

Children's practice of computer-based composition¹

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Today's children live in a world where music in all its different forms has become a significant factor in their everyday life. This article describes a 2-year empirical study of nine 8-year-old Swedish children creating music with synthesiser and computer software. The aim of the study is to describe and clarify the creative processes of computer-based composition. The tasks given to the children were framed as invitations to create music to different pictures. Computer MIDI-files were systematically collected covering the sequence of the composition processes step by step: observations were made of their work; and interviews were carried out with each of the participants. In the analysis, five variations of the practise of composing were identified, each with a different object in the foreground of the activity: (i) the synthesiser and computer; (ii) personal fantasies and emotions; (iii) the playing of the instrument; (iv) the music itself; and (v) the task. The findings of the present study also give evidence that young children are able to create music with form and structure.

Introduction

Today's children live in a world where music in all its different forms is a significant factor of their everyday life. The view that children are capable of spontaneously creating music by singing or using musical instruments is now widely accepted and based on empirical research (Barrett, 1996, 1998; Pond, 1981; Folkestad, 1996; Folkestad *et al.*, 1998; Sundin, 1998). These findings are consistent with Vygotsky's (1998) view that creativity should be regarded as a basic human function, rather than as a special gift granted to only a few.

Recent technological developments and the increasing impact of the media mean that listening to and creating music constitute a major and integral part of many young people's lives. It is also true that much musical learning takes place outside schools, in situations where there is no teacher, and where the intention of the activity is not to learn about music, but to play music, listen to music, dance to music, or be together with music. Each of these examples typifies situations in which music is experienced and learned, one way or another. Today, this is further accentuated as a result of computers and new technology, and all the musical

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activities on the Internet (Folkestad, 1998). In a study by Nilsson (1992) it was found that young children, aged 3–6, had their own tape recorders, thus being able to play recorded music on their own. Today many children have their own computers at home, by which they explore the musical landscape in computer games and on the Internet. As a consequence of this, music teachers never meet musically ignorant, untutored or uneducated pupils (Folkestad, 1998; Nilsson, 2003).

In his study of children's spontaneous musical creativity in the 1930s, Pond (1981) concluded that, to children, musical improvisation is 'the heart of the matter in the development of the innate musicality they evidently possess' (p. 11). Sundin's (1963) study of children's spontaneous singing at two day-care centres in Stockholm, Sweden (reported in retrospect in English in Sundin, 1998), shared Pond's naturalistic approach to children's musical creativity. Sundin was interested in both spontaneous and constructive creative music making. He observed speech, singing and other musical activities, and concluded that creative music making in the early childhood seems to be a way to 'express an attitude towards the world and a way to approach different problems' (Sundin, 1963, p. 141; our translation). According to Sundin (1998), children 'work hard to make the world meaningful, including the world of music' (p. 53). Subsequent research of preschool children's spontaneous singing has much in common with Sundin's study: Bjørkvold (1990) regarded children's songs as basic components of their play, and Whiteman (2001), who studied Australian preschool children's spontaneous singing during free play, found that children used songs for specific purposes, such as communicating with others, accompanying play, experimenting with sound or just singing for its own sake.

Burnard's (2000) study of 12-year-old children's engagement and reflections concerning their experiences of improvising and composing, indicates that the distinction between improvisation and composing appears to be artificial when studying children's creative music making. She found that the children in different ways included improvisation in the composition process. Burnard also concluded that 'improvising and composing seemed to be as much about the children's relationship to musical activity as improvising and composing were to each other' (p. 20).

Folkestad (1996) performed a study of 15–16-year-old children's computer-based creative music making. In the analysis, six qualitatively different ways of creating music, divided into two main categories, horizontal and vertical, were found. Horizontal music creation begins by creating the melody, the harmonies and the form of the composition from beginning to end, with or without using the computer. Only after this is the computer equipment used for arrangement and instrumentation. In contrast, in vertical music creation, the tune is created section by section, and the various sections are completed with all instruments, before moving on to the next section. Hence, in the horizontal categories, composition and arranging are separate processes, whereas in the vertical categories composition and arranging are one integrated process (Folkestad *et al.*, 1998).

