

Young children’s interactivity – impacts of The Carnival of the Animals (COA) – iPad App. Cross-cultural observations: Finland and USA

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ABSTRACT

The education profession is presently facing the challenges of touch-based electronic devices, as a part of their teaching performances and in the behavioral reflections of the device-use. These devices may distract children, harm attention, and even cause addictions (Adams, 2014; Richtel, 2010). However, other researchers reported that using the iPad helps stimulate 2-year-old children’s creative-intellectual potential (Geist, 2012), children’s focus, learning styles, and various learning levels (Wilkinson, 2010). According to Hodgson (2013), 5-6-year-old children were found to use higher order thinking skills in creating content independently in music because of the possibilities of touch interface technology. This was also shown in the behavior of Finnish 6-year-olds (Marjanen, 2014). Nevertheless, the essential nature of children’s interactivity with the iPad in all its potential richness has not yet received enough attention (Tu, Cslovjecssek, Pérez, Blakey & Shappard, 2014). Many possibilities for increasing our understanding of how children develop their visual and audio preferences through the use of the touch screen tablets is to be observed, with the connections of the cultural and developmental inclinations. The present study points out to the interests of young children in favor of sounds, produced by manipulation of objects, supported by views opened via quantitative approach across culturally, and with qualitative aspects as a view for creating comprehension, and to interpret the results through the triangulation between the data, theory and the researchers from different cultural backgrounds. In this research, the authors investigate the Finnish-American, cross-cultural observations and comparisons and provided us interesting results.

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1 Introduction

The App: *COA* is a 14-page talking, a multisensory storybook with vivid illustrations of animals, interlaced with numerous animated graphics and interactive elements. It creates a fun and playful learning environment for both children and adults, regardless of their level of specific language competencies. This multi-sensoric and multi-lingual application was developed by Professor Markus Cslovjecssek from Switzerland, as a side-product for the European Music Portfolio - A Creative Way into

Languages -project (2009-2012¹). The writer, *Achim Lück*, composed a poem that tells a story about a bored lion and the wild animals that want to have a terrific party, following the original musical works, *The Carnival of the Animals* was composed by Camille Saint-Saëns in 1886. The texts of the poem are shown on each page of the App. Sixteen languages are currently available in this App, with constant additions to the possible language selections developed (Marjanen & Cslovjceksek, 2016). This App takes the current findings on language learning research² into consideration and fosters the discovery of relationships between languages, and between music and language. That means "we understand more languages than we think," labeled "intercomprehension" by Doyé & Meissner (2010) and Meissner (2010). At the same time, additional sources of information such as pictures, music and sounds aid comprehension³.

The basic framework for the core understanding of the current research is created from the comprehension of musilanguage (Brown, 2000) - music and languages sharing the same essential elements (Patel, 2008), supporting the understanding of music as sounds (Cslovjceksek, 2000; 2011; Marjanen, 2014; Marjanen & Cslovjceksek, 2014; Seibert, Hug & Cslovjceksek, 2015) and musical interaction with emotions (Juslin & Sloboda, 2010) and with physical and bodily experiences (Bresler, 2004). We may talk about music education, language education - and sound education in between and as a support for both, with experiences of the sounding environments as sounding or as imaginative sounds visualized in one's mind. This explains music connecting with tacit knowledge (Polanyi, 1966/1983) and flow (Csikszentmihalyi, 1975).

2 Theoretical framework

2.1 Music and languages as cultural expressions

Languages are expressions of cultures, and they connect individuals for subcultures, and for nations. However, cultures are complicated entities and require complex investigations, to understand the pathways and crossroads inside a culture, or between cultures, or as cultural bridges from one to another. In the current research, cultural comparison is being done, but the goal of that is not to really understand the cultures in question, but to observe behavioral similarities and differences of two children from both two cultures, to understand the interaction behavior of children because of or despite of a certain culture. Music and language are expressions of certain cultures, but in these multicultural worlds the transforming and mixing of cultures is quick and powerful, and thus investigating a certain culture will be even more challenging, so it cannot be implemented with this small-sized data: we only explore these children as age-oriented examples from the cultures they represent.

Musical culture is connected with the sounds of the native tongue, the way people act and behave, to their self-esteem and their orientation to the world, among other things. We may think of music as artistic productions and presentations,⁴ or music as processes and results of sounds produced and put together. The idea of maternal singing provides us with an understanding of the musilanguage phenomenon – a bridge at the line between music and languages. Maternal singing is observed in a sing-song manner, gliding-type sounds, poetic speech, musical speech, wordless song and breathy, moderately high-pitch voice (Malloch, 1999/2000), whereas Papousek (1996) describes the maternal musical communication as imitative or rhythmic nonsense sounds, and as repetitive nonsense sounds "filled with pleasure". We can even explore the broader framework of communication. Cross (2009) describes the evolutionary nature of musical meaning, and the systems of animal and human communication with the prosody of speech.⁵ According to Cross, music has semanticity, but it is adapted for a different function from the semanticity of language.

