum of distraction (interference) from adults.

By the middle of the 1980s it is obvious that researchers found an interest in developing a theory of chronological musical development, in line with Piaget's stages of development. Hargreaves (1986) published a book that has become a key text on musical development from this perspective, called *The Developmental Psychology of Music*. Other examples were Swanwick and Tillman (1986) who presented a general model of musical development (called the Swanwick and Tillman spiral of musical development) and Welsch (1986) who published a model of singing development.

In a survey of contemporary music research in early childhood, Young (2013) shows that psychology and education are the disciplines that have dominated the field, but recently the situation has changed to include different perspectives of music education, including multidisciplinary ones. She argues that this might be the most important change when it comes to research and scholarship in recent early childhood music education, since:

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This expansion into multidisciplinary perspectives reflects changes in how music and musical practices are being conceptualized and in how childhood and children's lives are being conceptualized. It also reflects contemporary social, cultural, and technological changes that are resulting in different patterns of family life, increased heterogeneity of communities (particularly in urban centers), and rapid changes in how music can be experienced through new technological innovations. (p. 977)

Young (2013) argues that a reason for this change is critique of previously taken-for-granted assumptions about childhoods that were based on children's development following universal stages. These stages of musical development were assumed to be applicable to all children, despite the research being based on a Western cultural context, including mainly white children from the middleclass. No account was taken of factors such as class, race, gender and physical ability. The classical view of child psychology and developmental psychology, where the individual child has been studied in a decontextualised manner, independently of society and culture, has in recent years been much criticized (Cosaro, 1997/2011; Rogoff, 1990; Sommer, Pramling Samuelsson & Hundeide, 2010). Contemporary, more context-sensitive perspectives on childhood take a much broader stance to children's everyday, cultural, and societal existence. In these perspectives, childhoods and identity formations are understood as historically and culturally contingent constructions, meaning that they are "not an essential, transhistorical or transcultural continuity, pre-determined by inherent biological or physiological factors" (Lesnik-Oberstein, 2011, p. 1). In many contemporary studies on children's musical development, identities are understood as varying, multifaceted and contextually dependent. For example, Hargreaves, McDonald and Miell, (2012) write about musical identities in terms of:

We all have several musical identities that manifest themselves in different ways. For example, our musical preferences and tastes help to shape how we view ourselves, as well as the image of ourselves that we wish to present to world [sic] around us. (p. 133)

This quote could be read in contrast to Turkle's (1984/2005) and Addressi's (2014) idea about the child's second self as a fixed identity reflecting his or her inner person. Also in contrast to the tendency of psychological studies to homogenize children's development, this quote instead emphasises the heterogeneity of childhoods.

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To summarise this section, in research on children and music there exists a division between seeing music as an individual capacity or as something relational (i.e., an activity that is constituted between people or between people and different forms of cultural tools).

As Sommer (2012) emphasise, there are always individual experiences at stake and not one privileged perspective on how to conceive today's children and their cultures. Music learners with membership in a particular community do not necessarily make the same experience. Also, children who occupy a shared space do not always share a sense of membership or ties to bind them together.

Musical cultures

All changes in the views of the child and childhood, reflect, according to Young (2013), a broad paradigmatic shift “away from the study of individual behaviour in mainly education-derived activities toward taking much more account of context and studying how musical thinking and skills are acquired in diverse sociocultural and material environments” (p. 980). When it comes to music education, Campbell and Wiggins (2013) argue in the introduction of the book *The Oxford Handbook of Children's Musical Culture* that the traditional approach to music education reflected a view of children as blank sheets (*tabula rasa*) when entering school. They were hence merely seen as recipients of knowledge that the adult transmitted with appropriate techniques. According to Campbell and Wiggins it was not until the early 1990s that music education specialists started to expand the view of the child as having musical experiences also outside the realm of formal schooling. Campbell and Wiggins (2013) refer to their own research as ethnomusicology. Young (2013) outlines ethnomusicology as a small but growing field with an interest in children's own cultural worlds, accessed by studying their musical practices, which can take place in numerous places, for example in the home, at the preschools and community learning places. Campbell's (2010) *Songs in Their Heads*, with its first edition in 1998, was one of the first attempts in this direction in using ethnographic fieldwork techniques in the search for children's musical interests and actions. She conducted conversations with children to allow them to speak for themselves as well as making field notes. One of her conclusions is the importance of the efforts teachers and parents can make to “take children from who they musically are to all that they can

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musically become” (Campbell, 1998, p. 223). Listening to children, observing them and talking music with them are ways to become aware of their musical interests and from these starting points plan and design education.

In her survey, Young (2013) refers to other researchers, such as Marsh (2008) and Vestad (2010, 2013), as adopting an ethnomusicological perspective. In 2008, Marsh published *The Musical Playground: Global Tradition and Change in Children’s Songs and Games*. The book presents the results of more than 15 years of research in playgrounds around the world, including both urban and rural playgrounds of Australia, Norway, the United States, the United Kingdom, and Korea. Marsh have explored how children maintain, transmit and transform songs and games from the playground by singing and dancing activities, often drawn from popular music. She found similarities across the countries in how children are singing similar songs and playing related games and chants. Marsh’s interest is in young children’s musical play, which she defines as everyday activities that are initiated by children on their own account (when not engaged in organized educational activities). Musical play are further characterized by being enjoyable, fundamentally motivated and controlled by the players as they invent rules to follow (Marsh & Young, 2006). Understood in this way, musical play is an activity children do with their friends who they learn from: “The primary means of acquiring repertoire is close observation and imitation of aural/oral models performed by more experienced peers” (Harwood & Marsh, 2012, p. 328).

Vestad (2010, 2013) has studied how Norwegian children aged 3-6 use recorded music in their everyday life. This study is of particular interest to the present thesis since she explores preschool children’s musical plays in relation to new music media. She focuses on children’s culture in terms of how the recorded music they listen to reflect their relation to music, their tastes and attitudes. In her study, she analyses a play situation where four children interact while listening to the soundtrack of a TV show for children. She uses the concept of affordance to analyse what the children do with the music and what the music does for, to and with the children. In a later article, Vestad (2014) found a range of contradictory subject positions that are made available by discourses of the child, childhood and music. For example, she has examined “the understandings of the child’s subject positions: children as subjects, children as co-producers of culture, children as beings and becomings, and children as competent and vulnerable” (p. 249). The results show that two contradictory narratives of children’s musicality are available

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simultaneously: the “everybody-can narrative” and the “only-the-talented-can narrative” (p. 248). These results are interesting in relation to previous studies on the MIROR technology where a point of view is that any child is able to sit in front of a synthesizer and express his/her personal musical style. In her studies, Vestad (2010, 2014) finds many examples of how music is used as co-constructions between children in group-play settings in Norwegian kindergartens: “The data also contain examples of children, on their own initiative, teaching themselves songs and lyrics by listening to the same song over and over again with a concentrated look on their faces, while singing a little more of the lyrics each time” (Vestad, 2014, p. 258). She interprets that the children in these examples also acted as subjects with musical agency.

With an intention to combine music psychology with a cultural understanding, Barrett (2011) edited a book called *A Cultural Psychology of Music Education*. Scholars such as Marsh (2011) and Campbell (2011) contribute with chapters also in this book, bringing “an ethnomusicological lens to the cultural psychology of music” (Barrett, 2011, p. 6). The assumptions here are built on Cole’s (1996) ideas to contrast ahistorical and universal theories of minds. He builds his understandings on the work of Vygotsky and Luria acknowledging the role of artefacts, that is, material culture. However, speech is not as emphasized as in the sociocultural perspective that I employ in the present study.

This section has contained an exploration of different views of children and childhoods, from the study of individual behaviour toward taking much more account of context and musical cultures. In the next section, there will be a critical review of the theoretical assumptions underlying the overarching MIROR project, particularly its conceptions of technology-enhanced learning.

Musical reflexion

In the previous section of the review of the MIROR project, focus was on the theme of “Musical Interaction”. In this section, the theme of different assumptions and connotations of the concept of “reflexion” will be in focus since these aspects have been found problematic in connection to the present thesis and the aims of its studies. As already mentioned, there are many claims made about IRMS technology, which stem from different disciplines. In the previous section, assumptions primarily from the psychological partners were presented in terms of the universal child that learns through his or her own

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activity in accordance with a Piagetian perspective. Connections are also made to neuroscience and artificial intelligence, with machines seen as ‘intelligent’ in being able to ‘learn’ the user’s playing style (cf. Turkle, 1984/2005). Addressi and Ferrari (2011) suggest that Reflexive Interaction softwares are “essentially intelligent *mirrors* that continuously attempt to learn and reproduce the musical behavior of the users” (p. 17, italics in original), and furthermore that the system can be seen as an advanced cognitive tutor that is able to promote cognitive abilities.

According to Crook (1996) it is important to have a critical stance towards such generalist assumptions made about a technology, as he argues that:

it is surely fanciful to suppose singular generalisations will be found that can make sense of such diverse educational activities. Computers support a very wide variety of learning encounters in a very wide range of curriculum areas. We must be wary of sweeping rulings on the success (or failure) of new technology. (p. 8)

Crook is also sceptical of the tutorial metaphor where the computer is seen as a tutor, since this perspective is lacking the individual learner’s experiences and it also assumes a view of instruction as static and not as a dialogue contingent on intersubjectivity. Hence, the assumption that the computer could replace a human teacher reveals a view of mechanic learning and learning as quantifiable, which implies that more of the same thing makes learning. Säljö (2010; cf. Crook, 1996; Lantz-Andersson & Säljö, 2014) writes about how computer-aided instruction (CAI) is a perspective on how computers could transform teaching and learning and is based on behaviourist principles of learning. The intention with the computer software is to provide a more stimulating learning environment, adapted to the individual’s need. The word reflexion in the acronym MIRROR and IRMS also reflects(!) the behaviouristic assumption underlying the technology. The theory called reflexology was developed by the Russian psychologist Ivan Pavlov on classical conditioning and conceives learning as reflexive or automatic, based on stimulus and response. This theory was later developed by John Watson and became behaviourism. Säljö (2015), in an overview of different perspectives on learning, explains a behaviouristic approach to learning as individualistic where people’s background is not seen as affecting their ability to learn new things. All humans are according to this perspective, products of the conditioning process and we can all be conditioned to new behaviours. Säljö argues that learning cannot be reduced to only behaviours because then

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many important and crucial aspects of what people can learn and how they acquire experience are disregarded: “In relation to what and how people learn, the claims of behaviourists overgeneralize to something that is far beyond what is actually studied. There are many aspects of human learning that are not captured by this atomistic conception” (Säljö, 2015, p. 35, my translation). Already Vygotsky argued that the reflexology perspective on learning only could explain elementary mental processes, abilities people share with animals (Vygotsky, 1934/1987).

From another theoretical perspective on learning, reflection would mean something completely different than in reflexology. From a pragmatic perspective, for example, language is considered important for knowledge development and the basis for making new insights is to discuss and reflect with others (Dewey, 1910/2007). Through communication and learning, concepts become more and more precise and specific. Learning is, from this perspective, an ongoing process of meaning making that enrich people’s experiences. From this perspective of learning one could question in what way people learn by interaction with “virtual copies of themselves” (Pachet, 2006, p. 360) instead of verbal conversations and meetings with other people’s perspectives and experiences.

As already mentioned, Addessi and Pachet base their arguments for the alleged success of the technology on even more learning theories. In a recent article, Addessi, Mafioli and Anelli (2015) provide an overview of the work that they have carried out within the framework of the MIROR project. They present a neuroscience approach, with reference to Lemán (2007) who stresses that “there is evidence... that mirror neurons are modal in the sense that they can encode the mirroring of multiple sensory channels” and, above all, “mirror neurons perform sensorimotor integration and transformation as the basis of imitation” (Leman, 2007, p. 91). From these claims, Addessi and colleagues (2015) draw the conclusions that: “a reflexive interaction can stimulate a resonance mechanism in the child who is interacting with IRMS, as it is grounded in motor areas of the brain” (p. 1). Young (2013) indicates that the brain imaging techniques used by neuroscientists give access to the music-active brain. For example, it has been shown that music experiences changes the structures of the brain, but there are still no evidence that these changes occur as a consequence of musical learning. There is strong disagreement on how to look at neuroscience research when it comes to its contribution to explain learning in different contexts. Säljö (2015) specifies a number of

reasons for being critical when interpreting results of neuroscience research. For example, he points out that there is only one specific and localized biological basis behind differences in measurable performances. It is not just a biological structure that is studied but instead how people remember, and remembering is an activity with many reasons for people to perform in different ways. Another critique raised by Säljö is that we to a large extent live in a brain-centric world and all pictures of colourful brains entice people to believe that it is possible to instantly observe psychological processes, which appeals to the human need for simple explanations of complex phenomena.

Musical scaffoldings

Addressi and Pachet not only argue that the system (the MIROR technology) can be seen as a ‘flow machine’, they also suggest that it has the ability to scaffold children’s learning:

The Continuator could be thought of as a Flow machine, in that it produces a response corresponding to the skill level of the user. This approach also allows for the progressive scaffolding of complexity in the interaction, which is not the case for most pedagogical tools designed with a fixed pedagogical goal in mind (Pachet, 2006). (Addressi & Pachet, 2006, p. 29)

As seen, the system is explained in terms of ‘scaffolding’, which is said to “not [be] the case for most pedagogical tools designed with a fixed pedagogical goal in mind”. The concept of ‘scaffolding’ (a metaphor from the support raised and consequently de-constructed when constructing buildings) was introduced into psychology by David Wood, Jerome Bruner and Gail Ross in 1976. As used by Wood et al., the concept refers to the manifestation of the help to the child that the adult gives in the situation. The more knowledgeable person gives the learner physical and/or intellectual support during the learning process. The more of the specific skill the learner masters, the more of the support can be removed from the situation (Säljö, 2015). If such a change would be visible (or rather, audible) in the technology-child interaction as studied by Addressi and Pachet (2005, 2006), it would be interesting to clarify this as well as how it is done. However, no such data or analysis is presented in the two studies (both referring to scaffolding), making the nature – or even the occurrence in these situations – of the proposed scaffolding unsubstantiated. In addition, and in relation to the last part of the last quote, it may be noted that in the original account of the concept, scaffolding referred to a

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goal-directed activity (the task of trying to build a pyramid from wooden blocks). In contrast, the interaction between the child and the IRMS technology is not goal oriented.

In a recently published study, made within the frame of the MIROR project, the result indicates that MIROR Impro enhances young pianists' musical capability to explore and improvise (Rowe, Triantafyllaki & Anagnostopoulou, 2015). Rowe et al. studied 19 piano students using MIROR Impro for six weeks. A reason for them to study students with a notation-based and classical piano-education background is said to be based on the results from a previous study. In this prior study, Young and Rowe (2012) studied children with no prior keyboard skill using MIROR Impro and they found that these children tended to be more interested in exploring the keyboard than to go into dialogue with MIROR Impro. Against this background they ask in what way would children that had taken piano lessons and therefore already were familiar with keyboard playing respond to the MIROR Impro system (Rowe et al., 2015)?

A conclusion that can be drawn from the results of Young and Rowe (2012) and Rowe et al. (2015) is that children that already have musical training improved their musical skills by using the system, in contrast to children with no formal piano training. One could hence question in what way the system is supposed to scaffold the child. Should it not be the other way around: that the child with no musical skills would need and receive more support from the system?

In another recent study made within the frame of the MIROR project, some of the participant researchers from Sweden have analysed situations where children interact individually with MIROR Impro (Wallerstedt, Pramling Samuelsson & Pramling, 2015). Their result shows that there is no linearity between how the children use the technology and the way it is designed (i.e., the children do not necessarily use the technology for what it is designed for). Instead, their study shows that the children engage in other activities than the turn-taking and improvising-enhancing dialogue the system is intended for. In contrast, one of the children "rather than improvising and thus creating new music, mainly struggled to play a familiar existing song, taking care not to vary the song" (p. 361). Another aspect that is explored in the study is the importance for the child to be introduced to the technology by a more experienced participant, such as a preschool teacher, in order to point out the ideas underlying the technology. An additional important role

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for the teacher is to introduce cultural tools, such as musical distinctions and categories, and to coordinate “the child’s perspective and the perspective in-built in the artifact (technology)” (p 362). In this way, the system is argued and shown not to be self-instructive and it is also difficult to say in what way the technology is supposed to act as an advanced cognitive tutor (as suggested by Ferrari & Addressi, 2014).

In Wallerstedt et al.’s (2015) study, it is emphasized that it cannot be presumed what experiences, interests and intentions children have in their use of technologies:

The child will always make sense of whatever he or she experiences; even with an artifact designed to afford and promote certain activities and perceptions, what sense children make of it and what activities they engage in will be open to negotiation. (p. 362)

Wallerstedt et al.’s (2015) conclusion summarizes what has been implied in this section of the thesis and suggests the importance of conducting empirical research on what children, all with different experiences and agendas, actually do with and around the MIROR Impro technology. These conclusions are also in line with Crook’s (1996) argument about the importance to “go beyond the input-output design” (p. 9) that is common in research on computer-based learning. The reason is “that any such computer experience is more or less situated in some broader framework of teaching activity” (p. 9). Craft (2012) also highlights the important role of the teacher in this context, and to explore how new technologies can be used in the educational settings. She argues for teachers to co-create with students through dialogue to nurture “the 4 Ps”, that is: plurality, playfulness, participation and possibilities; focusing more on the social than on the non-human dimensions.