In his study Folkestad (1996) also found three qualitatively different descriptions of how musical ideas arise: (i) the starting point of the creation is an image of a

musical idea; (ii) the work starts by defining a musical style; and (iii) the musical idea arises while playing an instrument (p. 188).

When a musical idea arises while playing an instrument, it brings improvisation into the composition process. Folkestad (1998) describes improvisation as ‘instant composition’ (p. 109) performed by its creator. A composition, on the other hand, is, according to Folkestad, ‘a product which can be separated from its creator and performed without the presence of its composer’ (p. 109).

Kratus (1989) concluded that only children aged 9 and older are able to compose with form and structure, and that this has a developmental basis. This view is challenged by Barrett (1996) who in her study collected 137 compositions from children aged between 6 and 12, and found that the children used various structural devices such as repetition, sequences, inversion and achievement of closure. Furthermore, the children used alternation between two or more ideas, abstraction of a musical idea from one context to another, and large-scale structures or forms.

As found in Folkestad (1996), children may not always be able to discuss their creative music making verbally, nor the meaning they associate with their musical activities. Barrett (1998) points out that if the researcher stresses verbal response from the children, this might lead to an ‘underestimation of their capacity to respond aesthetically’ (p. 60). She maintains that it is mainly through the musical discourse of the children that their aesthetic decision making can be understood.

It may be concluded that in order to examine children’s creative music making, it does not seem sufficient only to interview them about their experiences, nor to delimit the investigations to their musical products. This calls for a research design that includes both perspectives, and a theoretical framework that makes this analysis possible.

This article is based on a 2-year empirical study of children’s computer-based creative music making (Nilsson, 2002). The aim of the study was: (i) to describe and clarify the creative processes of computer-based composition; (ii) to describe the musical (products that were) results produced by the children; and (iii) to reach a deeper understanding of what creative music making means to the children. The research method and the theoretical perspective will be described in the following.

An ecocultural perspective

In order to understand the multidimensional character of musical creativity, we apply a theoretical framework called ecocultural perspective, developed in Nilsson (2002). This theoretical framework has its origin and points of departure in four theoretical areas: (i) Gibson’s (1979) concept affordances; (ii) orality; (iii) theories of play; and (iv) theories of chance.

The first point of departure concerns learning and creative activities in informal and everyday situations (Lave, 1988), and a view of musical learning as cultural practice (Folkestad, 1998). Gibson’s (1979) concept of affordances describes the suggestions of meaning (Qvarsell, 1998) offered to the individual by the

environment. On the basis of this, Folkestad (1996) proposes a definition of creativity, or rather of acting creatively, as the ability to perceive affordances.

The second point of departure emphasises that music and speech are sounding phenomena, which only exist as a whole (Ong, 1982). According to Vygotsky (1978), language is our most powerful psychological tool, and oral practice constitutes an important part of a situated perspective in order to understand music, musical practice and musical creativity.

In the third theoretical area, play is considered as a way of creating meaning in musical activities. Play, according to Huizinga (1955) and Caillois (1961), is something we do for its own sake. It is free, separate, uncertain, unproductive, 'make-believe' and yet governed by rules. Play with a lower degree of order is, according to Caillois (1961), associated with diversion, turbulence and improvisation, whilst play with a higher degree of order is associated with effort, patience, skill and ingenuity.

In the fourth point, these three theoretical points of departure are linked to chance, uncertainty and unpredictable events. Bateson (1979) argued that creative thinking always includes an element of chance. The nature of play is incompatible with an outcome known in advance, according to Caillois (1961).

Together, these theoretical points of departure emerge in an ecocultural perspective, in which learning, improvisation and creativity are seen as taking place within everyday activities, and as a basic human function.