¹ EMP-L www.emportfolio.eu

² e.g. EUProject, EuroCom www.eurocomcenter.com

³ e.g. EUProject

⁴ musical creations

⁵ as the musical qualities recognised in the speech contour, connected to the speciality of each language

2.2 Musical interaction

Musical⁶ experiences combine people because of the shared experiences (Marjanen, 2009) already when confronting the worlds of two sound systems during the fetal period and at the moment of birth, linguistic and musical, to lead into a mental framework with cultural connections (Patel, 2008). Musical integration, through any combination of disciplines, creates a framework and tools for working on a theme chosen. Musical learning is connected with transversal processes, and thus can be comprehended as "the pedagogy of connection". (Dillon, 2006.) Musical communication can be observed from the behavioural models connected to musical elements, such as imitation and repetition, created out of forms, pitch, rhythm or tone (Marjanen, 2009). In the categorization of the present study, music, language and sounds were categorized to understand the construction of the choices made by the children.

2.3 Music and learning

For learning, it is imperative to aim for deep-level experiences supported by the combined pathways of emotions,⁷ the body⁸ and the cognition⁹ (Hannaford, 2004b). This is grounded on the fetal processes and the holistic experiences by means of the 12 senses of the fetus (Chamberlain, 2003), and can be later supported with sense-based learning environments (Marjanen, 2021; Rätty, 2015). The deep level experiences will better remain in the long-term memory, connected with the complex processes supported "with the crossroads to connect the body and the mind" (Damasio, 1994; Hannaford, 2004b; Tomatis, 1963/1977). Thus, the current App tends to benefit musical learning with the support of multisensory, holistic experiences.

Aural, cognitive, technical, musicianship, performance and learning skills create the structures for musical learning (McPherson & Hallam, 2009). Playful activities connect with music performances and also with the imaginative, creative playful performances (Kurkela, 1997). Learning at its best may not be so serious at all; it is about creative playful activities enjoyed and concentrated, supported with inner motivation (cf. Deci & Ryan, 2012; Järvillehto, 2014; Plant & Ryan, 1985; Ryan & Deci, 2006; Vygotski, 1978) and flow (Csikszentmihalyi, 1975; Custodero, 1998; St.John, 2004). In addition, the social components for learning are essential (Wenger, 1998).

2.4 Tacit knowledge and the Arts

When observing the behavioristic view on knowledge, information was comprehended as sensory-motor, pictorial-visual and conceptual, language-based information (Engeström, 1994), with no apparent connections with music. However, according to Markku Pöyhönen (2011), a vague connection to musical information at the time could be observed in sensory-motor information, in the form of instrument playing activities.

Supported with the constructivist learning comprehension, we can clearly point out the connections between musical information and skills (Kurkela, 1993, p. 124), and the visual arts information being a result of experiences (Pullinen, 2003, p. 25-26) – as well as musical information. The comprehension of arts education thus includes information on skill-learning information, skill maintaining information, technical abilities, the evaluation of technical abilities, and information of the predecessors. It leads us to the relationship between the arts and knowledge, connected with Tacit Knowledge (Polanyi, 1966/1983). It also helps us to explain the behavior with its past, presence, and future, to formulate and being formulated by the culture (cf. Marjanen, 2021). Tacit knowledge is connected with human interaction and the earliest learning processes, as a part of humanity. It can be explained starting from the prenatal interaction processes (Marjanen, 2009), with their ground on the holistic world of experiences by way of the 12 senses of the fetus (Chamberlain, 2003), and the arts, especially music as a factor for the brain development (Hannaford, 2004b).

⁶ sound-based

⁷ mentally

⁸ physically

⁹ "the common sense", reasoning

Polanyi's concept (1966/1983) Tacit Knowledge can be comprehended as silence, speechless or wordless knowledge, information passing on within cultures and through generations, connected with practically oriented expertise, or experiential learning with no articulation of the possibility to articulate information (Pöyhönen, 2011, p. 89). In Marjanen (2021), music learning experiences and knowledge comprehension were described via Faces, Spaces and Timelines accessed through musical learning at the Multisensory Musical Design (MMD).

2.5 Musical elements in languages and arts integration

To create a comprehension of music as a core for holistic interaction and dialogues through the arts, it is vital to create these connections here, as well. Musical elements create grounds for interaction, learning and education. These may be observed as structures for arts-integrated teaching, and as an interesting phenomenon for further explorations in the future. The idea of the elements to connect music, languages and arts is presented in Table 1 in Attachment 1.

The experiences of arts are only possible via our multisensory resources for the needs of experiencing our environment, the presence of other human beings, and emotions. These are explained via the sensory modes, especially from the grounds of information on early childhood –, general– or special education for teachers, which are also crucial for the current research needs. Please see an idea to describe the sense-based dimensions in Figure 1 below, created as a sum of various sources (cf. Marjanen, 2021) and supported by the understanding of fetus's 12 sensory modes (Chamberlain 2003).



Figure 1. The essential human sensory modes for experiences.

The experiences gained via the pathways of sensory modes and arts integrative elements create interaction and experiences to share and are thus meaningful for the current research. They can be observed as imprints in the brain, via the methods of brain research. In research literature, focus is often set towards a comprehension of a certain sense or two. However, on the grounds of the anthropology of senses, David Le Breton, Carmen Ruschieski and David Hoves (2017) define sight as the projective sense – to know –, hearing as the sense of understanding, touch as the sense of contact, smell as the sense of transition, and taste as a taste for life. We also know about the imprints of the multisensory experiences shown in the brain, and the abilities of one sense to replace another (Damasio, 2004). However, the meanings of imprints in our minds are being even harder to show, and this research aims to take some steps in that direction.