Another line of reasoning that is relevant in this context is how the use of computers in education often is surrounded by a patchwork of arguments about its benefits. Lantz-Andersson and Säljö (2014) discuss the importance of noting that many of the arguments that are put forward originate in commercial interests to make producer’s products attractive to the big market of educational tools. They state that it is not unusual that there are commercial interests behind these claims about the educational and didactical advantages of particular technologies. This is also why Peterson (2014) argues for the importance of taking a critical approach when it comes to rhetorical claims about new technologies. She describes that new technologies often are

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surrounded by discourses of their alleged effects, as either good or bad, derived from either an excessive confidence or exaggerated distrust of the technology's ability. She therefore argues for the importance to evaluate the sources of research on digital learning tools to be able to form an idea of where different rhetorical statements about educational solutions come from.

It is also important to be aware of different traditions in music teaching in different countries contingent on structural levels such as different curricula. It is therefore here relevant to also review previous research on music learning in connections to computer-based music making in Sweden. One such study is Nilsson and Folkestad (2005) who present a two-year empirical study where children aged 8 are creating music to different pictures with a synthesiser connected to computer software in a Swedish school context. They identify five variations in the children's music making and they discuss some issues also relevant to this study. For instance, the importance to consider children's previous experiences of music, how the task is introduced to the children, that is the framing of the situation, and also the cultural practises of the children and the digital tools. They found it powerful to understand the children's creative music making within a play frame as it was introduced as an invitation to play. They suggest that the implications for music teachers is "to take children's musical creativity seriously, at the same time regarding children's creative music making as a form of play, and not as a school task with rules and assessment controlled by the teacher" (Nilsson & Folkestad, 2005, p. 35). They also found that an open-ended task to some extent did not contain explicit information, which made it hard for the children to make it into a meaningful experience. It resulted in the children instead of composing music of their own trying to play well-known songs. That is why they suggest to teachers to "guide the children by given a didactic framing to the invitation to create music" (p. 35). Their view of the teacher's role in technology-transformed music learning is also clarified in their final comment:

Today, young children are able to listen to music without any adult interfering, and by using computer music software that is easy to handle they can create music of their own, a fact demonstrated by the results of this study. (p. 35)

The use of the term "without any adult interfering" signals that the argument is positioned in the tradition of music development as a matter of children

exploring and learning on their own (i.e., if they have musical talent). These claims will be elaborated further in the discussion part of this thesis.

Musical playing and learning environment

Particularly in the Scandinavian countries, the playing child is and has since long been a powerful notion, probably even stronger and more positively viewed than in many other Western countries (Pramling Samuelsson & Asplund Carlsson, 2008; Vestad, 2014). In addition, also when it comes to children's musical play there are assumptions deeply rooted in a view of music as an individual ability and play during music-making is seen as a sign of children's free expressions (cf. Bjørkvold, 1980). There has been a tendency for a somewhat romantic view in the literature on children's own culture, implying a notion of children as sacred culture producers, something criticised by Qvortrup (2001) as he instead proposes we look at children as co-producers of culture (cf. Vestad, 2014). In the review from ethnomusicology's point of view of the musical playing child, it is implied that play to a large extent is decoupled from more formal learning strategies. As Harwood and Marsh (2012) argue about one characteristic feature of play, children themselves do not define a playful situation as a learning situation. Playground musicians are instead performing for their own pleasure: "We don't practice – just play" (ibid., p. 328) (cf. Saar, 1999). Also the idea of the importance of the educator to go into dialogue with the child in musical practices might be viewed in different ways. A relational aspect of music development which also Addressi et al. (e.g., 2014) is referring to is Communicative Musicality, coined by Trevarthen and Malloch (2009, 2012). They propose that the early musical experiences very young children have, lay foundations for how playful and engaged they will be later on in their musical lives. They argue that infants from birth prefer musical infant-directed speech and from a very young age they are participating with their voices and dance movements. The concept of Communicative Musicality is based on the empirical materials of a 27-seconds-long recording made in 1979 between a six-week-old girl and her mother having a proto conversation. The importance to respond to infants' initiative to conversation is emphasized, but as an engagement of minds without words (cf. Stern, 2004), since as they argue: "Music is capable of transmitting all colors of human emotion by representing the movements of their expression" (Trevarthen & Malloch, 2012, p. 251). They further suggest

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that since “every child is born with musical sensibilities” (p. 254), an early start for education is preferable. They also propose for a playful and creative cooperative act for learners and teachers with much spontaneous motives.

This approach has greatly influenced research on young children’s musical learning. For example Young (2003a) has investigated three- to four-year olds in a preschool setting in the UK engaged in spontaneous music-making with instruments. She discovered that when an adult participated in the child’s play with the instruments, the child showed interest in communicating with the adult. What is analysed in the study is not verbal communication but the “spontaneously well-balanced, phrased exchanges” in play on the percussion instrument. Even though the interpersonal dimension is here emphasised, it is not the social relationship per se that Young finds interesting, instead highlighting communicative exchanges “as sources for the co construction of new ideas” (cf. Bjørkvold, 1989). In another article based on the same project, Young (2003b) suggests that the implications for practitioners are to learn to observe, to listen to and to identify “the form of organisation that underpin children’s music making” (p. 56). This will help practitioners “to evaluate it positively and consequently to be affirmly and encouraging in their attitudes” (p. 56). The focus of children’s musical play is from this point of view in their own control and they make their own aesthetic decisions in contrast to more formal music education. Marsh (2008, 2011) argues for music educators to observe children’s musical play to incorporate features of these plays in their playful teaching. She argues for the importance of teachers realising “that children are not only learners but also expert teachers within their own milieu” (Marsh, 2011, p. 57). Alternatively, it could be interpreted that the teacher should follow the children and there are no arguments about what the children are supposed to learn from these activities. The suggestions made are more about what to do in the activities than about what the teacher has as goals for the children to strive for in the planned activities.

An alternative view of the playing-learning child is Pramling Samuelsson and Asplund Carlsson’s developmental pedagogy (2008), an early childhood approach. They suggest that if play and learning are to be integrated in education, it is important that the time in preschool becomes unified, implying that the teacher’s role and the children’s roles become equally important: both of them contributing to what is going on in the everyday life in preschool. There are three aspects in particular that clarify the similarities between play and learning: “(1) children’s experience as a point of departure, (2) discernment,

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simultaneity and variation as key-factors and (3) metacognition, metacognitive dialogues and meta-communication as crucial issues” (p. 631). The authors emphasize that early childhood education should be organized to allow developmental forms of interaction and communication between children and teachers (and between children). It is also emphasized to work in a goal-directed way with an adult taking an active part in children’s play. Not only the amount of communication is important, but particularly the nature of the communication, for example, whether sharing perspectives and introducing novel tools, rather than simply asking the child what he or she already knows.

To summarize from a developmental pedagogical point of view, early music education is to notice individual children’s abilities, as they occur in their musical play, and building the curriculum on what is going on in children’s musical cultures. This is all made with an emphasis on metacognitive dialogues between learners and teachers. By combining children’s musical repertoire with the professional skills of an educator might then lead to the co-production of music education (cf. Vestad, 2014). Even though it is important to recognize that children are born with an urge for social interactions and are showing interest in music from an early age, the role of the teacher in providing the children with new musical experiences are important to emphasize, I argue. As a cultural psychology of music education (Barrett, 2011) points at: learning “is not ‘eternal’ defined and determined by biology and chronology alone; rather, that is ‘historical’, and is determined and defined by participation in sociocultural practices and the use of ‘tools and signs’ (p. 4; Vygotsky, 1978). What is not highlighted in this tradition is that the most important tool according to Vygotsky is language and speech.

Even if it is argued that teachers should engage with children in their musical plays (cf Marsh, 2008, 2011; Trevarthen & Malloch, 2012), the importance of providing children with a richer repertoire of musical concepts and other cultural tools have been neglected in previous research.

In the next chapter I will present the sociocultural perspective used in present thesis. From this perspective, verbal communication has an important role in music education.

3. Theoretical framework

In this chapter, the theoretical perspective of this thesis will be presented. At first there is an overview of a sociocultural perspective and then a clarification of in what way this theoretical approach will be used in the analyses. Today, there is not one sociocultural perspective, but different strands. In this thesis, a perspective is taken where learning is understood as changed participation (Rogoff, 2003) and Rogoff's ideas about the mutual meaning making in the notion of guided participation and intersubjectivity are important. Mediation through cultural tools and contexts, as described by Säljö (2000, 2005) are also of importance to the study. This theoretical perspective is found particularly useful for analysing and conceptualizing the kinds of phenomena under investigation in the MIROR project, precisely because it includes in its unit of analysis material as well as psychological tools in human activities (Säljö, 2009). This fundamentally sets this perspective apart from, for example, cognitive psychology, where the 'isolated mind' is the unit of analysis. This sociocultural perspective provides a well-developed and systematic conceptual framework for making sense of observations and how these can be explained.

A sociocultural perspective on learning

The theoretical origin of a sociocultural perspective lies in the writings of Lev S. Vygotsky (1896-1934). His sociocultural (aka cultural-historical) theory was an attempt at overcoming a dualism, separating the individual from the practices s/he takes part in. He rejected the dichotomy between the internal and the external, since he argued that the individual cannot be separated from the social and material environment in which he or she acts, and that therefore learning is always situated in a context. Children in all communities are cultural participants, as he pointed out; they live in a particular community at a specific time in history. The world is mediated for the individual by cultural tools, physical as well as discursive ones, rather than directly perceived. Language and other symbolic system are used in an activity and learning is seen as part of social activities (Vygotsky, 1978). This implies the need for studying children's everyday lives, to examine their involvement in cultural

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traditions and institutions and how they pick up, use and transform cultural tools. Vygotsky's work on the mediational role of language and dialogue have been further developed by researchers such as Jean Lave, Barbara Rogoff, Roger Säljö, Etienne Wenger and James Wertsch, who all belong to a sociocultural tradition (e.g., Säljö, 2000; Peterson, 2011; Rogoff, 1990; Wertsch, 2002). The concept of appropriation has in recent sociocultural theorizing been used to describe people's increasing abilities to use cultural tools through their participation in different social practices. The development of higher mental functioning – contingent on the appropriation of cultural tools – takes place through a process on two planes: Through conversation and collaboration with others the individual appropriates cultural tools that he or she becomes increasingly familiar with and can make use of when reasoning and solving problems. Learning is thus described as a communicative shift from the inter-mental plane, between people, to the intra-mental plane (Vygotsky, 1978), when the individual by herself makes use of appropriated concepts and distinctions.

The zone of proximal development and scaffolding

According to Vygotsky (1978), an effective way of developing skills and strategies is by interacting with peers. He therefore suggests teachers to organise for cooperative learning situations where more experienced participants (for example peers or teachers) can help other participants to develop skills. This learning occurs in the zone of proximal development (ZPD) which Vygotsky defines as “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers” (Vygotsky, 1978, p. 86). The ZPD can be said to be the developmental space that defines what the child can achieve by him- or herself and what he/she can achieve with the help from a more experienced participant in the situation. Children are understood as being in a ZPD when encountering a particular task and if they are given appropriate assistance, for example by being given hints, they will be able to solve tasks they would not be able to solve on their own. The concept of ZPD has become closely tied to the concept scaffolding. It is however important to note that Vygotsky never used this term in his writing. Rather, the metaphor of scaffolding was introduced by Wood, Bruner and Ross (1976) in an article where they do not

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refer to Vygotsky. The concept is explained by Wood et al. as the adult is controlling those elements that initially are beyond the child's capacity, permitting the learner to concentrate upon and complete tasks, or parts of a task, that he/she is able to manage. In this way the task is successfully completed.

Learning as changed participation

One variant of a sociocultural perspective is to conceptualise learning as participants in interaction changing the nature of their participation. According to Rogoff's (2003) orienting concepts for understanding cultural processes and their relation to individual development, "*Humans develop through their changing participation in the sociocultural activities of their communities, which also change*" (ibid., p. 11, italics in original). At the same time as people participate in and contribute to cultural activities, they inherit practices invented by others, even if cultural tools, practices and institutions are partly transformed from one generation to another.

This process of making use of practices, cultural tools and resources inherited from other people in their shared sociocultural endeavours is also labelled situated learning or legitimate peripheral participation (Lave, 1993; Lave & Wenger, 1991). A relevant model for situated learning is apprenticeship, where apprentices and their masters change through acting as co-learners. This is in line with Rogoff's (1990) account of "guided participation", arguing that "both guidance and participation in culturally valued activities are essential to children's apprenticeship in thinking" (p. 8). Subsequent work by Rogoff and colleagues (Rogoff, Paradise, Arauz, Correa-Chávez & Angelillo, 2003) examines how people learn by actively observing ongoing activities as they participate in shared endeavours, where "experienced people play a guiding role, facilitating learners' involvement and often participating alongside learners - indeed, often learning themselves" (p. 187). According to this notion of situated learning, participants develop the ability to take various roles in activities, further resulting in their identities changing (Lave & Wenger, 1991).

In this study, learning as change participation could be interpreted in situations when, for instance, a participant initially takes an observing position, perhaps listening to others playing on the instrument, to becoming

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increasingly involved in the activity and finally being able to take initiatives of his/her own in shaping the activity.

Intersubjectivity and intent participation

In order to analyse the processes of guided participation, Rogoff (1990) refers to the concept of intersubjectivity (see also, Rommetveit, 1974), or “shared understanding based on a common focus of attention and some shared pre-suppositions that form the ground for communication” (p. 71), allowing participants to go on with a joint activity. She argues that guidance by more experienced members of a culture is an essential ingredient in cognitive growth. With the emergence of representational systems (cultural tools) such as language, shared understanding may shift to other objects and events, including those not in the immediate social interaction setting.

In the situations analysed in the present study, the activity of playing with a music technology is for most of the children an unfamiliar experience. One way of attempting to establish intersubjectivity is through communicating in ways that link new experiences to more familiar ones. The purpose of an activity is understood in the tradition of intent participation, as of importance for engagement in it, making motivation inherent. Adult-child and child-child communication are important in employing words to provide needed information during shared endeavours, and questions are a way to seek information in the context of ongoing activities or to explore ideas (Rogoff et al., 2003).

Cultural tools and structuring resources

As Säljö (2005) points out, our lives would look very different if we were not able to make use of experiences made by earlier generations. What we can learn from these previous experiences at the individual, organizational and societal levels form the platform for new generations. What makes this possible is people’s ability to make use of tools in various activities. Säljö argues that there is something revolutionary in how we look at ourselves, our thinking and our abilities to learn. These tools, which have emerged in history, are crucial to how we use our intellect, our bodies and how we interact with others. The way that these change the way we make experiences and how we learn are in a sociocultural perspective expressed as cultural tools mediating (Wertsch, 2002) the world around us in various activities as a way of codifying

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experiences. A basis for Vygotsky's (1978) emphasis on cultural tools and mediation is an assumption that we live in both a material and a conceptual world. As a consequence, there are both physical and psychological tools, artifacts which are man-made objects and tools that are alternatively and interchangeably referred to as linguistic, intellectual, communicative, mental or discursive. The most important tool, in Vygotsky's view, is language understood as a wide set of tools, including categories, metaphors and genres. Of particular importance are the communicative tools (Vygotsky, 1978) that the individual appropriates through the experience s/he is allowed to make. Communicative tools are the resources through which people make sense of the world and take part in other people's experience as they mediate the world for the individual. People also use semiotic tools of a non-verbal kind, such as gestures when communicating (Säljö, 2005; Vygotsky, 1978).

Lave (1988; see also Lave & Wenger, 1999) uses the concept structural resources (borrowed from Giddens, 1979) to understand similarities and differences in the way individuals solve problems in situations that appear to be identical ones. To act within different activity systems is about making judgements of what kind of situation and what behaviours that are proper and expected in these. Structuring resources support the individual to identify, to learn to see, distinct patterns of different practices and to decide what is reasonable and to act in line with these (Lave, 1988; Säljö, 2000).

This line of reasoning is very similar to Goffman's reasoning about communicative framing, something that will be elaborated upon in the next section.

Goffman and the concept of framing

In addition to the theoretical concepts of a sociocultural perspective, referred to above, I will use the concept of 'framing' from Goffman. This concept has previously been used as an analytical concept in socioculturally-informed studies (e.g., Lantz-Andersson, 2009; Linderöth, 2004; Peterson, 2011). It is useful since it, in parallel to a sociocultural perspective, focuses on the participants' understanding of activities. Knowledge is from both these traditions seen as developed in practices and in interaction. Goffman's perspective is also situational and his framework theory emphasizes how people's actions are governed by what they perceive a social situation to be about and their implicit answer to the question: "What is going on here?" (p.

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8). Hence, Goffman (1974/1986) emphasizes that actions, events and utterances do not talk for themselves, they are dependent on what people understand them *as*, which is in line with Bateson's definition of the term frame (Bateson, 1972). There might, of course, be many different descriptions, depending on whether the focus is close-up or distant and from whose perspective. The view of what is going on is likely to differ between individuals in a situation, depending on their roles in it. Often, there is not solely one thing occurring in a situation. Instead it is common that several different things occur at the same time, that is, depending on how people define the activity while performing it, it will be framed differently. Even 'the same' event might differ. For example, how a person experiences a football game is dependent on what team he or she holds as a favourite. Framing is hence important for the participants' interaction possibilities, depending on how they conceive the situation to be and different practices have their traditions of how people are expected to act (cf. structuring resources).

In the analysis made in the present thesis it is *the activity of framing*, as an act that involves agents, that is in focus (cf. Lantz-Andersson, 2009; Linderoth, 2004). In this sense the concept of framing could be seen as more impermanent and negotiable than the term 'frame' which implies a constant substantive.