Method and research design

The methodological approach, which is qualitative in character, might be described as inspired by anthropological and ethnographical methods. This approach includes an attempt to study children's musical creativity, with the aspiration of showing respect for, and interest in, the children's musical worlds.

Digital tools offer a way for young, musically untrained children to express their musical ideas. In their creative music making, the participating children were using a synthesiser with a keyboard, together with a professional computer sequencer program. The study was carried out in a multi-ethnic Swedish school over a period of 18 months. All nine children from year 2 in an age-integrated school class were participating in the study. At the beginning of the study, the participants, five girls and four boys, were 6–8 years old.

Each composition process took place in one session without interruption. The children's creative music making was investigated by collecting different types of data: (i) step-by-step computer MIDI-files collected using the Save-As method (Folkestad, 1996); (ii) participant observations; and (iii) interviews conducted throughout the project.

In the first phase of the project, the children were given tasks, framed as invitations, to create music inspired by pictures related to the themes of Landscape and Water, respectively. The aim of the researcher was to intervene as little as

possible during the children's work and the participants only received instructions referring to the use of the synthesiser and the computer software.

In the second phase of the project, in order to make the invitations to create music more open-ended, the instruction was framed as an invitation to paint a self-portrait in colour, and to create music along with the portrait. The subsequent instruction or suggestion was to create music to a painting by Kandinsky. In addition, at the concluding interview all children were invited to create music without any special prompt.

Folkestad (1996) argues that studying the product separately disconnects the music from the creator, while studying the process puts the creator in focus. He stresses, however, that the process and the product are 'two sides of the same coin, in an intertwined relationship' (p. 67). Accordingly, the product cannot be left out of the analysis of the process; the musical creative process and the product cannot be studied separately. Instead, it becomes a question of the researcher's approach.

The unit of analysis is the creative process, analysed through participant observations, interviews and the collected pieces of music (data files). By interpreting the saved 76 computer files together with the participant observations and interviews, five variations of the children's creative processes were identified. These variations will be described in the following section.

Results: five variations of the children's practice of computer-based composition

The results of the empirical study provide evidence of complex creative music making, full of nuances. Five different variations of the practice of creative music making were identified in the analysis, each with a different object in the foreground of the activity:

- i. Putting the synthesiser and the computer in the foreground of the activity;
- ii. Using creative music making as a means to express personal fantasies and emotions;
- iii. Putting the playing of the instrument in the foreground of the activity;
- iv. Placing the music itself in the foreground of the activity;
- v. Putting the task in the foreground.

Often, however, there was an oscillation between foreground and background, and therefore the identified variations should not be regarded as excluding each other in the actual individual processes.

In the following section, the five identified variations will be further described. Each variation will be illustrated by a musical example created by one of the participating children. In each example, a young musician's way towards a completed composition will be followed through the interviews, the field log and the computer files.

In order to communicate some of the methodological approach of the study, the five variations, in accordance with ethnographic tradition, will be presented, if not through a *thick description* (Geertz, 1973), at least through a *rich description* (Nilsson, 2002)².

The synthesiser and the computer

With the synthesiser and computer in the foreground of the activity, the equipment is turned into tools and devices that are to be examined and controlled, and the limitations of which are to be explored. Extensive experiments with sounds and tracks are performed. In the following section, we will follow 8-year-old Niklas's process towards a completed composition.