2.6 Visual preference theory

Following the presented idea of the connections between various fields of the arts, we can now better explore the visual factor at the Carnival of the Animals App and research. Robert Fantz's visual preference theory is based on his seminal study on infants' visual attention, which suggested that in attending to or fixating on a visual stimulus, the infant was actually learning

about the stimulus (Fantz, 1958). In this research, when a pair of visual stimuli were simultaneously presented to the right and left of the midline of infant participants, their fixations were systematically directed toward one stimulus over the other. In other words, infants spent significantly more time looking selectively at, or “preferred” one stimulus of the pair. This is supported by Hannaford’s “Dominance factor” – model (2004a). Although Fantz’s work focused on preverbal infants, his assumptions provided a conceptual basis for the current study. It is reasonable to speculate that when young children are fixating on and touching an object on the iPad, they are also learning about that visual stimulus. (S)he naturally uses also other senses with these visual explorations: besides the already mentioned the tactile sense, (s)he might also connect this experience with kinesthetic and auditive, or linguistic and proprioceptive sense-oriented information (see Figure 1 above). This idea of the visual stimulus is further supported by Bandura & Walters (1963), who believed that a child learns what he or she attends to. This is supported by the pedagogies of music education by Regelski’s (2017) notion, that in music education, experiences without a direction are not enough: the direction gives a motivation for one to learn, connecting with Vygotski’s (1978) socioconstructivist learning approach. Nevertheless, there has been little work on what attracts and maintains a young child’s preference for visual and auditory categories on an iPad App. The study of preference of visual and auditory elements on an App may provide valuable insights and implications for early childhood music learning, as a part of the holistic world of experiences in transversal learning processes.

3 Purpose of the study

Within a naturalistic setting of the home in the United States and Finland, the researchers examined the finger movement produced by four 6-year-old children, to determine their preferred graphic objects and sound categories, and to investigate the development of their visual and auditory preferences when interacting with the iPad App cross culturally.

Specifically, the research questions addressed are as follows:

- 1) Which visual/auditory elements do they engage first when they look at an App page?
- 2) What cultural changes or patterns occur in their preferences of graphic objects and sound categories?
- 3) What are parents’ views on children’s various abilities, such as ease of iPad use, reading, listening, language, music, visual, and other special interests?¹⁰ Does the child’s behaviour support the parent’s views?

Questions 1-2 are answered by the quantitative data set of the current research, and question 3 is based on the qualitative observations, to define why triangulation methodology creates significance for human-oriented research settings.

4 Delimitation

Because of the rapid changes in the media formats, this study may only be credible for the current time frame. Also, due to the small sample size, the findings of this study should not be generalized to a large population as a piece of absolute evidence. The aim has been in the deep level understanding and interpretation of a child’s behavior at a certain age, in a certain moment. It is also important to understand the philosophical grounds of the use of small size data. As shown via this research, detailed information for behavior needs to be observed via magnifying lenses, and later connected for several research results to create a whole, when possible. At this Carnival of the Animals research, the research process was constructed from this kind of an approach (Perez & Cslovjecssek, 2013), and it should support e.g., teacher students’ learning pathways.

5 Method

This study was a part of an international pilot study, following the procedure given for the pilot study (Perez & Cslovjecssek, 2013). After obtaining institutional review board approval and parental consent, the researcher followed the protocol to collect the finger-movement tracking data. However, at the Finnish research performance, information on the child’s interest and motivation for playing with the App was also collected: the children played as long as they wanted to. For the cross-cultural, quantitative investigation, a sample of 12 minutes from the beginning of the data was being analyzed, being able to create the

¹⁰ For this reason, the attached table to explore the elements behind various arts fields included examples of various arts forms in a variety that currently was being at our reach.

comparison for the needs of the current research setting.

Visit 1. Before the first visit, the App was installed with the mother tongue and one additional language. The mother tongue, English / Finnish, was the first language that the child experienced in the home. The App was turned on and revealed a picture of two lions on the screen on page 1. The researcher turned on the tracking button of the iPad and invited the participant to explore the App freely. The participant interacted with the App without receiving any guidance from the researcher. The session ranged in length from 10 to 12 minutes. If the child wanted to show something or to start a conversation, the researcher reacted naturally and redirected the child to the App. If the child did not touch the screen with the fingers, the researcher provided some encouragement and/or help to turn the page. The researcher did not intentionally touch the screen nor did she point at a specific place or indicate where to touch.

Visit 2. The child explored the App freely for about 10 to 12 minutes. If the child didn't change to page 2 during the first visit, the researcher showed her how to turn the pages.

Visits 3 and 4. The child explored the App freely for about 10 to 12 minutes. If the child did not understand how to scroll in the language or the musical bar,¹¹ the researcher showed her these manipulations during week 3, the researcher made sure that the participant played through all 14 pages on the App. All procedures were used in the same manner across participants in the study.

The target group consisted of four children, a boy and a girl from the United States, and a boy and a girl from Finland. Home visits with these children / their families were performed four times during five weeks in 2014. Of the visits, data were collected both quantitatively, in the form of finger movement-tracking created by Zehnder (2013), and qualitatively (interviews, videotaping the play activities during the sessions). In the current paper, our focus is set cross- culturally for the quantitative data, methods and results, and supported by some views on the qualitative data, as a support.