A sociocultural perspective on play

There is not one concept of 'play' that encompasses all forms of play and that at the same time distinguishes the concept from adjacent ones (e.g., game). According to van Oers (2013), it is important both for researchers and practice to employ a communicable definition of play. In the present study the concept of play as make-believe will be used in Goffman's (1974/1986) sense. He describes make-believe as one of the basic keys that transform a given activity into something patterned on this activity and seen by the participants to be something quite different. He sees playfulness as unserious mimicry during interaction and that "the transformational power of play is nicely seen in the way certain objects are prone (disposed) to be selected for play or disposed to evoke play" (Goffman, 1974/1986, p. 43). One well-known example of this play-objects transformation is when Vygotsky (1933/1966) writes about the child using a broom as a horse.

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As already mentioned, Vygotsky (1934/1987) has been influential when it comes to understanding children's play, creativity and development. He outlines creativity and play as the novel use of previous experience, or 'cultural tools' that he in later accounts conceptualized it in terms of (Vygotsky, 1978).

An important play characteristic, according to Vygotsky (1978), is freedom, even if he emphasizes that every human activity is dependent on rules, which consequently means that there is no such thing as absolute freedom in a play activity. In play, the child submits to some rules that are occurring even in a play that seems to be "free" (cf. Wallerstedt & Pramling, 2012). From an outside perspective, play may appear to be free and impulsive but since the child is able to oppose satisfying impulses and needs, for example to eat candy, this indicates that the child gradually adheres to the rules of the play. The rules of the play can be observed as the participating children are taking different roles and in them directing one another, through meta-communication. Hence, characteristically in children's role play is the sense making children do in a particular situation, as the rules motivate their actions. Since children in playing begin to acquire motivation, skills and attitudes that are necessary for social participation, Vygotsky (1978) argues that they are at the front of their development in these activities. van Oers (2013) has developed cultural-historical theorizing on role play and proposes a reconceptualization of this specific mode of activity, especially regarding the role of adults. He defines play in terms of three basic parameters: rules, degrees of freedom and involvement, and argues for the importance of adults participating in children's role play in order to promote different types of playful learning. Hence, here is a contrast to the view of the teacher's role in children's musical plays that was presented as a cognitivist perspective, where the adult was seen as interfering in children's free expressions.

Music learning from a sociocultural perspective

In contrast to perspectives that view music learning as free expressions of an innate individual capacity, a sociocultural perspective sees music learning as a relational or dialogical process. This does not imply that the individual is not born with some competences. Rather, from this perspective, humans are understood as biological, social and cultural beings. Music learning is hence seen as the transformation of the biologically given as a cultural process (cf. the development of elementary and higher mental functioning (Vygotsky,

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1978). Primarily it is through our interactions with significant others that we develop, which Hargreaves et al. (2012) refer to as Vygotsky's (1933/1966) most fundamental idea, and the heart of a sociocultural approach. In a way we become ourselves through others and of course our musical identities are created because of "how the social environment is incorporated into the development of musical thinking at the individual level" (Hargreaves et al., 2012, p. 126). Also O'Neill (2012) emphasizes the importance to create dialogical opportunities that can seize the contexts that shape learners' musical worlds and expand learning possibilities. O'Neill also points to the importance of organizing for purposeful and engaging activities and that outcomes are both aimed at and emergent, that is, even if the activity is goal-orientated, the route to get there might differ.

Like other learning activities, learning music is tool-dependent. It is important to note that creative meaning making in music not only concerns expression, but also impression. Both are seen as tool-dependent activities. "We rely on our skills for meaning-making when listening to music, when playing with others and when monitoring our own playing" (Wallerstedt, Pramling & Säljö, 2014, p. 366). One fundamental musical skill is the ability to listen in an informed way and to engage in a music-listening activity. The participants in a musical activity are dependent on tools in the form of distinctions and conceptual resources to be able to make musical sense. For the child to appropriate significant tools, he or she is dependent on guidance of a teacher (or a more experienced peer) who introduces relevant resources and guides the child to make sense of these (Lagerlöf, 2013; Wallerstedt, 2010; Wallerstedt et al., 2014). In the present thesis, the importance to understand how these significant others do this is pivotal, in order to explain how the trajectories of the growing mastery of cultural tools in a concrete sense plays out (Vygotsky, 1978).

4. Methods and methodology

In the previous chapter of this thesis, some common assumptions about children's learning with music technologies have been discussed. From these points of views, learning and music-making have been seen as an individual achievement and as an innate capacity, and, furthermore, it is premised that children will learn from technology. These assumptions stand in contrast to a sociocultural perspective on learning and meaning-making as contingent on tool use in social, historical and situated practices. Based on these assumptions, the most appropriate unit of analysis is to study the unfolding of activities when children interact with and in connection to the music technology of MIROR Impro. In this chapter, epistemological premises as well as the study's methodology, implementation and analytical procedure will be presented.

Background and rationale for reformulating the research approach

Since it was proposed by the MIROR project leader that experimental studies should be made with 4-, 6- and 8-year-old children, consents were collected from parents for all three age groups. In the spiral design approach between the transdisciplinary participants it became obvious that from the limited time scale it would not be possible to do individual experiments with all three age groups and also that the individual experiments were not considered relevant from the perspective of the pedagogical partners. We as pedagogical partners argued that what experiences children get of music in early years education is related to their own decisions and in collaboration with peers. These things make experiments like the ones initially devised for the overarching MIROR project difficult to carry out. For example, we have to be sensitive to children's own choices and willingness to participate, and it may be difficult to engage someone to do something they have never done before, particularly if they have to do it alone without a friend by their side. Studies of the music technology of MIROR Impro in naturalistic settings in a Swedish context would mean activities where children can explore the technology with their

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peers. Also more goal-directed activities with a teacher would be relevant to investigate. If viewed from the perspective of Swedish early childhood education and the kinds of activities that children are familiar with from their everyday life, a different kind of study was needed for investigating the use of the technology in such settings. Since there were objections from the pedagogical partners to the originally designed methods, the other partners agreed to a modified protocol involving just the 4-year olds and the 8-year olds. Still, the consent forms from the 6-year olds were already collected. This is why I had the possibility to study the 6-year olds more freely and in line with the arguments above. As seen in Appendix B, the video observations of the individual experiments of the 4- and 8-year olds were conducted in parallel and during the same period of time: three months during the spring of 2011.

The design of the study and empirical data

The empirical material consists of video recordings of sessions when children aged 4-8 are trying the musical system (computer-software connected to a synthesizer) in the educational settings of preschool and after-school centre.

The present study, in contrast to the original idea of the MIROR project, emphasises the importance of studying social activities where children interact with and around the music technology, called MIROR Impro. That is, how children (in this case 6-year olds) and adults (when present) act and participate in activities in connection to the MIROR technology.

Since we had already worked with the preschool and after-school centre in other studies, we had established relations and trust among teachers, parents and children. It was a complex mission to achieve entrance to the settings since it requested a lot from the everyday activities when we had to set up all the equipment required and they had to spare a whole room on our behalf. In order to gain access we had a period of fieldwork to discuss the project with the core participants before the recordings took place. Since the project time scale was tight it had probably been impossible to gain access to schools that we had no prior relationships with, considering the importance of carefully preparatory work for establishing a secure relationship based on trust with the participants.

During two months, I and a colleague from the Swedish project team spent eight days in an after-school centre and ten days in a preschool, where we set up the equipment in separate rooms.

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The generated data collection involves 21 children (see Appendix B) participating individually (Study I), in pairs with and without an actively participating adult (Studies II and III) and in triads (Study IV). Individual-based experiments differ, as already mentioned, from how activities in a Swedish preschool are usually carried out. Because of the organization of educational settings, children are familiar with participating and collaborating with their peers (and their teacher) during ordinary activities. Hence, to conduct the study when the children are interacting more freely with the technology, friends and an adult, arguably increases the ecological validity of the study (Crook, 1996; Suthers, 2006). The ordinary preschool and after school teachers were not present at the sessions since the children according to the original idea of the overarching project were supposed to interact individually with the technology. For this reason, the researchers took the role of teachers in these sessions and encouraged the children to try the system. Some basic rationales for this idea were to let the children take part together rather than being tested individually, and with an adult (teacher) as a partner, communicating and interacting with the children and the technology. The adults' engagement was of spontaneous and informal character, and not planned teaching situations. Both investigators have an education, and have worked, as teachers and they are therefore familiar with this practice and the role of the teacher in these institutions. Dockett, Einarsdottir and Perry (2009) emphasize the importance of having an understanding of the research context and to make efforts in understanding children's comments and how they contribute to the studied situations.

Even if there is much to gain from having participating observers in the studies, there are also a complexity in the double role of being both the one studying and being studied at the same time. This tension includes taken-for-granted assumptions the participant brings to the situation and might not be able to show empirically (e.g., so to speak, read the participant's mind). In this case it was important to have a project group which made it possible to analyse the video films together. Since it was always at least one member of the group who had not been part of the situation, we could help each other with critical questions about what claims can be made on the basis of the empirical material.

Participants

Researchers taking a sociocultural perspective often focus on a small group of children and undertake detailed observation while the children interact in, for example, preschool (Edwards, 2001), and this is also the case with the present study. The children are 4-8 years old and take part either in a preschool or an after-school centre (also called leisure-time centres in current Swedish studies, see for example Lager, 2015; Haglund, 2015) in Sweden. In the after-school centre, eight children participated. The children have been interacting with the technology for up to three sessions each, alone or with one or two friends. In some cases, the researcher has, as already mentioned, also been interacting with the child(ren) during their play sessions or afterwards in stimulated recall interviews (see Table 1 and the overview of participants in Appendix B).

The individual experiment observations consist of eight hours video-recorded data, which have all been transcribed and analysed (Study I). There are also sessions commencing for about 40 minutes each, where two or three peers and, in part, an adult interact with and around the instrument. These have also been transcribed and analysed (Studies II, III and IV).

Table 1: Overview of the four empirical studies

Study	Participants	Sessions	Location
I	20 children 4-8 y., 1 adult	37	both contexts
II	2 children 5-6 y., 1 adult	1	preschool
III	2 children 6-7 y., 1 adult	2	afterschool center
IV	3 children 5-6 y., (1 adult)	1	preschool

The settings

Sweden has an early childhood education system for all children from the age of 1 year of age, full-time or part-time. Part-time is free of charge and full-time is strongly subsidized. This means that almost all children participate from early years. There is a national curriculum stating the mission and the perspective on learning, play and care. The goals of preschool are ‘to strive for’, not to ‘reach’, which also implies that children are not to be assessed (Sheridan & Pramling Samuelsson, 2009). The University-educated teachers

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are in a way generalists, and not necessarily particularly skilful in particular subjects, such as music. Democracy and children's voices, participation and collaboration are strong notions in the curriculum and mandatory for the teachers to apply in their work with the children (Skolverket, 2010). The particular preschool and after-school centre participating in this study are considered to be ordinary in the sense that they have no particular music profile.

The studied preschool consists of four sections with children aged 1-6 years and it is placed in a small community. The sessions were held in a room called the studio, since it is usually used by the children for painting and drawing.

After-school centres, the institution where the studies with the 8-year olds were conducted, have recently been integrated in the curriculum for compulsory school. In the particular after-school centre here studied, there is usually no music activities lead by the teachers and there are no instruments or music technologies available to the children. The children normally choose what to do by themselves and they stay at the after-school centre before and after the school day when parents are at work. The after-school centre is placed in connection to a primary school in a rural area in Sweden.

Observational contexts "vary in terms of the amount of control the observer has over the setting", as Rolfe (2001, p. 235) points out. Since, in the present case, it was in a regular preschool and after-school centre, they could be considered to be naturalistic settings, but since new tools were introduced (a keyboard, a computer and a video recorder) that are not usually present at the preschool/after-school centre, it could also be seen as a kind of designed setting, which increased the ability of controlling a part of the research context.

The sessions were video recorded with a camera on a tripod placed in front of the children who sat beside each other (unless they were participating individually) at a table with a synthesizer and a loudspeaker. There was a bookshelf on the side of the table where the computer with the software installed was placed.



Figure 1: The “designed” setting (in the preschool).

Stimulated recall interviews

In study I, there is a stimulated recall interview reported, which is a research procedure used extensively in educational research today. In three of the cases the participants involved in the individual experiments were proposed to come together and look at the filmed sessions. Stimulated recall is “an introspection procedure in which (normally) videotaped passages of behaviour are replayed to individuals to stimulate recall of their concurrent cognitive activity” (Lyle, 2003, p. 861). What can be learnt from stimulated recall interviews are, among other things, details about procedures people use to engage in particular kinds of activities and also to provide the researcher with important variations in the research context (Demsey, 2010). This could, for example, be variations in the participants’ previous experiences of playing on an instrument or in connection to music technologies. Even if the stimulated recall interviews have much to offer, by allowing more perspectives of the situated activity and not only the participating observer’s experiences, there are some limitations to this technique. Demsey (2010) refers to the difficulty of transducing musical thoughts into words. In the present study, the children used gestures to describe their experiences, but the interviews were very fruitful in providing us with information about how they perceived the situation, since it is, arguably, impossible to observe people’s minds. It is

important to view the interview as an interactional event and to analyse the utterances as responses to the researcher's question.

The validity of the study

Edwards (2001) argues that validity often is a vexed issue in qualitative research approaches because of the competing ways validity is understood within different research paradigms. "Validity in qualitative research is a matter of being able to offer as sound a representation of the field of study as the research methods allow" (ibid., p. 124). The aim is to establish the validity of the study by focusing on the context and the analytical claims. As this study was conducted in the children's preschool/after-school centre and that they were together with their peers, give the study ecological validity for making claims about children's everyday activities, for example in preschool, in a way that cannot be done on the basis of laboratory studies (Suthers, 2006). Regarding the question of generalizability, it is important to report the circumstances of the particular case, but the findings might be related to findings reported in other studies (Merriam, 1994) in the form of recurring patterns of communication and participation. Wallerstedt et al. (2014) discuss the fact that when the analysis is reported in close relation to empirical excerpts (as in the present studies) it makes it possible for the reader to not only see the empirical grounding of analytical claims but also make alternative interpretations, which is not possible if merely reporting categories of responses. The suggested way of reporting research also puts emphasis on being explicit with the theoretical perspective taken (Säljö, 2009) and to make evident for the reader how it is used in analysing the empirical data. Hence the validity is strengthening by being explicit with the theoretical assumptions and to clearly demonstrate the analytical claims made in close connection to the excerpts.

Ethical considerations

Dockett et al. (2009) argue that there is a need to reflect on both the processes and the outcomes of the range of approaches aimed at promoting children's engagement in research, with the specific intent of listening to children's voices. They suggest that there are a number of contextual and relational variables that guide research interactions, and that no 'one best solution' is applicable to all contexts. Engaging with children in research and seeking their

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perspectives are complex processes. Promoting children's participation needs to be aligned with an obligation to conduct methodologically rigorous research and a need for ongoing reflexivity due to the ethical tensions inherent in seeking consent and assent for children's engagement in research. The study follows the ethical guidelines of the Swedish Research Council (Vetenskapsrådet, 2011). I have informed all the participants in the study (the teachers, the principal, the children and their parents) about the purpose of the study, which, according to Coady (2001), is the key to ethical research. In the written letter to the parents, they had the opportunity to determine what they consider best for their children (See Appendix A). It was formulated in words that they would understand and described the nature of the research, what was expected of them and that they could withdraw from the research at any time. The confidentiality of the children was also promised in the consent form. It was ensured that when reporting the research, pseudonyms would be used for participants (the exception being the researchers, when participating in the activities) and settings. The parents had the possibility to also give consent for us to show data for educational purposes, such as video sessions among scholars. Most of the parents did not give their consent for their children to participate in the study. This became a dilemma, as Farrell (2005, 2010) has described, since most of the children showed interest in participating. All children were of course offered to try the instrument connected to the software, even if they had not been given consent to be part of the study.

It was essential to listen to the children's voices when they were interacting with the technology and their friends to be able to know that this was entirely voluntary from the children's side even if adults asked them to participate. Grieshaber (2001) points out that "Because researchers enact and participate in relationships of power, there can be no researcher neutrality" (p. 139). Through the double role of (occasional) participant and observer, I was "sharing the power through collaborative approaches" (*ibid.*, p. 139). Viewing the video documentation it is clear that the children who participated in the sessions contributed with their ideas and it was primarily they who decided in what way they participated, how much they wanted to speak and act in relation to how the activities unfolded. Unfortunately, this was not the case in all the individual experiment situations, as they were originally prescribed by the overarching MIROR project. Initially, most of the children showed enthusiasm in trying the system, but this eagerness had a tendency of getting

somewhat weaker. Instead of showing excitement while interacting all by themselves with the system, many of the children tried to get the adult's attention. They asked questions and wanted to communicate about what they explored while playing the instrument. Since the role as experiment leader during the original experiment protocol was to not engage with the children and to pretend being busy with other matters, the task was markedly contrary to the ordinary preschool teacher's role and the situation was found unethical. It became obvious that most of the children lost interest in participating in the experiment situations when they did not perceive the affirmation that they searched for. This is one of the reasons why a large portion of the video data (i.e., from the overarching MIROR project) is not used in the study, and why it was decided to design a more social and interactional situation for studying children's use of the technology.

Video-documentation of interaction

The children were introduced to the camera beforehand and the camera on the tripod was visible to the children during the sessions. They did not show that they were concerned with being video recorded.