'*My arm is tired!*'. Niklas is 8½ years old and likes handicraft and music. Last year his action story about Santa Claus won first price in a writers' contest at his school. Niklas also likes to play soccer. He listens to music on his new CD-Walkman, and sometimes he plays computer games and watches MTV in between. His Kandinsky music was created in a hurricane of activity, demonstrating a creative process that took place during 45 minutes. Niklas and another boy, Linus, both reacted positively to the presentation of the Kandinsky painting. During the creative process, they communicated and gave suggestions for instrument sounds to try out. Through the field log and the computer files we can follow Niklas's 13 steps towards his completed Kandinsky music (the GM numbers of the instrument sounds in brackets):³

Minutes	Take	
0		Getting started. Niklas starts playing, but does not record anything.
5	A	Track 9. A short glissando over the entire range of the synthesiser with Fantasisynt (89)
7	B	Niklas adds some drums on track 10. Duration 5 seconds.
11	C	Niklas deletes the drums but keeps the glissando on track 9 and adds a new short glissando with Fantasisynt (89) on track 8.
12	D	– Check out Polysynt (91)! (Linus to Niklas). A short recording, 4 seconds. Niklas deletes track 9 but keeps track 8.
15	E	Niklas deletes everything.

Niklas' first steps, A–E, could be regarded as a warming up process, during which he 'claimed' the synthesiser and refreshed his acquaintance with the instrument sounds. During the entire process, the two boys, Niklas and Linus, were giving each other suggestions for instrument sounds. In Figure 1, we can see how several tracks were orchestrated and all previous recordings deleted. A fresh start!

During the following steps, F–J, Niklas played with a lot of bodily dedication using both hands and several fingers. At one time, this resulted in his earphones falling off.

Instrument	Track	
Flygel	• Spår 1	
Flygel	• Spår 2	
Flygel	• Spår 3	
MetallSynt	• Spår 4	Ej sparat
MetallSynt	• Spår 5	5
FantasiSynt	• Spår 6	6
SvepSynt	• Spår 7	7
FantasiSynt	• Spår 8	8
PolySynt	• Spår 9	9
Standard Set	• Spår 10	10
Standard Set	• Spår 11	11

Figure 1. Niklas orchestrated his tracks either with a synthesiser sound or with the percussion instruments

- 18 F Niklas tests the pitchbend control and records on Track 8 FantasiSynt (89).
 20 G Drums added on track 10.
 22 H More percussion added on Track 11.
 24 J A new recording on Track 9 with Polysynt (91). Clusters.

The compositional process turned into a kind of musical ‘workshop’ and the duration of the recorded tracks, which at the start was as short as only a few seconds, now is up to 2 minutes. This development persists and the last recordings, K–N, are even longer; the last one is more than 8 minutes long. Niklas’ physical dedication increased, and his head and his right foot were now engaged during the playing. During the last take, Niklas also used the synthesiser controller.

- 27 K Track 7, Svepsynt (96). Niklas looks at the computer screen.
 31 L Track 6, FantasiSynt (89). The music has now developed into a thick soundscape. The longest recording so far.
 33 M Track 5, adding Sitar (105).
 46 N Track 4, Metallsynt (94). Niklas looks at the computer screen.– My arm is tired, Niklas shouts to Linus.

This last take, N, was more than 8 minutes long, but was not possible to save since Niklas had used so many notes that the program finally crashed! Afterwards, Niklas had a fairly clear picture of the course of events, and said that the piece was meant to have many tracks with different instruments.

With the tools in the foreground, the creative process turns into a kind of workshop. The process is full of activity, showing similarity to the state of flow described by Csikszentmihalyi (1990). Selecting sounds on new tracks, recording, deleting and adding demonstrate different ways of handling the synthesiser and the computer in order to (take) gain control over the tools.

Fantasies and emotions

With fantasies and emotions in the foreground, the compositional process becomes a way to get in touch with fantasies, daydreams and memories, and with moods or strong emotions. Deliberate as well as non-deliberate use of memories and various techniques for generating musical ideas are used in the creative music making. The synthesiser and the software are explored primarily in order to realise musical ideas, and the children select the instrument sounds very carefully.