5.1 The Quantitative Analysis (Questions 1-2)

For the analysis, 12-minute data from the beginning of each session was explored with the focus on action,¹² object¹³ and sequences.¹⁴ The results were observed on the basis of the first choices on objects and sound made. In the analysis, 7,411 touch points¹⁵ were coded and output as raw data to identify the object, sequence and page number of each touch. The content analysis of the visual and auditory characteristics was performed in the framework of nine sound categories, to be grouped into four areas: (1) Language: talking animal, poem; (2) Music: conductor,¹⁶ music bar,¹⁷ music instruments and animals with ostinato sound patterns for improvisation; (3) Sounds: animal sounds, nature sounds; and (4) Game-like other sounds.¹⁸

5.2 The Qualitative Comprehension to Create a Dialogue with the Quantitative Interpretation (Question 3)

The qualitative data included the videos and the interviews.¹⁹ This was used as a support to understand the child and to better interpret the behavior within the framework created, and to collect information of the free play with the App, and about the experiences from the family's point of view. In the video data, the interaction was observed in sending and receiving messages,

¹¹ bar lines situated at the bottom of each page when touched, these bar lines will play the theme music from COA

¹² type of the movement: tap, move, or scratch

¹³ names of visual and auditory objects on each page and the times they were touched

¹⁴ the order of objects to be touched

¹⁵ US: 3,368; Finland: 4,043

¹⁶ theme carrier bug

¹⁷ barcode-like track playing the melody

¹⁸ require trigger of the game

¹⁹ starting and ending interviews with the parents and the children together

creating contact, exchanging of ideas, and musical-linguistic behaviour. Only within an incident of three minutes, the child may play with rhythms, imitate, use reverse language, improvise, create contact and connections to one's own life, etc. Also, the emotional expressions were investigated at the video data.

To access these phenomena, musical-linguistic elements were used as analysis tools to observe the transcriptions first made from the videos, and musical happenings were then highlighted from the data. As a support for the emotional expressions, theories of music and emotions were used to define the emotions expressed by the child. Four main categories presented for emotions supported the analysis: happiness, anger, fear and tenderness, and other emotions are then explained as mixtures of those, to connect finally in ways of musical expressions, as explained by Juslin (2001).

Besides the interaction evidence from the musical-linguistic inspiration connected with creating connections, also bodily behavior was shown in the videos, with a variation between various personalities. At their spoken language expressions, they also expressed their real-life experiences via playful episodes, thus taking the App as a part of their own life happenings. This can be comprehended also as an expression of the vocal development – children's spontaneous songs as a part of the enculturation process (Fredriksson, 1994), according to the phase of a child inventing and creating songs as stories of her own life. These kinds of individual features were shown, besides in the bodily interaction behavior, also in the duration of the child's playful focus duration. There was much variation between various individuals. The data revealed these features towards the results, with the support of systematic video analysis, supported by Annotation and HyperResearch video analysis software, connected with other data sets and theories (triangulation). In this paper, we delimited those out of the focus.

Qualitative comprehension is deeply oriented in the comprehension of knowledge, in reference to what is being searched for, how it is explained, understood, and observed. In this cross-cultural setting, our possibilities to holistically share the qualitative data would have needed a shared ground constructed from the beginning of the research, to direct the interviews and the video recordings. Unfortunately, this has not yet been performed in a cross-cultural research setting. However, the qualitative approaches, even as separate sections, help us understand and explain the results with their connections grounded in the prenatal, musical and linguistic development, and the holistic nature of music at the human life, and as a bridge between the individual and the social (Marjanen, 2021).

6 Results

In this Chapter, each question is being answered separately on the basis of the quantitative and qualitative data collected, with the analysis following the same procedures and performed by the same researcher. For the quantitative results, only 12-minutes period of the data was analyzed, while for the qualitative part, the data as a whole were observed.

Question 1: Which visual/auditory elements do they engage first when they look at an App page?

When looking at the rankings of the first preferred objects on the grounds of the four main areas,²⁰ it seems that the preferences demonstrated a consistent pattern across culturally. All the children, regardless of the cultural differences, preferred music clearly the most, and game-like sounds the least. This is supported by Eerola & Zentner (2010), with results for 2-year-olds preference for the musical, rhythmic sounds instead of spoken or other sounds. Please see Figure 2 for the description details.