Heath, Hindmarsh and Luff (2010) suggest that when using a fixed camera, the researcher "adopts the role of observer rather than cameraperson" and that "fieldwork may be undertaken alongside recording and can be designed in support of the analysis" (p. 40). In the present study the researchers took an active part in some of the sessions and were hence supported by the camera on tripod, instead of holding the camera in the hand (see Figure 2). However, it is important to note that the recordings do not afford a complete picture of the how the activities proceed; it only represents parts of the event depending on the camera's position (cf. Lantz Andersson, 2009).

Video offers resources of close documentation and observation and presents unique analytical, collaborative and archival possibilities (Derry et al., 2010). It also raises many challenges of which one is to select what aspects of the extensive video corpus that should be sampled for further examination. The selection process must focus on particular information in accordance with the theoretical framework and research questions. Since the present study concerns activities and how they unfold across time through the participants' interaction, I have selected some of the sessions as cases. Because of the overarching interest in investigating children's interaction as musical play, activities

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with this focus were selected for further analysis. After mapping all the data some themes were found. For example, how the children interacted alone or with peers, with and without an active adult, and with and without working software. The cases chosen were particularly illustrative in relation to these themes. Hence the empirical material has driven what should be in focus of the four empirical studies.



Figure 2: A picture made from a video-recorded session. (It is the same setting as depicted in Figure 1, but shows how the participants in study IV were placed in front of the synthesizer)

Transcriptions

The first step of data analysis was based on transcriptions of the video-documented activities. It is important to illuminate the interactive dynamics of the participants' communicative organisation and hence how to turn the conversations into written form. To be able to capture activities emerging at the same time, a column system transcription (cf. Wallerstedt, 2010) was used (see Figure 3). In this way the participants' dialogues, considered as social interactions, are mapped. Through this transcription model, several interesting patterns in the empirical material appeared. For example, it led to identifying uptakes and responses in the participants' verbal and other actions.

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Turn	Time	Event	Teacher (P)	Child H	Child I	<i>MIROR Impro</i>	play on the synthesizer
13	01.15		Vill du prova en gång H och se hur den låter				
14				(nickar, men tvekar)			
15			Eller vill du att jag börjar spela?				
16				Mm (nickar)			
17			Jag börjar att spela..				C-D-E
18						svarar tre toner annan tonföljd	
19	01.30		Hörde du? Det var inte jag som spelade (lyfter upp händerna) det var dator som spelade. Vill du prova en gång?				
20	01.33			(nickar) jag spelar hellre lunka på			
21			ja, spela lunka på				A-H-C-HH
22						svarar med andra toner	

Figure 3: Example of a column system transcription

Analysing the videos

The main advantage of a videotape to other forms of observation is that you can replay activity sequences again and again (Rolfe, 2001). It is also possible to show the films to other researchers, to share analytical topics and to discuss alternative interpretations.

The unit of analysis applied to the video recorded material is tool-mediated activities (Säljö, 2009), encompassing interaction between the participants (children and an adult), and between the participants and the MIROR technology. The method of Interaction Analysis (Jordan & Henderson, 1995) is to identify the ways participants make use of various resources in situated activities. It captures the way the sessions unfold across time in the form of speech, non-verbal communication, and how children interact with, in the

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present case, the music technology, in the way they reason, negotiate and engage in the activities.

When it comes to analysing collaborative interactions, Crook (1996) suggests two distinctive features: firstly, to focus on what access the participants have to a shared understanding and how they manage to coordinate their perspectives with this mutual knowledge. Secondly he highlights the importance to make explicit what resources the studied contexts provide that promote the participants' problem-solving in their interactive accomplishments. Crook (1996) argues that in the foreground of collaborators' conversation is the concern to construct common ground and it is therefore important to capture how they reflect to create a shared understanding.

The analysis in the present study thus identifies the active investment that peers make in and to the organised sessions. It was also important to be sensitive to how the organisation of the underlying shared task offered different opportunities for creating shared understanding. All of these features are contingent on the situation, what previous experiences the participants have and the different contexts of interaction.

A basic premise of human interaction and communication is that people's actions are responses to others present and the situation as they perceive themselves in. As Goffman (1981) emphasizes, this premise makes participation framework important to attend to when analysing human interaction:

When a word is spoken, all those who happen to be in perceptual range of the event will have some sort of participation status relative to it. The codification of these various positions and the normative specification of appropriate conduct within each provide an essential background for interaction analysis. (ibid., p. 3)

This is also why the sense of an utterance (e.g., a question or an answer), "can ultimately depend in part on the specific value of the words it contains and thus [...] escape complete formalization" (Goffman, 1981, p. 6). How participants make sense of an utterance depends on the framing of the situation, that is, how they understand what is going on in the situation and what seems to be the natural way to act and respond (Goffman, 1974/1986). How the participants respond to what is said and done is thus essential to analyse. According to Heath et al. (2010), the concept of participation is an useful resource in analytical work since it provides a conceptualization of the

different ways people engage in the same activity and how sequences of interaction are forming those practices of engagement.

Representations of the transcripts

In the four empirical studies excerpts of the transcriptions have been chosen to illustrate the analysis. Even if the transcripts presented as excerpts do not fully represent the interactional practice, the intention is to present a transparent picture of the events and to provide a representation of how the speech and other actions the participants performed (such as gesturing and playing on the keyboard) were connected. The focus of the transcriptions has been on the spoken words, speech, and less on the gestures used. The way gestures have been transcribed have also varied, depending on what has been in focus of the particular study. The turns have been numbered to be able to point at an utterance or actions in the analysis.

Transcribing musical activities is not unproblematic. It is difficult to represent musical actions and the way that children use their bodies when playing on the keyboard and trying to verbalise how they perceive the sound produced. When songs are sung, this is shown by a ♪-sign.

To translate an utterance from Swedish to English always involves a risk in missing some aspect of the children's meaning making and the transparency of what has been said. Therefore care has been taken to capture the essence of what the participants said and in regards to the situation as such. Eco (2001) argues that it is not necessary to represent the translation in a strictly literal way. A faithful translation of a conversation is in this sense not the same as equivalence in the word meaning, but instead a consideration of the context-dependent interpretations and to the connotations of the words. In the present study it has also been important to consider the children's vernacular and how they sometimes use grammar in another way than adults typically would. The ambition has been to use translated words that appear appropriate for the studied context.

5. Summary of the empirical studies

The overarching aim of this thesis is to explore activities where children (and adults) interact with and around music technology called MIROR Impro, and what this participation allows and supports children to learn, including musical learning.

In contrast to previous investigations of the MIROR technology (including its earlier incarnation, the Continuator) (Addressi & Pachet, 2005, 2006), with a more individual psychological approach, the focus of the present studies is interactions from a pedagogical point of view, theoretically informed by a sociocultural perspective. Thus, the focus is on the participants' interaction with each other and in relation to the instrument connected to the software (MIROR Impro). This means studying how these activities evolve, what the children themselves express and in what ways adults and peers engage each other in and around the technology. Since a basic rationale of the design of this music technology is that the system will take turns with the child; if, and if so how, the children have made sense of the 'dialogical nature' of the technology has also been investigated.

Since the four studies have raised different research questions, different approaches and concepts from a sociocultural perspective have been employed. In this section, the four empirical studies are summarised.

Study I: Exploring turn-taking in children's interaction with a new music technology. Published 2011 in *He Kyru* 2(5), 20-31.

This study investigates empirically 4-8-year-old children's interaction with the MIROR Impro technology. In the study is analysed (1) whether the children participating identify and align with the basic turn-taking rationale of the technology; (2) what characterizes the turn-taking between child, technology and/or another child or an adult; and (3) if and if so how the responses from the technology scaffold the child's musical playing.

The study examines whether the assumption of the technology leading to the establishment of children engaging in turn-taking holds up to empirical scrutiny. The points of departure are twofold. First, from a sociocultural

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perspective, children's knowing, as human knowing more generally, is understood as socially situated (Wells, 1999). The analysis concerns how this knowing is contingent upon how a certain task is communicatively framed. In the case of the specific technology of MIROR Impro, it refers to what the tool/software in the studied situation affords and what aims it may scaffold (Wood et al., 1976). The second premise of the study is the importance of analysing learning from the learner's perspective (e.g., Sommer et al., 2010; Säljö, 2000).

The examples of children using MIROR Impro are taken from approximately eight hours of video recordings. The children are 4-8 years old and they take part either in a preschool or an after-school centre in Sweden. The children interact with the technology for up to three sessions each, alone or with a friend. In some cases, the researcher has also interacted with the child/children, during their play sessions or afterwards in stimulated recall interviews.

The results show that while some children discover the turn-taking nature of the technology's responses, some children need help in noticing this feature. The changing nature of interaction and turn-taking when the child plays the keyboard alone or with a peer or adult is also clarified. When there are two users of the system at the same time, they use both physical and verbal resources to coordinate their playing, and to achieve intersubjectivity that allows them to develop a joint activity (Rommetveit, 1974). Playing together with someone also affords visual impressions (i.e., to see how someone else does), while playing alone with the system is exclusively auditory. When beginning to explore the technology, children use their previous experiences: that is, they use some cultural tools (Vygotsky, 1978) as resources for their activity. In the examples analysed, the children do not necessarily orientate themselves towards the rationale 'inscribed' in the technology, instead being focused on achieving other musical goals, for example, playing a melody rather than improvising. The findings are discussed in terms of a more dialogical notion of musical development than traditionally conceived and the importance of the child's previous musical experiences in relation to his or her activities with the music technology.

Study II: **Engaging children's participation in and around a new music technology through playful framing**, published 2013 in *International Journal of Early Years Education* 21(4), 325-335.

This study reports an analysis of empirical data from a 43-minute session with two 6-year-old children (Hans and Iris) and an adult interacting with and around music technology (MIROR Impro) in a preschool setting. The questions asked are: (1) How do the children interact with each other, the technology and the teacher when the teacher communicatively frames the activity as a playful activity in two senses of the word (i.e., as playing music and pretend playing), (2) what are the children provided the opportunity to learn, and (3) how do they respond to these opportunities?

In this study a participatory frame is used to understand children's engagement with new media and to contextualize media use in relation to institutional structures. Therefore, children's interaction with the technology is studied, in an activity that was framed in a way familiar to children from their everyday life in preschool.

The theoretical framework of this study is a sociocultural perspective, where learning is understood as changed participation (Rogoff, 2003), conceptualized as an act of participation in communities of practice. Rogoff (1990) argues that guidance by more experienced members of a culture (and community) is an essential ingredient in development. In order to analyse processes involved in engaging children, the notion of intersubjectivity (shared focus of attention) has been used. In a given type of activity, there are a set of (often implicit) rules that structure what is going on; Goffman (1974/1986) uses the term 'framing' to refer to these. In this particular study, the activity is framed as playful (in both senses of the word).

The results indicate that the communicatively established framing made it possible for the children (i.e., provided scaffolding for them) to participate actively in a joint playful music-making activity. The children became engaged participants who took the initiative and lead in these joint activities. The adult who took the role of a more experienced peer also provided the children with musical experiences, not only in guiding them to explore the system but also in introducing mediating tools as a way of discerning musical aspects. As the adult framed (Goffman, 1974) the activity as make-believe play, the children

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changed their participation as they explored the computer program instead of only exploring the keyboard. Thus the framing scaffolded the children's engagement in the process, including for them to discern that the technology plays back a piece similar to, but varying from, their own playing. According to the claims made by the designer of the technology (Pachet, 2004), initiating and promoting a musical dialogue (interaction) is premised to happen by way of the design of the program. The children did not in this case spontaneously discover and engage with such a dialogue by themselves simply through the program playing back some musical snippets of music during a pause in their playing. Rather, when the adult took the role of a more experienced participant within a playful framing, the nature of the communication changed, resulting in an activity which engaged the children in a musical dialogue and encouraged them to become central participants in this activity.

Study III: Playing, new technology and the struggle with achieving intersubjectivity. Published 2014 in *Journal of Music, Technology & Education* 7(2), 199-216.

The purpose of the third empirical study is to analyse how a pair of children and an adult taking the role of a 'more experienced participant' (Rogoff, 2003) interact with and around MIROR Impro. The analysis is guided by the following questions: (1) What practices develop when the children interact with and around this novel music technology, with and without an adult taking the role of a more experienced peer? (2) What is the nature of the participants' communication, that is, what structuring resources are introduced and used, and do - if so, how do - the participants establish intersubjectivity?

The technology is explained by the designer, to be an advanced cognitive tutor (Addressi & Ferrari, 2011). Among other things, this implies that children's use of it does not require any scaffolding from a teacher or a more experienced participant; their role is instead expected to be played by the computer. In the study, a sociocultural perspective on learning, emphasizing language, is taken. In order to act within a social practice, people use structuring resources (Lave & Wenger, 1991) that come from a variety of sources. To be able to participate in a social practice presumes the learner being familiar with or supported in identifying those structuring resources that are functional in it.

SUMMARY OF THE EMPIRICAL STUDIES

The empirical data consist of video observations from an after-school centre, chosen as a case to analyse and illustrate the participants' interaction with and around the technology. In the first session the children, Erik (7 years old) and Helen (6 years old), act alone and in the second session one of the investigators (Cecilia) takes the role of the preschool teacher, participating in the activity.

The result shows that the activities, both with and without an adult present, developed into different types of play-based participations: make-believe and/or musical play. In the session where the adult participated, the actions are more musically oriented than when only the children were present. Although the adult provides some structuring resources (counting, using metaphors and gestures) to engage the children in a 'musical dialogue' with the system, they to large extent engage in distinct and uncoordinated activities. By structuring different types of resources (Lave & Wenger, 1991), for example communicate instructions; by gestures and eye contact; by using metaphors or building on previous experiences, the participants at times establish temporarily sufficient intersubjectivity (Rommetveit, 1974). However, they to large extent engage in distinct and uncoordinated activities. The finding that the children (and adult) engage in many different kinds of activities illustrates the creative and open-ended nature of participating in social practices.

Study IV: Musical make-believe playing: Three preschoolers collaboratively initiating play 'in-between'. Published 2015 in *Early Years* 35(3), 303-316.

The fourth study presents an analysis of three six-year-old children interacting in front of the synthesizer in a Swedish preschool and in connection to MIROR Impro. It investigates how a musical role play unfolds as an intermediate activity when there is a malfunction with the set-up of the technology and how it commences when the technology is again functioning. The aim is to analyse how the children's interaction evolves during the intermediate activity. More specifically, the following questions are investigated: (1) How do the children communicate and negotiate in and about (i.e., meta-communicate) the play activity? (2) How do they scaffold each other in their musical performances?

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It is relevant to study children as part of media society and how they develop new forms of play, against the background of children's musical playground having changed as a consequence of the impact of digital music media (Harwood & March, 2012; Vestad, 2010).

The theoretical perspective used in the study conceptualizes people, contexts and tools as constitutive and inseparable elements of an activity (Wertsch, 1998). Seen in this perspective, make-believe play is fundamentally cultural and contingent on experiences made, tools appropriated. In this study, the concept of make-believe play is informed by Goffman's (1974/1986) work, where play is a way of framing an activity. Framing could be defined as what actions and utterances are understood *as* by the participants, for example as make-believe play: that is playfulness, unserious mimicry during interaction. For children to jointly interpret their actions as play, some intersubjectivity is required. The notion of intersubjectivity refers to establishing common ground to be able to create a joint activity (Rommetveit, 1974; Rogoff, 1990). Another aspect that will be analysed in the present study is how the children scaffold each other in their performances of gaining new musical competences.

The result shows how the children make use of the gap that appears, to develop mutual make-believe play and how they actualize and use some of their experiences from other activities, in this case a children's choir. Play can in this sense be seen as an expression of children's cultural frames of references. How the children establish coordination into a joint activity and how they scaffold each other's music performance are also shown. The study relates to children's music experiences in contemporary childhood and how early childhood music education can respond to these.

6. Discussion

The overarching aim of this thesis has been to explore activities where children (and adults) interact with and around music technology and what this participation allows and supports children to learn, including musical learning. The research has focused on the participants' interaction with each other and in relation to the instrument connected to the software (MIRROR Impro). Over the four empirical studies, some more general questions emerged, which will be discussed in this section. These are: How did the children and adult, when present and participating, interact with and around the technology? What was the teacher's or peers role as a more experienced participant in the analysed activities? And finally, what are the implications for a technology-transformed early childhood music education?

This chapter is structured with sections that do not directly correspond to the research questions, but will in different ways discuss them. The first section will give a background to why the present study should not be seen as an effect study of the technology as such. It relates also to the importance of conceiving technologies in early childhood education, and the significance of taking a critical stance towards rhetoric about their alleged effects of children's learning. The second section is closely connected to the first, but discusses and argues for the relevance of the choice of theory and hence methodological implications of the study. The third section provides an overview of the four empirical studies in the thesis and discusses what connects and differentiates them. It is primarily linked with the question about how the children interacted with the music technology. In the section of the changing view of children and childhood I discuss how these assumptions impact on both epistemological and methodological concerns in research but also how they have implications for early childhood music education. Another assumption discussed is the idea about free musical play, also to a large extent connected to the question of the implications of the present study for music education but also for how to conceive playing-learning children – how do features of play and learning interact? The last section is maybe the most important in this chapter and discusses the role of the teacher in this context. The main contribution of this thesis I will argue, is that it shows the

importance of verbal communication to provide children with concepts and distinctions, and how teachers can respond to how the children are making sense in and of these activities.