Ninna's gruesome story. Ninna is 7 years old and likes to read and write. She also thinks that maths is great fun. When Ninna is not in school, she usually visits some of her friends or stays at home cleaning the kitchen or doing some cooking. She is thinking of taking up handball, since her best friend has taught her a little. Sometimes Ninna plays computer games. She listens to many different kinds of artists on MTV and thinks that *Titanic* is the best movie she has seen, but she also likes all of the Disney movies, like *Aladdin* and *Lion King*. Ninna's mother wants her to learn music and she would like to play the flute, like her elder sister. Piano is also one of her favourites.

During the concluding interview, Ninna composed a song. When she listened to the song directly afterwards, she commented on the music and told a story to go along with the song. The music described below, Ninna's gruesome story, was performed without any special suggestion or prompt provided by the researcher. By comparing Ninna's own comments (in italics) with the saved computer file, we are able to follow her compositional process. She chose the sound Piano (1) for her music.

Min.sec

- 00.00 *This song is really gruesome and sad and many people die but they wake up again!*
The music starts with the first bars from a Swedish song, *Spanien (Spain)*. The song *Spain* originally is in C major, but Ninna played it in A minor.
- 00.11 *And [Ninna sings with dark voice] someone is getting murdered (giggle).*
The music develops into jumps at big intervals where a minor fifth creates extra tension.
- 00.22 *And then [Ninna sings again] this means that it's getting a little better, but ...*
The music is now becoming more and more tense.
- 00.41 *... but then [singing in a dark voice again] someone has been murdered.*
Different clusters turn up in the music.
- 00.52 *And now everything is all right again!*
This part of Ninna's composition consists of a new quotation from the song *Spain*, this time performed in G major, maybe signalling a return to the normal, well-known and safe, and perhaps to a happy ending.



Figure 2. Ninna's gruesome story ends with a quotation from the song *Spain* followed by a coda

01.01 *They come to life again and then everything is all right.*

Ninna adds a coda to the song.

01.14 *There!*

Ninna's coda consists of a scale movement, first down and then up again. A $d\#$ note gives the impression of a modulation from G major to E minor, and the final scale movement up to the note g creates a closure back to G major (Figure 2).

It is not clear if Ninna started to play the song *Spain* in A minor on purpose or not. Maybe she started playing on the wrong note, a instead of c, then continued to play on the white keys on the keyboard, thus changing the key from C major to A minor. In Ninna's practice of role-playing, it is quite plausible that elements of chance, like starting on the wrong note, might serve as an inspiration during the process.

When fantasies and emotions come into the foreground, many things may offer inspiration to the children during the creative music activities, such as dolls, invented stories, imagined conversations, memories and emotions. The Kandinsky painting itself might be turned into role-playing with different creatures acting towards each other.

The playing of the instrument

When the playing of the instrument comes into the foreground of the activity, this often produces long compositions where improvising and composing are integrated. The instrument sounds are carefully selected and often only one or two favourite sounds are used. The music is recorded in one session on a single track where musical formulas and motifs are repeated and varied. In the next section, we will follow one of the boys, Ferhad, and his approach to a long composition.

13 minutes and 11 seconds. Ferhad is 8 years old and likes to play soccer. He listens a lot to music and also likes to play music himself. Most of all he likes to use his hands while playing and his favourite instruments are piano, keyboard and everything that has to do with drums. Sometimes he plays with his hands on a table, pretending that the table is a pair of drums.



Figure 4. Ferhad's motif B consists of only one bar, which later is developed into a closure

her music directly after a finished recording. Musical ideas arose directly from the activity. As one of the boys put it: 'Once you get started, you will hit on something'. Mostly the creative process takes a long time, showing a similarity with the state of flow described by Csikszentmihalyi (1990).

The music itself

With the music itself in the foreground, musical ideas are deliberately brought forth to be used directly or to be revised. Spontaneous ideas are used in a premeditated way together with rehearsals and planning. The participant is aware of his or her own practising and planning, and is able to discuss the compositional processes. Practising and rehearsing, 'to see if it fits', as one of the girls expressed it, does not in any way limit the options offered by the situation. On the contrary, rehearsing and practising seem to enhance both the possibilities and the options in the creative process, and to develop the synthesiser and the computer into natural tools for realising musical ideas. The music is frequently played with several fingers on each hand using only one single track for the recording. If the recording is not satisfying, the creator simply deletes it and commences a new recording. The next section demonstrates how Gunborg created her composition prompted by the Kandinsky painting.