²⁰ music, language, general sounds, game-like sounds

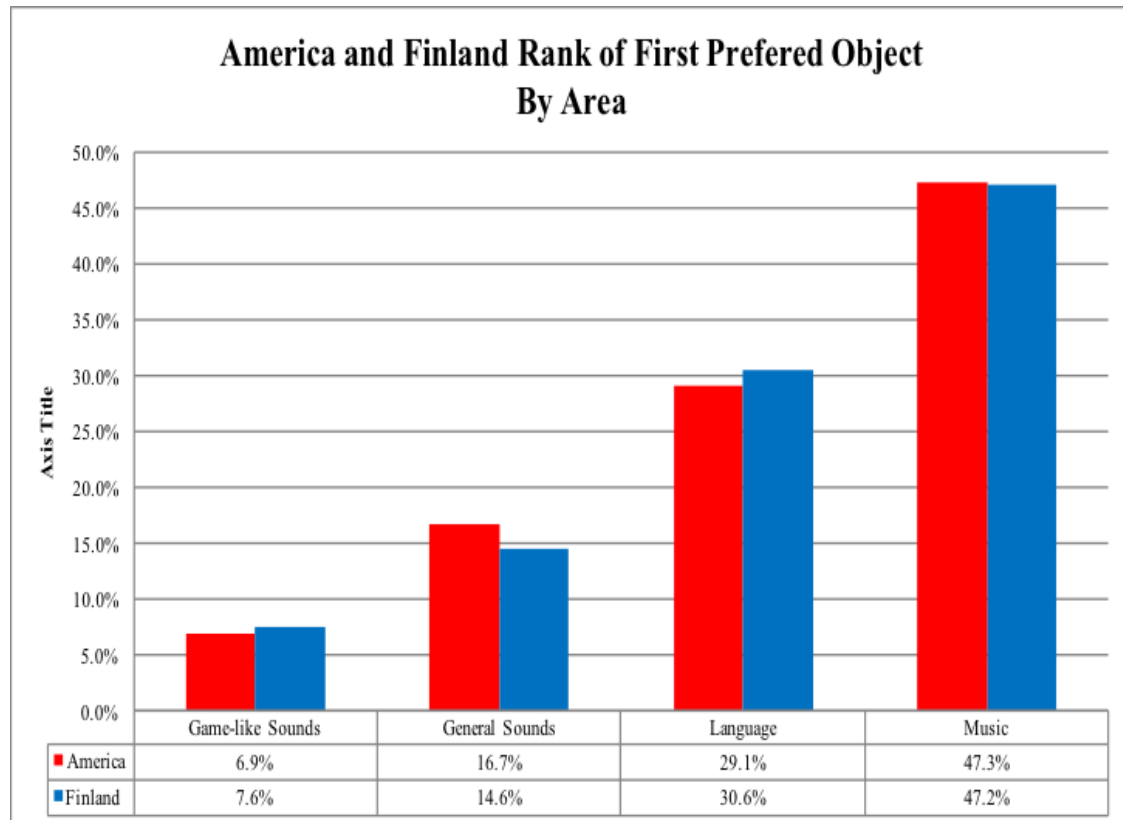


Figure 2. Comparing of the first preferred object: American and Finnish 6-year-olds.

Question 2: What cultural changes or patterns occur in their preferences of graphic objects and sound categories?

To clearly answer the question on cultural changes/differences, large-scale data would be needed. However, some interesting details can be seen when looking at this small sample (n=4). Figure 3 shows a bar graph of the summed percentage of the rank of first preferred objects within the nine subcategories between the Finnish and American 6-year-olds. Talking animals were the most visited object for all participants. When comparing the Finnish and the American 6-year-olds under the nine subcategories, the most apparent difference would seem to be on the choices of the poems.²¹ The other main differences would seem to be the choices on the talking animals,²² the choices on improvised sounds,²³ and the choices made on the music bar.²⁴