The present study vs. previous studies on IRMS

In the overview of previous research, particular attention was paid to studies with the IRMS/MIROR technology. A reason for this review was that the interdisciplinary nature of the overarching project reveals several different perspectives on how to understand child-machine interaction. This analysis therefore provided a frame of reference and presented an argument for the theoretical basis of the present study. The designer of the technology, Pachet (2003, 2004a, b, 2006, 2010) have invested much effort to develop the technology and of course has an interest in convincing others to see what he sees in his product. It is important to note that even if there are a lot of arguments about the studies made and how the Swedish children reacted to the technology, these are not normative judgements about the technology as such. Questions about technologies in educational settings today are too complex for us to make general judgements about their benefits for, or hindrances to, children's development; that is, in the present context whether they enhance children's musical skills or not. Answers to such questions will always have to be formulated in more qualified terms. The outcome is contingent on what musical experiences the child has from home or preschool activities, but mainly it depends on the nature and development of the child-machine interaction and how meaningful it appears to the child, that is, whether, and if so how, the child engages with the technology and the activity. For example, in Study II it is shown that the playful framing provided by the adult scaffolded the children in the process as they became engaged participants and jointly developed the activity. Hence, the participation of the adult, who introduces the technology and what expectations he/she has on the technology are important, and whether the activity applies to the child's interests and how they interact with others. In Study I it becomes clear that it was not obvious for the children how the turn-taken machine was supposed to work. It also shows that the children in the study were used to discover new games and technologies together with peers and adults. In the initial "experiment situation" they could see and hear their peers playing together

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outside the room. In the videos you can see that the children are trying to get the adult's (experiment leader/researcher) attention, but since the initial project protocol was not to 'interfere' with the child-machine interaction, their search for attention was in vain. There was a significant change in how the children lost interest in exploring the technology from the first individual experiment to when they tried it for the third time and many of the sessions lasted merely a couple of minutes. In contrast, the 6-year-old participants had the opportunity to interact with peers and adults during their exploration of the technology and most of the time they did not finish their sessions on their own initiative but instead time ran out and the adult had to stop the activity. Another clear result of the empirical studies in the thesis is that even if there is an inbuilt function in how the technology is supposed to work, there is no guarantee that the children by themselves discover these features or find them interesting. Generally, the studies show the situated aspects of learning and what sense children make of the technology and what activities they engage in are open to negotiation between the participants.

The meta-issue of the importance of theory for empirical observation

The most important function of the critical review of the previous MIRROR studies was to exemplify how research on musical development in the context of new technologies is conducted. The methodology of these studies is often based on experimental and laboratory procedures and typically they have the individual as the unit of analysis. The review also shows that the previous studies (Addressi, 2014; Addressi & Pachet, 2005, 2006; Ferrari, & Addressi, 2014; Pachet, 2006) are based on markedly different theoretical perspectives and some of them do not share ontological groundings, making the knowledge they generate difficult to combine. One example is when Addressi and Pachet (2005) suggest that children have certain musical styles and that musical style is integral to the very idea (the design) of the technology. However, it remains unclear what are taken as indicators of "the ability of the system to replicate the musical style of the children" (p. 40) or indeed what their "style" is, as I have already mentioned; In what sense do the children have a musical style and what are empirical indicators of this? Considering the fact that 'learning' is a commonly referred term in Addressi's and Pachet's articles, it is noteworthy that these texts speak about the technology in terms

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of 'learning'. As cogently argued by for example Bruner (1990), information processing is fundamentally different from learning; the former being algorithmic while the latter is an active sense-making endeavor. As concerns 'musical style', this notion makes sense within the framework of the original investigations of the technology which were conducted with professional jazz musicians (see, Pachet, 2003, 2004). However, when used in early childhood education with children who may not have any previous experience of playing an instrument, such as the keyboard, it immediately becomes far less useful to presume that the child has a certain musical style.

According to the original idea, the first set of studies to be conducted in the overarching MIROR project was to investigate the possibility that MIROR Impro facilitates a state of flow in children interacting with it. Building on the theory of flow of Csikszentmihalyi (1996, 2014), the hypothesis was that the technology would facilitate this state of being. The theory as developed by Csikszentmihalyi builds, as already mentioned, upon interviews with adults where they clarify their experiences. That people may describe certain experiences as them being in a state of flow is an empirical fact. However, to transfer this empirical result to the study of children's activities with a musical technology transforms the object of study from what people retroactively report to what can be observed in people's actions. It is unclear how this can be observed from a research point of view. We can only study what is empirically available for observation; we cannot read people's minds or mental states (cf. Ivarsson, Schoultz & Säljö, 2002).

This discussion leads to the argument of the importance of analysing the process of children's engagement in the video-observed sessions. Since in this thesis a sociocultural perspective on learning is taken, instead of merely analysing the individual child's behaviour and for instance presupposing that children are learning because they show excitement (cf. Addressi & Pachet, 2005), emphasis lies on communication as the mechanism of learning.

Empirical data in the form of video documentation makes it possible to analyse the participants' communicative processes, that is, how they relate and respond to their peer's initiatives and contributions as well as the responses from the music technology. Studies II, III and IV in this thesis can be considered process studies, which implies that they capture the unfolding of events from initiation to conclusion. In Study II the analytical focus of the evolving activity is how Hans and Iris become engaged participants in a joint playful activity supported by the playful framing introduced by the teacher. In

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Study III it is shown how Erik, Helen and Cecilia struggle to achieve intersubjectivity and how social interactions are multifaceted. That is, depending on how different perspectives are coordinated, intersubjectivity might be established or not, or to greater or lesser extent. In Study IV it is shown how Ann, Liv and Sue develop a mutual make-believe play and how some previous experiences from other activities are actualized in this play. Since intersubjectivity and coordination of perspectives have been at the core of these analyses, it is necessary to document in some detail the participants' interactions, their sense making and actions and that the sessions are transcribed thoroughly and verbatim. The analyses have been made in close connection to the transcribed excerpts.

Overarching themes and differences

The four studies map four different aspects of the empirical material. Study I (Wallerstedt & Lagerlöf, 2011) consists of both individual observations of the children in sessions that were part of the design of the overarching project and also observations where more than one participant was engaged in the interaction with MIROR Impro. The study explores the children's perspectives of the turn-taking principle inherent (designed) in the technology. The study can be seen as a background to the following studies, since more and diverse kinds of empirical data is being analysed and a combination of the methods observation and stimulated recall interviews have been used. One important result of Study I is that there is a changed nature of interaction when the individual child is interacting with the technology in comparison to when this interaction also includes peers/adults. The findings emphasise the relational aspect of music learning as a more dialogical notion than what could be observed from the individual experimental situations. The three following studies are more in-depth analyses of case studies and are focusing on peer interaction and are process studies (cf. Pramling & Pramling Samuelsson, 2011). These studies are validated by the analysis that is reported in close relation to the empirical excerpts and by being explicit with how the theoretical perspective have been used in the analysis process with the empirical data (Wallerstedt, Pramling & Säljö, 2015). The three case studies are focusing on three different aspects of these particular interactions. In Study II (Lagerlöf, Wallerstedt & Pramling, 2013) there are two six-year olds and an adult interacting in the preschool context with and around the music

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technology. In Study III (Lagerlöf, Wallerstedt & Pramling, 2014) there are two children interacting with and around the music technology, with and without an adult. This study is conducted in an after-school centre and the adult is a trained music teacher. This is something that in many cases distinguishes Swedish preschool from a school context since teachers for older children often are more subject oriented than in preschools where most teachers have a generalist training. What implications does the different teacher training have for children in preschool/primary school when it comes to music learning? This thesis does not contain empirical data making it difficult to answer such general questions, even if the question is relevant and can be raised on the basis of this research. The last study, IV (Lagerlöf, 2015), concerns three six-year olds who are interacting with and without the music technology in the preschool context. In this study, there is a focus on children's culture and the experiences they have of popular music and in what way this frames their make-believe play "in between".

An overarching theme for the three case studies is that the activities in different ways can be characterized as diverse kinds of play events. In Study II, the make-believe play is about how Hans and Iris orient towards the technology *as if* it could talk to them through the synthesizer. In this situation there is an adult present that can support the children to coordinate their perspectives and they are able to establish a joint activity. In Study III the make-believe play is not efficiently coordinated all the time, perhaps because Erik is not being explicit about the imagined situation when he orients to the red light on the loudspeaker *as if* it was a staring lizard. In Study IV, Ann, Liv and Sue share previous experiences and to a larger amount are able to share perspectives on the make-believe play, where they act *as if* they were choir leaders/project leaders. In these examples it is obvious what part the artifacts (Säljö, 2005) or play objects (Goffman, 1974/1986) are disposed to play in the patterned activity. Both artifacts (synthesizer, video camera, loud speaker and computer) and discursive tools are used when the children enact their make-believe play. Seen in this perspective, make-believe play is thus fundamentally cultural and contingent on experiences made, tools appropriated. The participants' engagement in their interactions and meaning making of the unusual activity of trying a synthesizer connected to a music technology also unfolded as playing in two senses of the word: playing on the instrument and make-believe playing.

Changing views of children and childhood

Throughout the history of research on children's development carried out in different disciplines, there have been, and still are, different assumptions on how to conceptualize children and childhood and what part children's culture and play have in this. Assumptions about children and childhood encompass understanding not only children but also approach towards children and questions about how to conduct research on and/or with children (Dockett, Einarsdottir & Perry, 2009). It is important to have a historical perspective on how the view of children have been changed, since social, cultural, historical and political conditions shape the thinking of researchers' and teachers' often taken-for-granted truths or common assumptions.

In cognitive psychology research, particularly in the domain of music, there has been a strong focus on infants and how they relate to and communicate with their primary caregivers (Imberty, 2008; Malloch & Traverthen, 2009; Stern, 2004). What can be observed to happen in infant interaction and proto-communication will therefore be fundamental to that childhood perspective, which often leads to a focus on what children should be developed towards and *become* later in life. This view also encompasses a universal view of children's development. Even though the empirical material in this study is limited, since only 21 children were participating, the result shows a range of different ways of sense making in the activities in connection to the music technology (MIROR Impro). This also illustrates the importance of taking children's previous experiences and different learning contexts into consideration. As Sommer (2012) emphasise, there are always individual experiences at stake and not one privileged perspective on how to conceive children and their cultures. The participants in the studies may all be members of Swedish early childhood education, have access to the same musical choices, but even then they do not necessarily have the same experiences. Childhoods are thus understood as a varied and structural phenomenon. With such an approach, children are studied here and now and how they are engaged in making sense in the situation in interactions with their surroundings. In opposition to an exclusive focus on what children can become, this perspective on children's development instead, or rather also, focuses on what children already are (cf. Sommer et al., 2010 Vestad, 2014).

From this perspective, children construe a connection to other situations in interpreting or defining the task they are given, which in these studies is

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shown by the children's make-believe playing. They also interpret what the adult wants from them and act in response to this expectation. In Study III it is shown that the situation is unusual and especially Helen does not seem to know what is expected of her. She chooses to follow and imitate Erik in the way he plays on the piano. Even if the adult asks questions, such as when Cecilia asks: "Can you play light Helen?", Helen just looks down and shrugs her shoulders, even if she earlier in the session has shown that she knows how to play light. The meta-question is then: What does he/she [the adult] want from me? What is the intention of this activity? This is what Rommetveit (1974) describes as "the why of the situation?" (cf. also Goffman, 1974/1986). If conceptualising activities in terms of intersubjectivity, a child's action is thus not just a reflection of his/her inner self (cf. prior MIRROR studies), his or her innate abilities, but rather a reflection of the child's sensitivity to and of mastering of the code for the action or speech act that is reasonable and appropriate in the intersubjectively established space between the child and the other participants in the situation (cf. Sommer et al. 2010).

The view of the child as relatively socially competent has to do with changing conditions for children. Today they are living in a wider world and are from early years establishing numerous relationships, for instance through participating in preschool activities. Since it is in relation to the cultural context that the child acts as competent and resilient, it is important to study children's everyday actions and interactions with others in the child's life. To be able to study an activity from the child's perspective, or rather a participant's perspective it is a prerequisite. This means seeing the participants as research subjects and not as research objects, as actors rather than informants and instead of regarding them as isolated individuals see them as social beings (cf. Sommer et al., 2010). In the present studies the ambition has been to present the children as authentic as possible by giving them names and contextualise them in their environment. Even if the names Hans, Iris, Erik, Helen, Ann, Liv and Sue are not their real names, the children are in every ways real children. To make them as genuine as possible it has been important to transcribe every word they have said and most of their gestures made in the video clips. In the music activities it has therefore been the meaning-making process where the social and cultural aspects are recognized and elaborated on that has been of prime importance.

‘Free’ musical play?

When it comes to children’s musical play there are still strong common assumptions about their singing and playing as signs of alleged innate capacities. But if singing is their mother tongue, as it was proposed by Bjørkvold, how come children today prefer singing pop song, as illustrated in Study IV (see also Marsh, 2008; Vestad, 2014), rather than children’s songs as found in Bjørkvold’s (1980) study, conducted in Norway in the late 1970s? Can this difference be accounted for in terms of changes in contemporary musical ecologies of children? That is, what do we read children’s musical expressions (singing and playing) as indicators of: musical experiences and/or genetic disposition (‘talent’)?

Play in Swedish preschool is often referred to as “free play”. The aim of this activity is often said to create a space for children to act freely and independently. Children’s “free expressions” is a conception used both when it comes to children’s music making and their play, and musical play in this case means that teachers take a step back in order to allow children to improvise and act upon their own alleged innate abilities.

If musical play is conceptualised from a sociocultural perspective, based on Vygotsky’s theorizing about play and creativity, these processes are inherently about turning past experiences into new ones. We use something already familiar in a new way, in other words, that is, play and creativity are understood as contingent on the appropriation of cultural tools. No situation is identical to another situation, which means that each new activity requires some active creative sense making. This feature is for example shown in the examples in Study I when Anna tells Cecilia: “At home I use to play the whole song...” as an explanation to why she found the answer from the system to be annoying. Free creation and free play therefore, from this perspective, presuppose that children have started appropriating some kinds of cultural tools. To be able to express something freely requires one to have something (some cultural tools) to express oneself with. Hence, from this perspective, free play – or musical improvisation in connection to new music technology – does not mean freedom from ‘interference’ by adults or more experienced peers. In relation to, for example, Nilsson and Folkestad’s (2005) study (see above, p. 27) one could ask why one way of framing the situation excludes another. Is it not possible to guide children to discern musical aspects through a playful framing (cf. Lagerlöf et al., 2013)? Since education has goals to strive

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for or to achieve also when it comes to music learning, is it not the teachers' responsibility to facilitate children achieving musical competences? Furthermore, since Nilsson and Folkestad (2005) argue that "the synthesiser and the computer software represent powerful tools, which facilitate the participants in expressing their musical idea without being formally trained in music" (p. 35), one could ask: Is it really sustainable to rely on digital tools to provide opportunities for children to acquire musical skills?

It is shown both in Study II and III how the adult communicatively scaffolds the children to make sense of the music. A way of doing this is by referring to the children's previous experiences, what they have told or shown the adult beforehand. As when Iris is asked what the computer programme did (last time) and she answers: "Well...Spoke..." and the adult later on making a playful framing of the situation by asking the children: "Would you like to play (Swedish: *leka*) that we talk with the computer through the synthesizer?"

Together, the studies of the present thesis show the educational values of adult involvement in children's play (cf. van Oers, 2013; Fler, 2015) and that since these kinds of activities, characterised by participants' shared attention and engagement, are favourable for them to start appropriating music-cultural tools.

The role of the teacher in musical sense making

Also the issue of the teacher's role in music education is replete with common assumptions related to contemporary views of children's development and education. The teacher's role in music education has been described in many different ways, but remarkably few of these seem to describe a teacher who actually go into dialogue with the children/pupils about the musical content and contributes to developing their knowledge about this. Even if the importance of communicating has been shown in studies of music activities with children, for example in Young (2003a), it is rather an instrumental communication through percussion instruments that is highlighted. Also in the theory of communicative musicality (Malloch & Traverthen, 2009) and the assumptions underlying the MIROR technology, it is not the verbal or discursive tools that are in focus, but instead imitating sound making.

When reviewing literature on music education, the cognitivist/Piagetian perspective is often prevalent (see e.g., Addessi & Pachet, 2005; Young, 2013).

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In this tradition, the child's own activity is in focus and the teacher's role is to take a step back and not 'interfere'. This perspective is also evident in Nilsson and Folkestad's (2005) study, when they argue for the value of the children exploring music technologies on their own, without adults 'interfering'. The use of the term "without any adult interfering" (p. 35) signals that their argument is positioned in the tradition of music development as a matter of children exploring and learning on their own (i.e., if they have musical talent). This anti-pedagogical perspective (cf. Säljö's, 2015, analogue critique of Piagetian theory), in effect, obliterates the role of the teacher in children's music learning. In fact, the very notion of music *education* loses much of its meaning.

Historically, this view was a response to an earlier approach to music education that reflected a view of children as blank sheets (*tabula rasa*) when entering school and that they were merely recipients of information that the adult transmitted with appropriate techniques. The view of the music-learning child can further be related to different teacher roles: (i) children are incapable and need to be trained by a teacher; (ii) children develop by themselves and do not need any training, merely to be observed; (iii) children are competent and do not need to be trained, just encouraged and (iv) the perspective implied by the present thesis, on the basis of its empirical studies: Children are competent and therefore can be developed further through the teacher entering into dialogue with them with and about the music activity. This is for example visible in Study II when Hans is able to design the reply from MIROR Impro and think ahead in the situation. All three participants are in this session engaged and goal oriented, but at the same time it was a playful activity. Since play activities are negotiated through verbal meta-communication also a communicatively playful framing of a situation in connection to music activity is shown to support children's sense making.