'A long straight'. Gunborg is 8 years old and likes to write stories. She listens to a lot of music and would like to play music herself all the time. Gunborg likes most kinds of music, with the exception of hard rock. She explained that when she had a headache it usually got better if she played some music. Gunborg has tried to play the recorder but thinks it is more fun to play on her own than to take lessons. Her dream is to be on stage—just like Michael Jackson or the Spice Girls.

When Gunborg composed her Kandinsky music, her creative process developed in three steps during 28 minutes. Gunborg started by checking out the percussion instruments, and recorded some music, which she immediately deleted before it was



Figure 5. Ferhad developed his short motif B into a short closure, ending his Kandinsky music after 13 minutes and 11 seconds

saved. The following part of the process could be regarded as 10 minutes of warming up, while Gunborg tried out different ideas.

Gunborg's warming up resulted in a 33-second-long piece with *Fantasisynt* (89). This first version consisted of a drone in the bass (low C), played rhythmically with her left hand accompanying a melody on top, and centred around the notes in the C major triad, which she played with her right hand. Gunborg was not satisfied with the piece, though, and deleted it as she thought 'the ending was a bit strange'. Then she started playing with two hands, using several fingers on each hand.

In the second step, Gunborg kept the sound *Fantasisynt* (89) and played for about 10 minutes before the music was saved. This second recording consisted of 23 seconds of an apparently unfinished variation of one of Gunborg's earlier compositions: the bass line moves diatonically upwards from C₁ to E₁ with the melody on top. Gunborg rejected even this piece since she 'happened to press some wrong buttons'. Before she deleted it, she wanted to 'play it to the end and finish it'.

In step 3, Gunborg developed a completely new idea. In this 1-minute-long final version, Gunborg was consistent in her use of call and response. She prolonged the last note in each phrase overlapping the next phrase, thus creating a drone. The bass line and the melody were freer than in her earlier compositions. Gunborg was satisfied with her result:

I'm very pleased with it . . . it's almost like a fairy tale. Maybe it starts there and ends over here [pointing in the Kandinsky painting]. The ending is supposed to be like a long straight (Figure 6).

This final Kandinsky music could be regarded as a development of several of Gunborg's musical ideas combined with new ideas. She had one musical idea based on a structure with a single melody played by her right hand on top of a bass line by

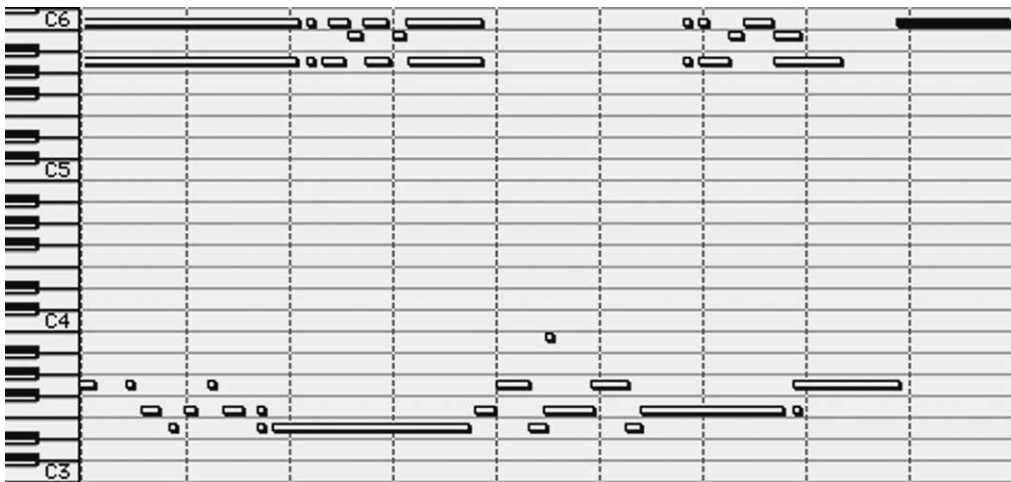


Figure 6. Gunborg's 1-minute-long final composition ends with 'a long straight' note (highlighted)