²¹ almost 12 % often chosen by the Finnish children

²² with about a 7% more by the Finnish children

²³ with about 7% more by the American children

²⁴ about 7% preference by the Americans

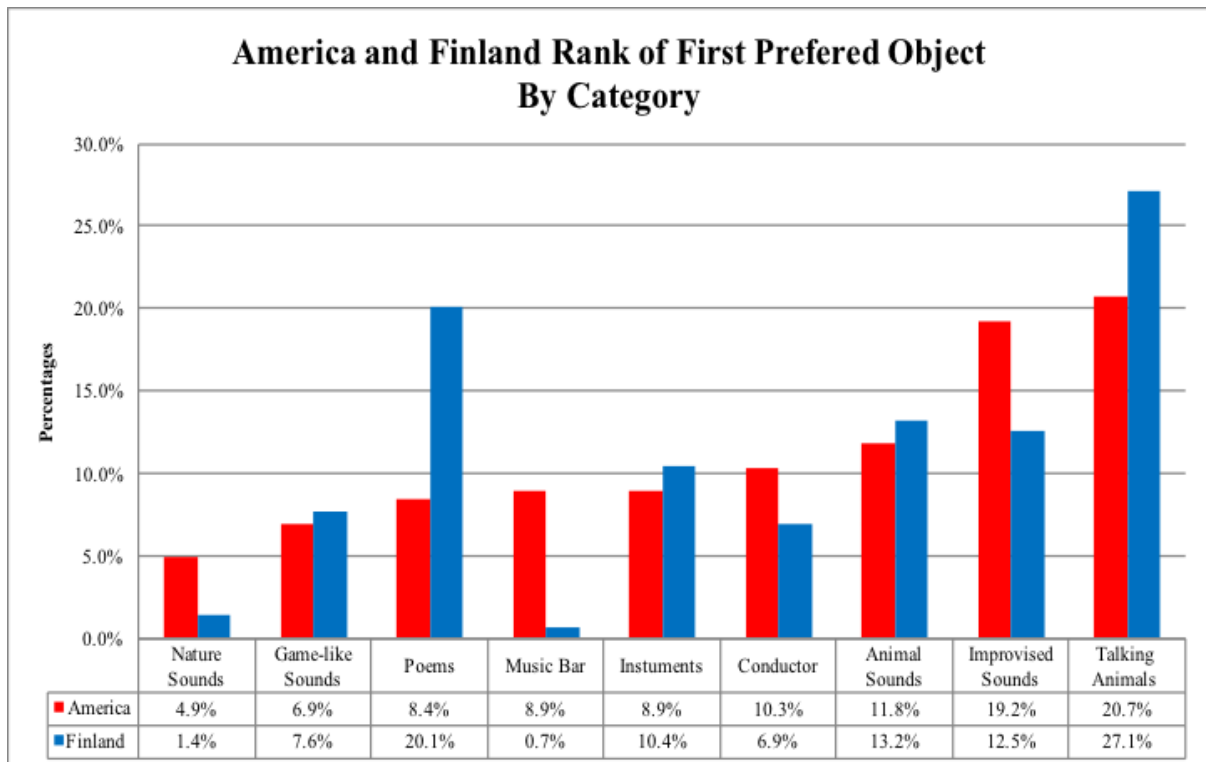


Figure 3. Comparing the rank of first preferred objects within the nine subcategories between the Finnish and American 6-year-olds.

To understand and explain the cultural differences, also the comparison between the sexes should be made, and the qualitative information²⁵ should be observed from that regard. However, due to the small amount of data, it would not serve the purposes of the paper, to go further for these observations. Gender behaviour models or differences by the Finnish and American behaviour cannot be found to make a generalization. When observing this limited amount of data, we can only see individual differences because of the differences in personalities, likes, dislikes and reflections may be of domestic cultural values. We can go back to Figure 1, to examine the choices made follow the same preferences within the framework of the four main areas: language, music, sounds and game-like sounds, which of music was clearly the most preferred despite of the sex or culture. So, at this point we can state that there are explicit behavioural models and preferences despite of the culture and sex, but the children's behaviour may be more personally oriented than culturally or sex-oriented. Another new approach to explore these results further would be to analyze the data via musical-linguistic elements, which might give us more information also of the deposit of music and the prosodies of speech, and the musical elements in spoken or other sounds. Let us now have a look at the qualitative data on the interviews and the videos, to answer the last question, number 3.

Question 3: What are parents' views on children's various abilities, such as ease of iPad use, reading, listening, language, music, visual, and other special interests? Does the child's behaviour support the parent's views?

The interviews with the Finnish parents and their children provide us with another perspective: how to describe the experiences during the study. All the Finnish parents pointed out the educational nature of the Carnival App; describing the learning processes observed by their children by imitating languages, sounds and music, creating music, learning about the use of this technical device and especially the App itself. The App was also found very amusing and positive with many possibilities to support the child's interaction behaviour.

At the personal level, the inner motivation and individual interests were clearly shown in the video data as well as in the session durations and the variety of choices made while the children interacted with the App. It was clear that the interest in reading

²⁵ videos, interviews

and writing skills were also shown - both the Finnish children had already learned the reading skills, and the girl was especially interested in reading, imitating and continuing of the App stories,²⁶ when the boy was more interested in writing.²⁷ These results need the support of musical-linguistic elements as a ground, to understand how music reflects in the communication and spoken or bodily interaction.

As an example of what happened during such an interaction episode, here are samples from the beginning of two episodes by a 6-year-old Finnish girl. During these samples, lots of interactive behaviour were inspired by the playful activities with the App, connected with creative musical performances:

1) Episode 3 (total duration of the sample: 6' 40'')

- Communicating with the father
- In the beginning: playing with tempo changes
- "Isi!" (Father in the Finnish language) (0' 20'')
- Bubbles (1' 15'')
- Talking about the story
- Imitating "Aasit ovat köyhiä" ("The donkeys are poor", Finnish language at the App) with facial – bodily expression and the tone of the voice (1' 48'')
- Back to tempo changes (2' 13'')
- Imitating only with the mouth (silent imitation) (2' 18'')
- Imitating, reading, listening (2' 33'')
- Taking contact to the father, eye to eye contact, smile (2' 46'')
- Imitating aloud, reading (2' 50'')
- "Olen niin surullinen" ("I am feeling so sad", Finnish language at the App): emotions, listening to the guitar (3' 49'')
- Making rhythms out of sounds (4' 29'')
- Playing the piano (5' 30'')
- Sharing the playing with the mother (6' 18'')
- Remembering their own cat, imagining the cat's concert with him (6' 28'')

2) Episode 4 (total duration of the sample 3' 37'')

- Eye-to-eye contact with the daughter's head on the mother's lap
- Asking the mother to guess the page in question by the sound sample
- A lot of discussion on guesses and answers and about the animal species in question
- Reverse language, to guess the page... (1' 33'')
- Talk about the facial images of the animals
- "Mihin te kaikki menette" ("Where are you all going?", Finnish language at the App) – communicating via the App to present a question to the elder daughter (1' 58'')
- Repetition
- An answer received (2' 35'')
- Animal sounds (2' 48'')
- Discussing about the sounds with the mother (3' 09'')

These small sample examples are given to create an idea of why this qualitative data is needed to understand the child's interaction behavior while using the App: it reveals what happens externally of the App, or as inspired by the App playful, imaginative performances. The child connects with the other people in the room, but to create a real research evidence, another research paper should be written with a separate focus on that. These examples were only picked out from the data collected by these two children as the target of the Finnish sub study.