According to the latter view, one important task for teachers is to provide children with musical experiences, that their parents or other significant caregivers in their surroundings are not necessarily able to provide them with. Every child should have the same opportunity to choose what they want to spend their time doing, rather than this being dependent on what family they have been born into. This is a fundamental democratic aspect: to strive for creating the same developmental opportunities for every child. To give every child a real opportunity to make choices of their own requires that they are introduced to, have become familiar with and supported in various fields of

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knowledge and traditions, such as different types of music and different aspects of music. One of the roles of a preschool teacher is therefore to give children opportunities to have experiences that they would not necessarily otherwise have. Even if it is important to notice what music children choose to play with and listen to, using these experiences and preferences can be used as a starting point in teacher-lead education. It is however also important to challenge children and help them to discern different kinds of musical aspects and traditions (genres etc.). From this perspective, a role of the teacher could be described as a co-creator, participating in children's play, sharing attention and engagement with the children and giving them opportunities to start appropriating cultural tools in musical domains. Music education is, in this perspective, at heart a matter of supporting children to become active participants in different musical cultures, both as listeners and performers.

The role of the teacher as a more experienced participant in musical play is to scaffold children in the interpretation of the activity. In the zone of proximal development, the competences of the more experienced might be lent to the less experienced mediated by communicative tools such as pointing and describing. Hence, the role of the teacher is to go into dialogue with the children about the musical content and to contribute to the further development of their musical actions and knowledge. Even if music as content is well worth to highlight also in the preservice of teacher students, the most important aspect is to realize that children do not learn less mundane forms of knowing by themselves. The role of the teacher is thus very important also in children's meaning making of the context of their musical play. Since children's perspective on technology-mediated music education in early childhoods and how musical play is occurring in preschools and afterschool centres is a relatively under-researched area, further investigations in their "natural" settings are needed.

On the basis of Vygotsky's perspective (1934/1987) on play and learning, it is not enough that preschools and afterschool-centres organize for learning through play. In addition, teachers must ensure that children receive complementary experiences and perceptive tools that are possible for the child to relate to and that are nuanced and varied. Vygotsky (1978) argued that the joyfulness of play might be the most important characteristics which may be linked to engagement, interests and motivation. An important part of play is the motivational potential that the playing represents. Nurturing this interest, through relating new tools to children's experiences in mutual activities poses

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a challenging ambition to early childhood professionals, regardless of whether these activities are mediated by technologies.

7. Swedish summary

Musikalisk lek. Barns samspel med och i anslutning till musikteknologi

Inledning

Denna avhandling handlar om yngre barns samspel med och i anslutning till en musikteknologi¹ i förskola och på fritidshem i Sverige. Avhandlingen är en del av ett storskaligt och tvärdisciplinärt EU-projekt med namnet MIROR (Musical Interaction Relying on Reflexion, 2010-2013). Övergripande fokus i projektet var att utveckla ett datorprogram genom att studera barns användande av det. De tekniska parterna i projektet utvecklade prototypen av en mjukvara, MIROR Impro, designat för att hjälpa barn att lära sig musikalisk improvisation i förskolans och de yngre skolårens verksamhet. Programmet som är en så kallad IRMS-teknologi (Interaktivt reflekterande musikaliskt system) installeras på en dator som ansluts till en synthesizer och när den som spelar på instrumentet gör en paus i spelandet ”svarar” datorn. Programvaran omvandlar det som användaren har spelat och spelar tillbaka ett svar som låter på liknande sätt. Tanken är därmed att användaren och datorprogrammet ska turas om att spela i något som kan liknas vid en musikalisk dialog. I den version av programmet som barnen har använt i föreliggande studier finns inte något för barnen synligt gränssnitt i datorprogrammet, utan i den mån de interagerar med mjukvaran sker det uteslutande via synthesizern.

Användningen av ny teknologi i undervisningssammanhang har studerats från olika perspektiv de senaste decennierna och skilda synsätt tenderar att kollidera med varandra (Lantz-Andersson, 2009; jfr Crook, 1996). Ofta landar diskussionerna i normativa bedömningar om vad som anses vara ”bra” och

¹ I den svenska sammanfattningen används ordet ”teknologi” även om ”teknik” i vissa hänseenden kan anses vara mer korrekt översättning. Wallerstedt, Lagerlöf, Pramling, Olsson & Pramling Samuelsson (2014) anger: ”Teknologi innebär enligt dess etymologi ”läran om teknik”. Det var också så ordet tidigare användes på svenska. Under senare tid har dock ordet i likhet med i många andra språk, till exempel engelska, danska och norska, kommit att användas synonymt med ”teknik”. Att vi i enlighet med detta talar om teknologi i stället för teknik är för att det senare i vissa (vardags)pedagogiska sammanhang har betydelsen av ett speciellt föreskrivet tillvägagångssätt (en metod för utläring), något som återkommande kritiserats av pedagogisk forskning” (s. 45).

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”dåliga” lärandemetoder (se t.ex. Peterson, 2014, för en kritisk diskussion). Flera olika antaganden om barn, lärande, musik och ny teknologi finns i den pågående diskursen och MIRROR-projektet som sådant är ett typiskt exempel på hur olika synsätt kommer i spel. Projektet som var tvärdisciplinärt visade att ontologiska, epistemologiska samt metodologiska antaganden inte var helt förenliga mellan deltagarna, vilket ledde till att en del initiala planer för projektet fick omförhandlas (vilket kommer att utredas närmare i texten).

Barns musikaliska förutsättningar har drastiskt förändrats under senare år då dagens förskolebarn har tillgång till en mängd musikval genom t.ex. Spotify och Youtube, vilket leder till unika möjligheter till ökad självständighet i deras musikaliska liv (O’Neill, 2012). Det har t.o.m. hävdats att i och med att de tekniska förutsättningarna så snabbt har förändrats har innebörden av vad det är att vara barn förändrats, vilket kan komma att utmana grundläggande föreställningar om vad barndom är eller borde vara (Buckingham, 2009; Craft, 2012; Livingstone, 2009). Det faktum att teknologi har blivit en alltmer självklar del av yngre barns vardag har således föranlett olika debatter om dess upplevda för- och nackdelar.

Även om den digitala teknologin inte längre kan definieras som ”ny” finns det nya aspekter att beakta när det gäller utbildningsmiljöer – inte minst vad införlivandet av tekniken som sådan innebär för lärarrollen. Många argument för nya datorprogram i utbildningssammanhang härrör från olika kommersiella intressen, vilket tydliggör vikten av att alltid ha en kritisk hållning gentemot resultat som pekar på den nya teknologins påstådda effekter på barns lärande (Lantz-Andersson & Säljö, 2014; Peterson, 2014).

Forskningen om teknologitransformerat lärande har dessutom tenderat att fokusera på resultatet av lärandet som en produkt, snarare än att studera lärande som process, till exempel lärare och barns kommunikation och samordning (se även Pramling & Pramling Samuelsson, 2011, för en diskussion). Eftersom ett sociokulturellt synsätt har antagits i denna studie ses lärande som deltagande i sociala praktiker snarare än som ett individuellt och kognitivt internaliserande av färdig kunskap (information). Från ett sociokulturellt perspektiv handlar det således om att analysera delaktighet och kommunikation som processer.

Eftersom musik är en så viktig del av yngre barns vardag, betonas i dag behovet av att utifrån ett deltagarperspektiv studera barns musikaliska kulturer som en sammanflätad del av deras musikaliska lek (Campbell & Wiggins, 2013; Harwood & Marsh, 2012). Det finns få begrepp som är så tvetydiga som

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lek och även om lek har använts som en del av lärandet i förskolan, har läraren oftast haft en passiv roll i den (Fleer, 2015). Även om retoriken om lekens värde för barns lärande har funnits under längre tid, har det saknats teoretiskt grundad empirisk forskning på området. I studier som antar ett vygotkskijanskt perspektiv på lek har det dock hävdats att den teoretiska basen i analysen kan begreppslighetsgöra ett lekfullt lärande och samtidigt beakta den vuxnes viktiga roll i barnens lek (Fleer, 2015; van Oers, 2013).

Studiens syfte

Avhandlingens övergripande syfte är att undersöka aktiviteter där barn (och i vissa fall vuxna) interagerar med och i anslutning till en musikteknologi (MIRROR Impro), och vad detta deltagande möjliggör och stöder barn att lära sig (inklusive musikaliskt lärande). Följande frågor har varit vägledande för analys och diskussion:

*Hur interagerar barnen, i par eller triad med kamrat(er) och även med en vuxen som i vissa fall deltar i aktiviteten, med och i anslutning till teknologin?

*Vad är lärarens eller kamraters roll som mer erfarna deltagare i de analyserade aktiviteterna?

*Vilka är implikationerna av en teknik-transformerad musikundervisning i pedagogisk verksamhet med yngre barn?

Avhandlingen är en sammanläggning som består av fyra empiriska delstudier i form av publicerade artiklar samt en kappa som tar ett mer övergripande perspektiv på delstudierna samt ett metaperspektiv på MIRROR-projektets olika utgångspunkter.

Tidigare forskning

I detta avsnitt ligger ett särskilt fokus på tidigare studier gjorda med MIRROR-teknologin (även kallad IRMS-teknologi). Det ursprungliga namnet på teknologin är "the Continuator" och den första versionen utvecklades för vuxna musiker (Pachet, 2003). Anledningen till att ägna så stor del av forskningsgenomgången åt dessa studier, är att den tvärvetenskapliga karaktären av projektet avslöjar flera olika perspektiv på hur samspelet mellan barn och maskin kan förstås. Den här kritiska genomgången av studierna kan

därför rama in, referera till samt argumentera för den teoretiska grund som härvarande studie utgår från.

Tidigare studier av IRMS-teknologi

Flera tidigare studier av barns användande av IRMS-teknologi är genomförda som individuella experiment, där ett barn i taget har fått spela på en synthesizer som är kopplad till datorprogrammet. Sessionerna har videodokumenterats och observationerna har därefter analyserats. Antaganden har gjorts om att IRMS-teknologi har stor potential för yngre barns musiklärande och detta diskuteras och relateras mestadels till utvecklingspsykologiska teorier samt anknytningsteorier i form av samspel mellan spädbarn och moder (Imberty, 2008; Malloch & Traverthen, 2009; Stern, 2004). Det antas också att barnen upplever ”flow” (Csikszentmihalyi, 1996) när de interagerar med teknologin (Addessi, 2014; Addessi & Pachet, 2005, 2006; Ferrari & Addessi, 2014). Flow är ett tillstånd som innebär att en person upplever höga nivåer av flera olika variabler, såsom ökad uppmärksamhet, tydlig målfokusering, lustfylldhet, situationskontroll, hög medvetenhet, avsaknad av rädsla för misslyckanden och en annorlunda tidsuppfattning. Tydliga mål anges som en viktig flow-variabel, något som saknas vid musikalisk improvisation. Det går även ifrågasätta metoden att observera barns eventuella flow-tillstånd. Csikszentmihalyi (1996, 2014) som har myntat begreppet ”flow” inom psykologisk teoribildning är konsekvent i sina framskrivningar om att ”flow” endast kan utläsas från vuxna individer som själva definierar och registrerar sitt psykologiska tillstånd i ett noga utformat frågeformulär.

Analyserna i de tidigare studierna är i flera fall inte gjorda på basis av definierade begrepp för lärande och kreativitet och kan därför ses som vaga ur ett pedagogiskt perspektiv. Det antas t.ex. att barn lär sig då de ser exalterade ut (Addessi & Pachet, 2005, s. 35), vilket inte har en tydlig teoretisk förankring. Ett av de grundläggande resonemangen bakom teknologin rör den spegling som antas ske när teknologin svarar på det barnet har spelat på synthesizern. Här utgår författarna främst från teorin om kommunikativ musikalitet (Malloch & Traverthen, 2009) vilken grundar sig på den tidiga och medfödda protomusikaliska utveckling som barn sägs visa när de härmar och interagerar med sin omsorgsperson (t.ex. en förälder). I analogi med detta

resonemang om musikalisk utveckling är alltså tanken att denna IRMS-teknologi ska kunna ersätta den mänskliga partnern i den musikaliska dialogen.

De tidigare studierna kan tolkas som att de utgår från en piagetansk kognitivistisk barn- och lärandesyn när det gäller vikten av att barnet på egen hand ska samspela med teknologin och att lärarens roll är att inte lägga sig i, endast observera (Ferrari & Addessi, 2014). Stöd från en vuxen anses därmed störa barns spontana utveckling, eftersom lärande, enligt detta synsätt, sker genom barnets eget utforskande (se Säljö, 2015, för en kritisk diskussion av detta antagande). Denna syn på barns utveckling som universell och individuell har tidigare varit kännetecknande för det musikpsykologiska forskningsområdet, men detta fält har under senare år öppnats upp för alternativa barn- och barndoms perspektiv, vilka kommer att behandlas i nästkommande avsnitt.

Barns musikaliska utveckling

Young (2013) visar i en forskningsöversikt av musikstudier om yngre barn att psykologi och pedagogik är de områden som har dominerat fältet. Under förra seklet var det vanligt med experimentella studier i laboratorium, långt ifrån de situationer och kontexter där barn naturligt kommer i kontakt med musik. Inläring sågs som individuella kognitiva processer där hjärnans utformning bestämde om ett barn var musikalisk eller inte.

Under senare år har dock den tidigare synen på barns utveckling kommit att ifrågasättas och alternativa tolkningsramar speglar även förändringar i samhället i stort vad gäller en ökad social, kulturell och teknologisk heterogenitet. Nutida perspektiv på barn är pluralistiska, vilket gör att det allt oftare talas om barndomar i stället för *en* universell barndom (se t.ex. Löfdahl & Pérez Prieto, 2012). Därmed har en bredare hållning vad gäller barns vardag samt kulturella och samhälleliga förhållanden upprättats. I dessa perspektiv förstås barndom och identitetsskapande som historiska och kulturellt betingade konstruktioner (Cosaro, 1997/2011; Rogoff, 1990; Sommer, Pramling Samuelsson & Hundeide, 2010).

Inom musikforskningen har under de senaste åren t.ex. etnomusikologi fått ett allt större genomslag, med forskare som t.ex. Campbell och Wiggins (2013) samt Marsh (2008), vilka har ett intresse av att studera barns kulturella världar. Ofta utmanas i detta perspektiv den traditionella västerländska musiktraditionen genom att barns musikaliska kulturer i olika delar av världen

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studeras. Det finns inte ett privilegierat perspektiv på hur dagens barn och deras kulturer uttrycks. Unga människor som tillhör en viss gemenskap behöver inte företrädesvis dela samma upplevelser av musik. Qvortrup (2001) anger att det har funnits tendenser att barns egen kultur blir romantiserad, vilket innebär en föreställning om barn som heliga kulturproducenter. Estetik i form av t.ex. musik och även lek tenderar att betraktas som barns fria uttryck och de bör därför, utifrån detta synsätt, inte störas. Qvortrup (2001) föreslår att istället för att se på barn som kulturella producenter välja att betrakta deltagarna som medkonstruktörer (jfr Vestad, 2010, 2014).

När det gäller lärarens roll för yngre barns musikinlärande, är det fortfarande vanligt att de föreslås ta ett steg tillbaka för att låta barnen på egen hand utforska musikaliska aspekter och lära sig tillsammans med sina kamrater (t.ex. Harwood & Marsh, 2012).

Antaganden om teknologitransformerat musikinlärande

De tidigare studierna av Continuator/MIROR Impro bygger på antaganden om IRMS-teknologin som härrör från olika discipliner. Utöver de som nämnts finns även utgångspunkter tagna i neurovetenskapliga perspektiv samt i definitioner om teknologin som artificiellt intelligent. Intelligensen anses ligga i att teknologin kan lära sig användarens spelstil och att den dessutom kan betraktas som en ”avancerad kognitiv lärare” som kan främja barnens tänkande (t.ex. Addressi & Ferrari, 2011).

Enligt Crook (1996) är det viktigt att ta en kritisk hållning gentemot så generella antaganden om teknologier. Han argumenterar för att det inte går att göra enkla bedömningar av teknologins förtjänster eftersom utbildningssammanhangen rymmer en mängd olika scenarier. Metaforen ”datorn som lärare” tar inte hänsyn till den enskilde elevens upplevelser då undervisningssituationer inte är statiska. I de här fallen bortses helt det faktum att undervisning handlar om intersubjektiva möten i form av lärandedialoger.

Ordet ”reflexion” i projektets namn MIROR (Musical Interaction Relying on Reflexion) och i IRMS-teknologins (Interactional Reflexion Musical System) speglar även de behavioristiska antagandena bakom teknologin. I reflexologin sågs lärande som något som sker automatiskt med hjälp av stimulus och respons. Dessa tankar utvecklades i det som i dag kallas behaviorism. Säljö (2015) visar att behavioristiska antaganden härrör från en individualistisk syn på lärande där individens bakgrund inte anses påverka

hans eller hennes förmåga att lära. Redan Vygotskij (1934/1987) argumenterade för att reflexologins lärandesyn endast förklarade elementära lärandeprocesser, förmågor som vi människor delar med djur.

Förutom att författarna bakom de tidigare studierna (Addessi & Pachet, 2006; Pachet, 2006) hävdar att IRMS-teknologin fungerar som en ”flow”-maskin, påstår de även att den har förmågan att stötta barnens lärande. Addessi och Pachet visar dock inte konkret i sina studier på vilket sätt teknologin har stöttat barnen. Inte heller framgår vilken form av problem som teknologin skulle hjälpa till att lösa.