her left hand. When she later created her Kandinsky music, she used this musical idea again on her path towards her final composition. The ending and closure of her final Kandinsky piece with a long note is also a development from one of her earlier compositions (Figure 6).

Repetition of musical ideas and developing new ones are not restricted to one composition, but often take place between different pieces. One example was given here by Gunborg, another by Ferhad, above, who already in one of his first recordings developed a special kind of call and response between his hands, an idea he developed in his later compositions.

When the music came into the foreground, a full range of affordances was used where old ideas mixed with new fancies, rehearsals and aesthetic decision making, all facilitated by the options offered by the musical instrument and the computer. The suggestion to compose music was interpreted as a challenge to engage in an aesthetic, creative process, not perceived as a task, but rather as an invitation to pretend to be a grown-up musician.

The task

When the suggestions to create music are interpreted by the child mainly as a school task rather than as an open invitation, the task itself stays in the foreground. This was the case for most of the children when they were creating music to the pictures related to the Water theme.

If the participants had difficulties creating musical ideas on their own, focusing on a task might help them to find meaning in the composing. On the other hand, for participants who normally found it easy to produce musical ideas independently, focusing on a task might have a limiting effect.

With the task in the foreground, the creative process might become restrained, since the full range of affordances (Gibson, 1979) in the situation is not perceived. Therefore, when an open-ended invitation to create music was interpreted in a way that focused on the task, this led to what might be described as convergent thinking. The open-ended suggestion did not seem to contain sufficient explicit information in order to engage participants when they had problems finding a meaning in their creative music making. This might result in attempts to play a well-known song or an established rhythmic figure, or in the choice of a familiar instrument name. This is illustrated by some examples from the Portrait Music: (i) Tanja tried to play a well-known song, *Happy Birthday*, but failed after a few notes and continued her recording with some exploratory notes. She made no attempt to revise her music or listen to it. (ii) Linus made a percussion recording in which he finally decided on an established rhythmic figure (later he explained that he did not like this piece and that he wanted to make a new one instead). (iii) Diana tried out the percussion instruments (Midi Track 10) but deleted her recording immediately. She decided to use the sound Birds (124) and although she made a recording, she seemed to have lost interest.

The synthesiser and the computer were available during the concluding interview, but this time the participants were not given any suggestions or prompts. Most of the children composed music at this occasion, one example of which is Ninna's gruesome song. In a few cases, though, the children wanted to create music but were not able to do so. This seems to imply that the suggestion, the task itself, is important; when no prompt is presented at all, this might in some cases block the creative process.

In conclusion, the result of the empirical study might be described as different phenomena coming into the foreground during the composition process: the computer and the synthesiser; fantasies and emotions; the playing of the instrument; the music; and the task. During the creative music making, a shift between the different variations sometimes took place. Furthermore, the participants created music with form and structure, used repetition and development of formulas, rhythmic or melodic ones. The range in complexity varied from a single motif with three notes, lasting only 6 seconds, to advanced combinations of form and structure that were developed during sequential steps in one composition or through separate compositions.

Discussion

The five variations identified in the children's creative music making might be discussed in relation to the children's earlier musical experiences, the invitations to create music, the children's cultural practise and to the digital tools. These are some of the essential factors or aspects that all together form the affordances (Gibson, 1979) or suggestions of meaning (Qvarsell, 1998) that were perceived by the children in their cultural practice of creative music making (Folkestad, 1998).