The individual differences shown in their skills and interests may have been a factor also shown in the durations of the sessions, as a deviation from the original research protocol, with the children's possibility to play as long as they wanted to. Please see Figure 4 below to observe this.

²⁶ poems

²⁷ no connection with the behaviour with the App

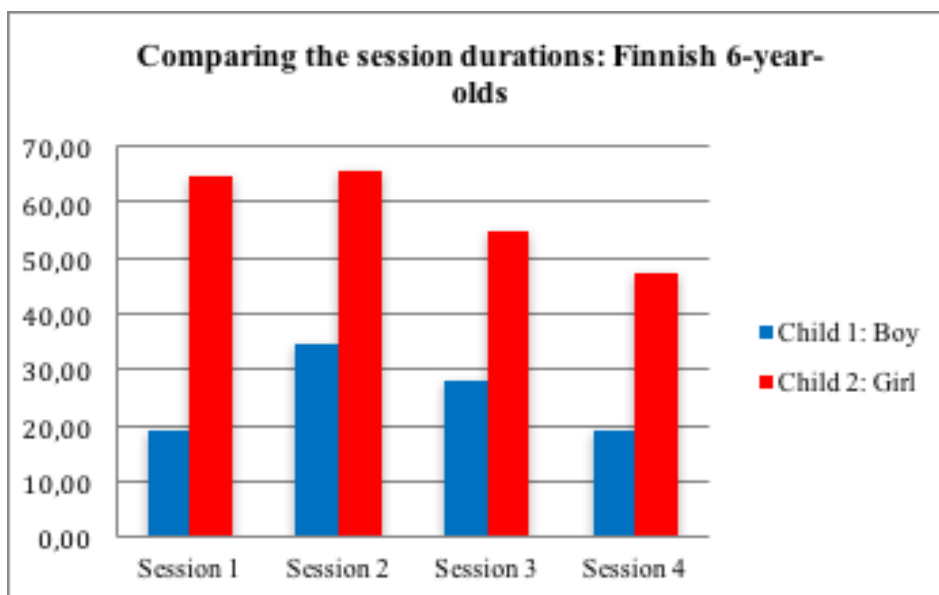


Figure 4. The session durations: Finnish participants' motivation and interests towards the App.

A lot of the child's activities would remain unknown unless we found the support of the video data. In the videos, the active interaction with the musical behavioural models can be observed, such as the improvisational activities performed, other than the improvisation with the App qualities - e.g., the Finnish girl used the speech rhythms, the syllables to create music with structures and tones out of speech, and to communicate with the parents. The video data also revealed a lot of silent ways to communicate, motivated by the App. It seemed to support the sharing of the positive experiences. Connections to one's own life were created, and the App was also used playfully to communicate directly with other family members. No fear of misuse of the device or fears of addictions created because of this App were shown. The modality of the chosen actions²⁸ with the idea of visualization, brought light to the importance of learning about the personalities of the children we interact with.

When looking at the latter research data on the Finnish 3-4 -year-old children, it may be stated, that the duration of the session tends to follow the same lines - with the second session being the longest by duration. There is a clear need to collect more data in various countries and age groups, to comprehend the phenomenon with its connections better.

7 Discussion and conclusion

This research study is the first attempt to investigate the cross-cultural behavior of young children's visual and audio preferences on iPad. The results were consistent with several previous studies (Tu, 2017a; 2017b). Talking animals were the first touched objects for younger children regardless of culture; both participants from the United States and Finland demonstrated similar patterns in their preferences among music, language, general sounds, and game-like sounds. Similar patterns shown between the two cultures proven that the finger-movement tracking software is a valid research tool. The finger-movement tracking software is reliable and accountable for investigating young children's interactivities with the iPad.

The core interest of the current focus was set for the musical interaction behavior as affected by the COA App. As it was already shown in many ways in the results of the study, that individual factors were found as strong implications for the study results. Only a small moment of the four children's lives was observed for the current research. However, it can be stated that both qualitative and quantitative data are needed to explain a bit of the child's (musical) interaction behaviour. On the basis of the quantitative data, interesting findings may be found, but to be able to answer the questions arising, qualitative data is needed. It is undeniable, that with the support of the videos and interviews, a lot can be further explained - with new questions arisen.

²⁸ animations, verbal appearances, sounds, soundtracks or music

Much interesting behaviour was revealed only within a few minutes of the video observations; and even with the limitations of the study kept in mind, we can claim that the amount of data as a whole is vast for a human discipline study - giving much information of the child's learning and behaviour with touch-based devices.

The interests of the children seemed to be shared despite of the culture. Musical elements - sounds - arise the child's interests, and the creation of music via the use of the elements – here is another direction to observe further. Is this benefitted enough in the educational field already? Music and languages seemed to function as sounds in learning on the basis of the current data. However, it would be fascinating to look further at certain appearances of the data, such as *the poems* arising in the Finnish children's interaction behavior. It might be connected to the rich and strong tradition in Finland for poetry and storytelling, also shown in the Finnish National Anthem, The Kalevala. Also, can we create any dialogues to the nature, connected with the Finnish children's interest on the animal sounds? It can also be considered and observed, if the cultural grounds would be seen in the American children's interest on the improvised sounds - due to the musical tradition and the history of jazz and blues in America? These American children found the music bar also more interesting than the Finnish children - are there references to the technological behaviour models, or how could this be explained?