Musikalisk lek i lärandemiljöer

Även när det handlar om barns musikaliska lekar finns förgivettaganden som är djupt rotade i en syn på att lek vid musikaliska aktiviteter ses som barns fria och individuella uttryck. Också i studier utifrån perspektiv som tar avstånd från individuella utvecklingspsykologiska teorier om barns lärande, ses leken ofta som helt skild från den formella undervisningssituationen. Att barnen inte själva upplever att de lär sig i leken uttrycks som något eftersträvansvärt (Harwood & Marsh, 2012; Nilsson & Folkestad, 2005; Saar, 2005). Även om lärarens roll och kommunikationen betonas som viktiga, handlar det ofta inte om en verbal dialog utan om en musikalisk interaktion med hjälp av t.ex. trummor (Young, 2003a, b). Lärarens roll anges i flera av de här studierna vara att observera, lyssna och identifiera hur barnen organiserar sina musikaliska lekar för att kunna bekräfta och uppmuntra dessa. Det nämns inget om vad läraren förväntas lära barnen utan pedagogiska implikationer visar istället på metoder för ett görande.

En alternativ syn på det lekande lärande barnet är Pramling Samuelsson och Asplund Carlssons (2008) utvecklingspedagogik som är ett förskoledidaktiskt förhållningssätt. De hävdar att om lek och lärande ska integreras till en helhet är barnens och lärarnas roller lika viktiga och att alla bidrar till verksamheten. Framför allt pekar de på tre aspekter som tydliggör sambandet mellan lek och lärande:

- (1) Barns erfarenhet som utgångspunkt;
- (2) Urskiljning, med samtidighet och variation som nyckelfaktorer; och
- (3) Metakognition, meta-kognitiva dialoger och metakommunikation som avgörande aspekter.

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Att förskoleverksamheten organiseras för att möjliggöra för en medveten interaktion och kommunikation mellan lärare och barn och mellan barn-barn betonas som betydelsefullt. Dessutom påtalas vikten av att arbeta målinriktat genom att lärarna tar en aktiv roll i barns lek, inom en målstyrd praktik som förskolan är. Utifrån det här perspektivet handlar yngre barns musikinlärande om att få syn på barnens förmågor så som de tar sig uttryck i deras musikaliska lekar och bygga en målinriktad verksamhet kring dem. Detta kan ske genom att kombinera barnens musikaliska intresse och repertoar med ett lekfullt lärande, där metakommunikativa samtal om musiken får utrymme samt att olika musikaliska begrepp och distinktioner introduceras av lärarna. De lekande lärande barnen liksom de vuxna blir därmed samtliga aktiva deltagare och medkonstruktörer av musikundervisningen.

Avhandlingens teoretiska ramverk

Teoretiskt grundar sig ett sociokulturellt (även benämnt kulturhistoriskt) perspektiv på Lev S. Vygotskijs skrifter. Perspektivet erbjuder alternativ till vedertagna dualismer då det t.ex. argumenteras för att individen inte går att separera från den sociala och fysiska omgivning där han/hon verkar. Barn är kulturella deltagare, då de lever i en viss gemenskap vid en viss tidpunkt i historien. Världen medieras genom kulturella redskap, fysiska såväl som diskursiva, och lärande förstås som ett situerat deltagande i sociala praktiker med hjälp av språk och andra symboler (Vygotskij, 1978). Detta innebär att för att undersöka barns medverkan i kulturella traditioner och praktiker – hur de fångar upp, använder och transformerar kulturella redskap – behöver de studeras i sitt vardagliga liv. Vygotskijs arbeten om det medierande språket och dialogens funktioner har vidareutvecklats av flertalet forskare, t.ex. Lave, Rogoff, Säljö, Wenger och Wertsch som alla har utarbetat sina bidrag till ett sociokulturellt perspektiv. På senare år har begreppet *appropriering* blivit allt vanligare när det handlar om att beskriva hur människor tillägnar sig kulturella redskap i olika sociala praktiker. Utvecklandet av högre mentala funktioner – avhängigt approprierandet av kulturella redskap – sker genom en process på två plan: (i) genom konversation och samspel med andra blir individen introducerad för och börjar ta över kulturella redskap som han/hon blir allt mer bekant med och (ii) så småningom kan individen använda sig av redskapen vid olika former av problemlösning. Lärande beskrivs därmed som

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en rörelse från det intermentala planet, mellan människor, till det intramentala planet (Vygotskij, 1978), när individen självständigt använder sig av dessa begrepp och distinktioner.

I avhandlingens delstudier har olika begrepp från det sociokulturella perspektivet varit vägledande för analyserna av de aktiviteter barnen deltar i. Nedan presenteras de mest centrala begreppen.

Att lära tillsammans med en mer erfaren deltagare

Den proximala utvecklingszonen (ZPD) kan sägas vara det utvecklingsområde som finns mellan vad barnet kan klara av att utföra på egen hand och vad han/hon kan utföra med hjälp av en mer erfaren deltagare. Barn kan definieras vara i ZPD när de med hjälp av anpassat stöd, t.ex. frågor och hintar, klarar av att ta sig an och lösa en särskild uppgift eller ett problem som de inte kan lösa på egen hand (Vygotskij, 1978). Begreppet har kommit att om inte bli synonymt, så intimt förknippat, med *scaffolding* (Wood, Bruner & Ross, 1976/2006). Vygotskij själv använde sig dock aldrig av detta begrepp. Ett annat begrepp som är nära associerat med ZPD är Rogoffs (1990) begrepp för lärande som sker tillsammans med andra: *guidat deltagande* (guided participation). Dessutom kan Lave och Wengers (Lave, 1993; Lave & Wenger, 1991) begrepp *situerat lärande*, *lärlingskap* och *legitimt perifert deltagande* förstås som att de beskriver liknade lärandeprocesser. En grundläggande poäng med dessa begrepp är att de beskriver den förändrade arbetsindelningen mellan deltagarna i en aktivitet, det vill säga vem som gör vad och hur detta förändras under loppet av en pågående aktivitet.

Språkets meningsskapande betydelse

Bakgrunden till Vygotskijs (1978) betoning på kulturella redskap och mediering är antagandet om att vi lever i en värld som är såväl materiell som begreppslig och att vi därför är i behov av både fysiskt tillverkade *artefakter* och intellektuella (språkliga, kommunikativa) redskap. Språket i vid bemärkelse (kategorier, metaforer, genrer m.m.) är enligt Vygotskij vårt viktigaste redskap. Genom kommunikativa, även icke verbala redskap (t.ex. gester), skapar människor mening och får del av andra människors erfarenheter då dessa medierar världen för den enskilda individen (Säljö, 2005; Vygotskij, 1978). Lave (1988, se också Lave & Wenger, 1991) använder sig av begreppet *strukturerande resurser* (lånat av Giddens, 1979) som begrepp för den

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tolkningsram människor använder för att kunna agera, identifiera och tolka olika former av aktivitetssystem. Med hjälp av dessa kan människor avgöra vilken form av situation de deltar i och göra en tolkning av vad som förväntas av dem. Strukturerande redskap är därför en viktig del i vårt kunskapande när det handlar om att lära sig att se vad som kännetecknar olika situationer och hur man förväntas delta i olika former av sammanhang (Säljö, 2005). Detta resonemang påminner mycket om hur Goffman (1974/1986) resonerar om *kommunikativ inramning* (framing). Goffman intresserade sig också för hur människor förstår och agerar genom situerade sociala interaktioner. Handlingar, aktiviteter och uttalanden talar inte för sig själva, de är beroende av hur deltagarna förstår dem. Hur aktiviteter ramas in beror således på hur deltagarna tolkar vilken form av situation de agerar i (jfr Lantz-Andersson, 2009). Ofta inträffar inte endast ett scenario i situationen; det vanligaste är att flera saker händer samtidigt. Beroende på hur olika människor som deltar i aktiviteten definierar den, kommer aktiviteten att ramas in på olika sätt, vilket kan leda till att deltagarnas perspektiv inte koordineras. För att kunna analysera de processer som sker i en lärandeaktivitet refererar bland annat Rogoff (1990) till begreppet *intersubjektivitet* (även Rommetveit, 1974). Intersubjektivitet kan benämnas vara ”en gemensam förståelse som bygger på ömsesidigt fokus och vissa delade förutsättningar som utgör grunden för kommunikationen” (Rogoff, 1990, s. 71, min översättning). Intersubjektivitet är därmed en förutsättning för att deltagarna ska kunna etablera en delad aktivitet. Kommunikationen mellan vuxna-barn och barn-barn är en förutsättning för att sätta ord på det som händer (metakommunikation) och frågor är ett sätt att få fatt på information eller för att utforska olika synpunkter och perspektiv i samband med en pågående aktivitet (Rogoff m.fl., 2003).

Lek utifrån Goffmans och Vygotskijs perspektiv

Som tidigare nämnts är det få begrepp som är så mångfacetterade som just lek. I denna avhandling förstås lek utifrån Goffmans (1974/1986) definition av låtsaslek (make-believe play). Han definierar lek som en form av nyckel som kan transformera en given aktivitet till en ”mönstrad” (patterned) variant av denna och som därmed uppfattas av deltagarna som något helt annat. Lekfullhet ses av Goffman som en form av samspelande och oseriöst efterhärmande av det som kan sägas ske i den givna aktiviteten.

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Transformerandet tar sig uttryck i hur lekobjekt väljs ut och anpassas till aktiviteten. Ett typexempel på ett sådant lekobjekt är Vygotskijs (1933/1966) kända exempel av hur ett barn använder en sopborste som en häst. Vygotskij (1930/2004) har varit väldigt inflytelserik när det gäller förståelsen av barns lek, kreativitet och utveckling, som han definierar som barns nya användande av tidigare erfarenheter (kulturella redskap). I leken underkastar sig barn olika former av regler, även om leken i sig kan tyckas vara ”fri”. Regler kan bli synliga genom hur barn tar på sig olika former av roller och då de regisserar varandra med hjälp av metakommunikation. Det karaktäristiska i barns rollekar är meningsskapande (sense making) i relation till de regler de etablerar. Vygotskij (1978) hävdade att barn i leken låg i framkant av sin utveckling (jfr ZPD) eftersom de i leken börjar förvärva förmågor och attityder. van Oers (2013) har vidareutvecklat Vygotskijs teoretisering av rollek och han definierar den utifrån parametrarna regler, grader av frihet och delaktighet. Han betonar dessutom hur viktigt det är att vuxna deltar i barns lekar för att främja olika typer av lekfullt lärande (jfr Pramling Samuelsson & Asplund Carlsson, 2008). Här ligger en kontrast till kognitivistiskt perspektiv i relation till lek och barns musikaliska aktiviteter. I ett sociokulturellt perspektiv spelar den vuxne en viktig roll medan den vuxna ur ett kognitivistiskt perspektiv anses störa barns fria uttryck om de deltar i leken.

Ett sociokulturellt perspektiv på musiklärande

I kontrast till perspektiv som ser på barns musikaliska aktiviteter som uttryck för en medfödd individuell förmåga, ser sociokulturella teoretiker på musiklärande som en relationell och dialogisk process som görs tillsammans med signifikanta andra deltagare (Barrett, 2006, 2011; Kullenberg, 2014; Wallerstedt et al., 2015). O’Neill (2012) betonar vikten av att utforma lärandemiljöer där de lärandes kontexter och musikaliska världar kan tas tillvara samt hur viktigt det är med meningsfulla och engagerande aktiviteter som ändå är målinriktade. Musikaliskt meningsskapande handlar inte bara om musikaliska uttryck (sjunga, spela) utan lika mycket om intryck (lyssna), vilka båda från detta perspektiv förstås som redskapsberoende aktiviteter. En grundläggande musikalisk förmåga är förmågan att lyssna på ett informerat sätt i en musiklyssningssituation. För detta är deltagarna i behov av kulturella redskap i form av distinktioner och begrepp för att kunna få grepp om (begreppsliggöra) musiken. För att kunna upptäcka och lära sig att använda

relevanta redskap, dvs. appropriera, behöver barnet hjälp av en mer erfaren deltagare (t.ex. lärare) (Lagerlöf, 2013; Wallerstedt, 2010; Wallers, 2014).

Metod och metodologi

När MIROR-projektet startade 2010 började diskussionerna om hur studierna som skulle undersöka barnens användande av MIROR Impro-teknologin skulle utformas. Det var dock redan fastslaget att det skulle röra sig om experiment där barn individuellt och med minsta möjliga vuxenpåverkan skulle pröva datorprogrammet i anslutning till en synthesizer under tre tillfällen. Det var viktigt att situationerna var så likartade som möjligt för att kunna göra statistiska jämförelser mellan delstudier av de olika parterna i olika länder. Det visade sig dock att barnen i den svenska kontexten inte fann experimentsituationerna intressanta. De sökte uppmärksamhet hos den vuxne som var instruerad att spela upptagen med annat och barnen valde att avbryta efter endast ett par minuter när de inte fick kontakt med den vuxne. Således gick det inte att påvisa att barnen upplevde någon form av "flow"-tillstånd, vilket barnen i tidigare studier av Addressi och Pachet (t.ex. 2005, 2006) hade tolkats befinna sig i. Den kulturella kontexten ramar in all form av forskning och här visade det sig att i studier gjorda i den svenska kontexten fungerade inte den här typen av experiment. Designen kom att modifieras i den svenska förskole- och fritidskontexten så att barns interaktion med MIROR Impro i stället innebar att barnen tillsammans med kamrater och i vissa fall även en vuxen utforskade och lekte med teknologin. Som följd av insikten om att barnen inte var villiga att delta i den experimentella designen, kom de studier som ingår i denna avhandling att designas utifrån andra premisser än de ursprungliga projektgemensamma studierna.

Studiens design och empirisk data

I kontrast till tidigare studier (t.ex. Addressi & Pachet, 2005, 2006) undersöker denna avhandling sociala aktiviteter när barnen interagerar med och i anslutning till MIROR Impro. Empirin består av videospelningar där 21 barn i åldern 4-8 år provar teknologin (datorprogrammet anslutet till en synthesizer) i en förskola och på ett fritidshem i Sverige. Under två månader, åtta dagar på fritidshemmet och tio dagar på förskolan, genererades dataunderlaget. Dessutom förekom flera förberedande möten på plats i

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förskolan och på fritidshemmet. Projektets tidsschema var begränsat, vilket ledde till att jag (med förskolläraryrkgrund) samt Cecilia (med musikleäraryrkgrund) ledde aktiviteterna, då det var vi som kunde installera och koppla upp teknologin. I designen av de individuella ”experimenten” ingick att vi inte skulle ”störa” barnen, men i de sessioner som främst ligger till grund för härvarande avhandling, tar vi en roll som kan jämföras med en lärare (studie II-IV). Motiven bakom denna idé var att låta barnen (två och två eller som triad) delta tillsammans istället för att testas individuellt, och med en vuxen partner som är med och kommunicerar och interagerar med barnen och teknologin. Samtliga sessioner är transkriberade och analyserade.

Förskolan som deltar i studien består av fyra avdelningar med barn i åldern 1-6 år och ligger i en mindre kommun. Fritidshemmet ligger i anslutning till en grundskola i en mindre ort på landsbygden. Varken förskolan eller fritidshemmet har någon särskild musikprofil utan kan karaktäriseras som ordinära svenska förskolor/fritidshem.

Datorn med datorprogrammet installerat, synthesizern med högtalare samt videokameran på stativ togs till platsen och riggades upp av oss som genomförde studierna. Vetenskapsrådets etiska riktlinjer har följts. (För mer ingående diskussion om studiens trovärdighet samt etiska aspekter hänvisas till själva avhandlingen.)

Videoanalys

Analysenheten i det videoinspelade materialet är både handlingar och samspel mellan deltagarna och musikteknologin. Interaktionsanalys (Jordan & Henderson, 1995) utgör studiernas analysmetod och innebär att identifiera på vilket sätt sessionerna utspelar sig över tid; på vilket sätt deltagarna tar fasta på och använder sig av olika resurser i aktiviteterna. Analysen fångar därmed hur sessionen utvecklar sig genom det som uttalas samt icke-verbal kommunikation och hur barnen interagerar med i detta fall musikteknologin.

Summering av de empiriska studierna

Studie I: Exploring turn-taking in children's interaction with a new music technology. Publicerad 2011 i *He Kupu* 2(5), 20-31.

I den här empiriska studien undersöks hur barn i åldern 4-8 år interagerar med musikteknologin och huruvida deltagarna kan identifiera den inbyggda turtagande funktionen i teknologin och delta i linje med denna. Dessutom riktas intresset mot vad som karaktäriserar turtagandet mellan barn, teknologi och/eller ett annat barn eller en vuxen, samt om och på vilket sätt svaren från teknologin stödjer barnets musikspelande. Utgångspunkten är tvåfaldig: För det första, utifrån ett sociokulturellt perspektiv ses kunnande som socialt situerat och beroende av hur en viss uppgift är kommunikativt inramad. I fallet med den specifika MIROR Impro-teknologin handlar det om att urskilja vad datorprogrammet kan erbjuda och vilka förmågor det är tänkt att stötta (jfr Wood et al., 1976). För det andra, en utgångspunkt rör vikten av att analysera lärande utifrån den lärandes perspektiv (t.ex. Sommer et al., 2010; Säljö, 2000).

Exemplen där barnen använder MIROR Impro är tagna från ca 8 timmars videoinspelningar där barnen har deltagit i upp till tre sessioner var, antingen själva eller tillsammans med en kamrat. Deltagarna är 4-8 år och går antingen på en förskola eller på ett fritidshem i Sverige. I vissa sessioner deltar även en vuxen, antingen som deltagare eller efteråt vid en intervju gjord genom så kallad stimulated recall.