The results of the present study demonstrate how the different instructions, or rather suggestions, might all be regarded as invitations to play. Once the invitations were accepted, the children established a frame of play (Bateson, 1987) before the process of creative music making commenced. The perspective of play was found to represent a powerful perspective in understanding the children's creative music making.

The first four variations of creative music making could all be described as different forms of play, where the suggestion to compose music was perceived as an invitation to play and make music. These four variations in many cases bear the signs and characteristics of flow (Csikszentmihalyi, 1992) and might be described as taking place in a musical framing (Saar, 1999).

However, when an open-ended invitation to create music was perceived mainly as a school task, as was the case in the fifth variation, this lead to difficulties in using the full range of imagination. Accordingly, creative music making with the task in the foreground could be described as taking place outside the frame of play (Bateson, 1987) and inside a pedagogical framing (Saar, 1999).

The synthesiser and the computer software represent powerful tools, which facilitate the participants in expressing their musical ideas without being formally trained in music. The digital tools used by the children represent a medium where planning, improvising and elements of contingency coexist. The different forms of creative music making, improvising and composing, can be understood as representing different degrees of order in the creative process, where improvising represents a lower degree of order, while composing is associated with a higher degree of order.

The findings of the present study clearly demonstrate how young children without formal musical training are able to create music with form and structure. In this respect, these results are found to be consistent with the findings of Barrett (1996) and of Burnard (2000).

Talking with the children about their music gives important insights into the way creative music making becomes meaningful to them. However, as mentioned earlier, it is essentially through the children's musical discourse (Barrett, 1996) that their musical creativity is best understood. Folkestad (1996) makes a distinction between a discourse in music and a discourse on music. The former concept refers to the music itself and to the way music is played and created, while the latter refers to the way music is verbally discussed. This study demonstrates the children's discourse in music, illustrated by their music and by the way they work with the musical tools.

The present study gives evidence that children create meaning in their creative music making in many different ways. The implication for music teachers may be 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 assessments controlled by the teacher. Based on results from the present study we suggest a definition of a composition as a piece of music that its creator experiences as meaningful.

The assumption made by Hickey (1997), among others, that an open-ended task will result in a more creative musical product, needs to be questioned. The findings of the present study demonstrate that in those cases when the children had difficulties in creating meaning on their own in their composing, they turned the task itself into the meaningful context. This implies that the teacher in some cases should guide the children by giving a didactic framing to the invitation to create music. Again, children (and perhaps even adults) create music in many different ways. This suggests that the teacher must be prepared to vary his/her methods, and strive to create supportive conditions in order to enhance creative music making for all children.

In Western countries, as stated in the introduction, even very young children gain musical knowledge and competence by taking part in the media world at home, in school, or during their leisure time. Today, young children are able to listen to music without any adults 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.

Accordingly, further research focusing on the consequences of this development in teaching in general, and music teaching in particular, is of great importance.

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Notes

1. This article is based on the first author's doctoral dissertation 'Jag kan göra hundra låtar'. Barns musikskapande med digitala verktyg ['I can make a hundred songs'. Children's creative music making with digital tools], accepted in 2002 by Lund University, Sweden.
2. In order to enhance the way to demonstrate findings from a research study, Nilsson's doctoral dissertation includes a CD with an interactive multimedia presentation. This can be downloaded from <http://www.mhm.lu.se/fou/musikped/nilsson2002.doktors.abstr.html>
3. The instrument sounds used by the participants in this article are referred to by their General Midi Instrument number (GM number). General Midi is a standard for synthesisers and digital musical instruments facilitating that different synthesisers provide an acceptable representation of song data written for General MIDI. The names of the instruments indicate what sort of sound will be heard when a certain instrument number is selected on the synthesiser. The sounds available are the same for all MIDI Channels except Midi Channel 10 that has only percussion sounds and some 'sound effects' (Midi Manufacturers Association, 2004). The English instrument names were translated to Swedish in the computer program when possible.

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