Resultatet visar att även om vissa barn själva upptäcker att teknologin fungerar genom ett turtagande, behöver andra barn stöd för att upptäcka denna funktion. Det visar sig även att aktiviteten utvecklas på ett annat sätt när det är två deltagare som samtidigt interagerar vid synthesizern, då de kan använda sig av både fysiska och verbala resurser för att koordinera sitt spelande. De kan då även etablera intersubjektivitet som gör det möjligt att utveckla en gemensam aktivitet (Rommetveit, 1974). Att spela tillsammans med någon gör det också möjligt att bygga på visuella intryck (genom att se hur någon annan spelar), medan det endast är möjligt att urskilja intryck auditivt (genom hörseln) som ensam spelare.

När barnen börjar spela på synthesizern använder de tidigare erfarenheter (kulturella redskap) som resurser för sina aktiviteter. I de analyserade exemplen är det inte självklart att barnen orienterar sig mot det som

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teknologin är designad för; istället fokuserar flera på andra musikaliska mål, t.ex. att spela en melodi snarare än att improvisera. Resultaten diskuteras i termer av en mer dialogisk ansats än traditionellt utformade musikundervisningspraktiker samt vikten av att ta hänsyn till barnens tidigare erfarenheter i samband med aktiviteter med den nya musikteknologin.

Studie II: Engaging children's participation in and around a new music technology through playful framing, publicerad 2013 i *International Journal of Early Years Education* 21(4), 325-335.

Den empiriska studien består av en analys av hur två 6-åringar samt en vuxen samspelar i anslutning till musikteknologin i en förskola. I studien undersöks hur deltagarna interagerar med varandra och teknologin, samt hur läraren kommunikativt ramar in aktiviteten som en lek. Vidare undersöks vilka lärandemöjligheter barnen härigenom erbjuds, samt hur de svarar på dessa möjligheter.

I den här studien förstås ett sociokulturellt perspektiv utifrån att lärande innebär ett förändrat deltagande i en praktikgemenskap, samt vikten av vägledning från mer erfarna deltagare (Rogoff, 1990, 2003). I analysen av deltagarnas process har begreppet intersubjektivitet och Goffmans term inramning (framing) varit vägledande.

Resultatet indikerar att den, av den vuxne, kommunikativt etablerade inramningen gjorde det möjligt för barnen att aktivt delta i en gemensam, lekfull och musikskapande aktivitet där de blev engagerade deltagare. Den vuxne som tog rollen av en mer kunnig deltagare gav barnen förutsättningar till nya musikaliska erfarenheter. Förutom att barnen blev vägleda i att utforska MIRROR Impros funktioner blev de också introducerade för medierande redskap som resurser för att utskilja musikaliska aspekter. När den vuxne ramade in aktiviteten som en låtsaslek, ändrade barnen sitt deltagande då de utforskade teknologin i stället för att endast utforska synthesizern. Inramningen stöttade därför barnens engagemang i processen även när det gällde att urskilja att teknologin svarade på barnens spel på ett liknande snarare än identiskt sätt. Enligt teknologins designer (Pachet, 2004) är systemet självinstruerande, men i detta fall krävdes en vuxen deltagare för att peka ut funktionen för barnen. Således, när den vuxne tog rollen av en mer erfaren deltagare och ramade in aktiviteten som en låtsaslek ändrades

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kommunikationen. Detta ledde till att barnen blev engagerade aktörer i en musikalisk dialog och uppmuntrades att bli centralt medverkande i aktiviteten.

Studie III: Playing, new technology and the struggle with achieving intersubjectivity. Publicerad 2014 i *Journal of Music, Technology & Education* 7(2), 199-216.

Syftet med den tredje studien var att analysera hur ett par barn och en vuxen, som tar rollen som mer erfaren deltagare (Rogoff, 2003), interagerar med och i anslutning till MIROR Impro. I analysen fokuseras hur praktiken utvecklas när barnen själva interagerar och när också en vuxen deltar i aktiviteten. Analysen belyser även hur strukturerade resurser introduceras och används, samt om och i så fall hur intersubjektivitet etableras mellan deltagarna.

Studien är intressant i relation till de antaganden som görs om att teknologin fungerar som en avancerad kognitiv lärare (t.ex. Addressi & Ferrari, 2011), vilket betyder att MIROR Impro antas kunna ersätta läraren i den musicklärande situationen. I studien fokuseras främst på språkets betydelse utifrån ett sociokulturellt perspektiv i form av strukturerande resurser (Lave & Wenger, 1991) samt betydelsen av intersubjektivitet i den gemensamma aktiviteten (Rogoff, 1990; Rommetveit, 1974).

Empirin består av videoobservationer från ett fritidshem där ett fall har valts ut för att analysera och illustrera deltagarnas interaktion med och i anslutning till teknologin. I den första sessionen agerar de två barnen, på egen hand, och i den andra sessionen även tillsammans med en vuxen.

Resultatet visar att aktiviteterna både med och utan vuxen deltagare, utvecklas till olika former av spelande (plays), musikspelande samt rollspelande (låtsaslekar). I sessionen där även en vuxen deltog, är handlingarna mer musikaliskt orienterade än när det endast var barnen som deltog. Även om den vuxne använder sig av strukturerande resurser (i form av att räkna, att använda sig av metaforer samt gester) för att engagera barnen i musikaliska dialoger med teknologin, engagerade sig barnen när de spelade själva främst i andra okoordinerade aktiviteter. Dock visar sig en del av de strukturerande resurserna, främst verbala instruktioner som länkade till tidigare erfarenheter, få deltagarna att stundtals etablera tillräcklig intersubjektivitet. Detta ledde till att de medverkande tillfälligt kunde få ett delat fokus och samförstånd i situationen. Upptäckten av att barnen och den

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vuxne engagerar sig i så många olika aktiviteter samtidigt visar på hur deltagande i en social praktik till sin natur är kreativt och mångfacetterat.

Studie IV: Musical make-believe playing: Three preschoolers collaboratively initiating play ‘in-between’. Publicerad 2015 i *Early Years* 35(3), 303-316.

Den fjärde studien presenterar en analys av tre 6-åringar som samspelar i anslutning till att de spelar synthesizer (både med och utan MIROR Impro ansluten) i en svensk förskola. I studien undersöks hur en musikalisk låtsas-/rollek utvecklar sig i mellanrummet av en aktivitet där teknologin först inte fungerar till dess att den gör det. Fokus i analysen är hur barnen kommunicerar och förhandlar i och om (metakommunicerar) lek/spelaktiviteten samt hur de stöttar varandra i sitt spel.

Studien utgår från teorin att människor, sammanhang och redskap är konstitutiva och oskiljbara delar av en aktivitet (Wertsch, 1998). Utifrån det här perspektivet är låtsaslekar fundamentalt kulturella och utgår från tidigare erfarenheter, dvs. approprierade redskap.

Resultatet visar att när datorprogrammet inte fungerar öppnas situationen upp för andra typer av samspel, där barnen aktualiserar erfarenheter från andra situationer utanför förskolan. Det visar sig att barnen använder sig av mellanrummet som uppstår till att utveckla en låtsaslek som bygger på deras gemensamma erfarenheter från en barnkör. De väljer även att framföra poplåtar som inte vanligtvis sjungs i förskolan, vilket visar på betydelsen av dagens mediaintensiva miljö för barns lekar och hur lekarenor därför har förändrats. Studien visar även på hur barnen koordinerar sina perspektiv till en gemensam aktivitet och hur de genom gester och ord (intellektuella redskap) stöttar varandras musicklärande. Studien i stort relaterar till barns musikerfarenheter i nutida barndomar och hur förskolan kan svara upp mot föränderliga socialisationsarenor.

Diskussion

Delstudierna synliggör fyra olika aspekter av empirin. Studie I (Wallerstedt & Lagerlöf, 2011) består både av individuella observationer och av situationer där fler barn samspelar kring teknologin. I studie II (Lagerlöf, Wallerstedt & Pramling, 2013) samspelar två sexåringar och en vuxen i en förskolekontext i anslutning till MIROR Impro. I studie III (Lagerlöf, Wallerstedt & Pramling, 2014) samspelar två barn på ett fritidshem med teknologin, i en session utan och en med en vuxen deltagare. Studie IV (Lagerlöf, 2015) behandlar samspelet mellan tre förskolebarn först utan MIROR Impro och sedan med en fungerande teknologi.

Empirin i form av videoupptagningar av aktiviteterna i anslutning till musikteknologin gjorde det möjligt att analysera deltagarnas kommunikativa processer. Det vill säga hur deltagarna relaterade till och svarade på sina kamraters initiativ och bidrag samt hur de svarade på MIROR Impros svar på deras spelande. Studierna II, III och IV i avhandlingen kan betraktas vara processinriktade fallstudier som fångar aktivitetens förlopp från att de introduceras till dess att de avslutas. I studie II är fokus på hur Hans och Iris blir alltmer engagerade deltagare i en delad lekfull aktivitet. Studie III visar hur Erik, Helen och Cecilia kämpar med att etablera intersubjektivitet och tydliggör hur komplex social interaktion faktiskt är. I studie IV utvecklar Ann, Liv och Sue en ömsesidig låtsaslek som bygger på gemensamma tidigare erfarenheter.

Eftersom intersubjektivitet och koordination av perspektiv är i centrum för dessa analyser, har det varit viktigt att detaljerat presentera deltagarnas interaktion, meningsskapande och agerande och analysen är därför gjord i nära anslutning till de transkriberade excerpten.

Ett övergripande tema i studierna är att de olika aktiviteterna på ett eller annat sätt utvecklas till olika former av låtsaslekar. I studie II orienterar sig Hans och Iris mot datorn *som om* den kunde tala till dem genom synthesizern. I studie III utvecklas flera olika former av lekar, bland annat orienterar sig Erik mot högtalaren *som om* den vore en stirrande ödla. I studie IV agerar Ann, Liv och Sue *som om* de vore kör- eller projektledare. I dessa exempel blir det tydligt vilken roll artefakter (Säljö, 2005) eller lekobjekt (Goffman, 1974/1986) har för lekaktiviteten. Både artefakter (synthesizer, videokamera, högtalare och dator) och diskursiva/intellektuella redskap nyttjas när barnen etablerar sina låtsaslekar. Utifrån det här perspektivet är låtsasleken alltså fundamentalt

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kulturell och beroende av de erfarenheter som gjorts, eller i andra termer, de redskap som approprierats.

Även om empirin i det här fallet är begränsad till de 21 deltagande barnen, visar resultatet på en mängd olika sätt som barnen skapar mening på. Det illustrerar vikten av att beakta barns tidigare erfarenheter samt de olika sammanhang som de gör erfarenheter av, i detta fall, musik. Som Sommer (2012) betonar, finns det alltid individuella upplevelser och därmed inte ett privilegierat perspektiv på hur nutidens barndomar och deras kulturer kan tolkas.

Även om tekniken sägs vara självinstruerande och antas fungera som en avancerad kognitiv lärare, visar resultaten att då en mer erfaren deltagare engagerade sig och interagerade med barnen, skapas det aktiviteter som avsevärt berikar barnens möjligheter att utveckla förståelser för det musikaliska innehållet. I dessa sammanhang behövs lärare för att konceptualisera och identifiera olika möjligheter som aktiviteterna inrymmer. Precis som i andra lärandesituationer i förskolan kan en lekinramning av en aktivitet hjälpa till att skapa ett meningsfullt sammanhang för barnen att lära (jfr Fleer, 2015; Pramling Samuelsson & Asplund Carlsson, 2008; van Oers, 2013). Genom att samspela med barnen kan den medkonstruerande läraren föra metakommunikativa dialoger med barnen och sätta ord på det musikaliska innehållet. Den mer erfarna kan med andra ord ge barnen nya musikaliska erfarenheter samt förutsättningar att tillägna sig kulturella redskap som de sedan kan använda i andra relevanta sammanhang. Läraren har därmed en viktig roll i att erbjuda alla barn musikaliska erfarenheter och möjliggöra ett musikaliskt lärande, vilket är en fundamental demokratisk princip och utmaning för en förskola och fritidshem för alla barn.

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GÖTEBORGS UNIVERSITET
INSTITUTION FÖR PEDAGOGIK, KOMMUNIKATION OCH LÄRANDE

Till vårdnadshavare

Hej,

jag heter Pernilla Lagerlöf och är doktorand och lärare vid Göteborgs universitet, men har tidigare arbetat som förskollärare på XX förskola. Nu har jag och förskolan fått möjlighet att vara med i en undersökning genom ett internationellt forskningsprojekt med deltagare från flera olika länder i Europa. Det vi vill utveckla kunskap om är hur barn lär sig musik. Den här gången har vi fått tillgång till ett dataprogram som är kopplat till en keyboard. Barnen ska få prova programmet och spela keyboard enskilt och tillsammans med varandra. Igenom detta vill vi undersöka vad barn gör när de spelar, hur de utvecklar musikaliska idéer och om och i så fall hur dataprogrammet kan stödja deras lärande. Den här delen av studien kommer att genomföras på liknande sätt med barn i Italien, England och Grekland, förutom i Sverige. Hur barnen spelar och agerar kommer att analyseras med hjälp av videoupptagning.

Allt deltagande är frivilligt och deltagare har rätt att avbryta sin medverkan när de så önskar. För att kunna filma barnen på förskolan behöver jag tillåtelse från varje barns vårdnadshavare. Jag ber er därför fylla i talongen nedan och återlämna denna till någon av pedagogerna på avdelningen så snart som möjligt men senast den 6 april. Filmerna kommer enbart att användas för forskning ändamål, samt om ni också ger denna andra tillåtelse, i undervisningssituationer såsom utbildning av lärare och presentationer på forskningskonferenser. Materialet kommer inte att vara tillgängligt för obehöriga. När denna forskning publiceras kommer alla barn, lärare liksom skolan ges fingerade namn. Självklart kommer jag att ta hänsyn till om barnet själv visar att hon eller han inte vill bli filmad. Studien finansieras av medel från EU. Har ni några frågor är ni välkomna att höra av er till mig (enligt kontaktinformation nedan).

Jag kommer också vilja be er fylla i en enkät för att få information om vilken musik barnen är vana vid hemifrån.

Vänliga hälsningar,
Pernilla Lagerlöf

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GÖTEBORGS UNIVERSITET
INST FÖR PEDAGOGIK, KOMMUNIKATION OCH LÄRANDE

Till vårdnadshavare

- Ja, jag ger tillåtelse att mitt barn får videofilmas inom förskolans verksamhet.
- Ja, jag ger **också** tillåtelse till att videofilmer får användas i undervisning och konferenspresentationer.
- Nej, mitt barn får **inte** videofilmas.

Barnets namn:

Målsmans underskrift:

Namnförtydligande:

Overview of the video-data

Date	Participants	Place	Event	Time/minutes
110123	Cecilia + Lisa (4)	At C's place	Pilot study	20
110213	Emma, Cecilia, Pernilla	HSM	Introduction/ demonstration	17
110414	Cecilia + 25 children	Afterschool centre		60
110415	Pernilla + 7 children (4-6)	Preschool		10
110416	Pernilla, L (9) +E (7)	At P's place		15
110418	P + 5 children (4-6)	Preschool		10
110416	Fanny (8) Sandra (8) Frans (8) Emma/Helen (6) + Eric (7)	Afterschool centre	"Experiment" "Experiment" "Experiment" "Extra material"	16 8 13 20
110418	Fanny (8) Sandra (8) Anders (8) Antonia (4) Kiara (4) Sara (4) Sandro (5) Lorentz (4) Mehmet (4)	Afterschool centre Preschool	"Experiment" "Experiment" "Experiment" "Experiment" "Experiment" "Experiment" "Extra material" "Experiment" "Experiment"	5,5 4,5 2,5 7,5 3,0 7,0 14,5 5,0 9,5
110419	Sandra (8) Emma/Helen + Erik+Cecilia Antonia (4) Lorentz (4) Lars (4) Mehmet (4) Susan (4) Pernilla + Hans (6) & Iris (6)	Afterschool centre Preschool	"Experiment" "Extra material" "Experiment" "Experiment" "Experiment" "Experiment" "Experiment" "Extra material"	5,5 19 16,5 18,0 4,0 10,5 3,0 31,5
110428	Noel (4) Lorentz (4) Susan (4) Pernilla + Susan Dejan (6) Mehmet (4)	Preschool	"Experiment" "Experiment" "Experiment" "Extra material" "Extra material" "Experiment"	10,0 13,5 8,0 4,5 8,0 4,0
110502	Anna (8) Fanny (8) Anders (8)	Afterschool centre	"Experiment" "Experiment" "Experiment"	9 5 1,5
110503	Anna (8) Frans (8) Anders (8)	Afterschool centre	"Experiment" "Experiment" "Experiment"	11 11,5 3,5
110504	Anna (8) Frans (8)		"Experiment" "Experiment"	11 10
110506	Leonore (4) Antonia (4) Ellinor (4) + Kiara (4) Leonore (4) Sandro (5) Pernilla + Iris (6) Pernilla + Sue+Liv+Ann	Preschool	"Experiment" "Experiment" "Extra material" "Experiment" "Extra material" "Extra material" "Extra material"	6 10 8 4,5 13 2,5 22
110516	Noel (4) Leonore (4)	Preschool	"Experiment" "Experiment"	14,5 4,5
110603	Anna + Sandra + Cecilia	Afterschool centre	Stimulated recall interview	30

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