Connections to the inner motivation were found. The App seemed to support the interaction behaviour - functioning as a factor for inventing and finding new ideas. The preferences of the 6- year-olds were very consistent across the two cultures. Would this be the case with all the age groups - could we find some behavioral models or patterns of behavior with this App, when observing various age groups in different geographic locations?

This App, and the study with the App would seem to produce much interesting information for the field of music education - both from the App developers' and the teacher's' point of views, but also for the development of music education and music education methods, and for language education and language education view, not to forget the significance of the results and information accessed for general early childhood education. The individual differences shown so clearly in the study would need a lot of attention by the teachers - the importance of giving the individual pupils the time and space needed, with the respect for it unmuch – and maybe, it would also be worth connecting with the various emphasizes of individual multisensory with respect use of this App also may provide us with interesting information via the use of it as a tool for the teacher students, as already pointed out in several investigations (Marjanen, 2016; 2015; 2014a, 2014b; Marjanen & Cslovjecsek, 2017). It seems that this App may support the comprehension of human behavior, connected with Tacit Knowledge (Polanyi, 1966/1983), and explain also the needs of music studies as a part of one's professional development, child behavior, students' research skills and identities, with teacher explain (Marjanen, 2016; Marjanen, & Cslovjecsek, 2017). The qualitative and quantitative data sets and researcher collaboration, to access triangulation, were found significant for the comprehension and results stated.

In the future, a large sample size should be conducted to investigate the variety of developmental processes, sex and age differences, and cultural factors etc. Important information obtained by the longitudinal approaches could be helpful and the need and possibilities for other research orientations, such as music at the general professional studies. It is phenomenal to keep in mind that the current framework: media formats changing rapidly may alter the results in the long term, and due to the small sample size, any absolute conclusion cannot yet be given. *It is strongly recommendable for the readers of this article to download the Carnival of the Animals App personally to understand the current research better and even to explore its use with children. Also, the ideas and wishes for new languages for the App are taken into notice!*

References

- Adams, G. (2014, January 29). The day I realized my toddler was addicted to the iPad: Three- year-old William tugged at the duvet and woke his father demanding the tablet...at 4am. *Mail online*. Retrieved from <http://www.dailymail.co.uk/femail/article-2548365/As-revealed-one- three-children-use-tablet-talk-fathers-alarming-story-The-day-I-realised-toddler-addicted-iPad.html>
- Bresler, L. (2004). *Knowing bodies, moving minds: Towards embodied teaching and learning*. Vol. 31, No. 2 (2005). Retrievable in: <http://www.jstor.org/stable/20715388>, University of Illinois Press, 94-97
- Brown, S. (2000). The "Musilanguage" model of music. In N-L. Wallin, B. Merker & S. Brown (Eds.) *The Origins of Music*.

London: The MIT Press, 271-300.

Chamberlain, D.B. (2003). Communicating with the mind of a prenat. Guidelines for parents and birth professionals. *The journal of prenatal and perinatal psychology and health*, 2 (18), 95- 108.

Chamberlain, David B. (1994). The sentient prenat: What every parent should know. *Pre- and perinatal psychology journal* 9 (1), 9-31.

Cross, I. (2008). Musicality and the human capacity for culture. *Musicae Scientiae*, Special Issue: *Narrative in music and interaction*, 147-167.

Csikszentmihalyi, M. (1975). *Beyond boredom and anxiety: Experiencing flow in work and play*. San Francisco, CA: Jossey-Bass

Csikszentmihalyi, M. (1990). *Flow. The Psychology of Optimal Experience*. New York: Harper & Grow.

Cslovjecsek, M. & Perez, J. (2013). *The Carnival of the Animals: A collaborative research project to explore the interactivity of 2 to 8 year-olds from diverse locations with an App for iPad*. Unpublished document.

Cslovjecsek, M. (2000). Sound-led learning. In Scholz et al (Eds.) *Transdisciplinarity: Joint Problem-Solving among Science, Technology and Society, Mutual Learning Sessions, Workbook II*. RW, 149-153.

Cslovjecsek, M. & Linneweber-Lammerskitten, H. (2011). Snappings, clappings and the representation of numbers. *The New Jersey Mathematics Teacher*, 69 (1), 10-12.

Custodero, L. (1998). Observing flow in young people's music learning. *General Music Today*, 12 (1), 21-27.

Damasio, A.R. (2001). *Descartesin virhe. Emootio, järki ja ihmisen aivot*. A Finnish edition of

Damasio (1994). *Descarte's error. Emotion, reason and the human brain*. Translated by Kimmo Pietiläinen. Helsinki: Terra Cognita

Deci, E. L., & Ryan, R. M. (2012). Motivation, personality, and development within embedded social contexts: An overview of self-determination theory. In R. M. Ryan (Ed.), *Oxford handbook of human motivation* (pp. 85-107). Oxford, UK: Oxford University Press. doi: 10.1093/oxfordhb/9780195399820.001.0001

Dillon, P. (2006). Creativity, integrativism and pedagogy of connection. *International Journal of Thinking Skills and Creativity*. 1 (2006) 69–83. Elsevier. Available online at www.sciencedirect.com

Doyé, P. & Meissner, F. J. (Eds., 2010). *Lernerautonomie durch Interkomprehension: Projekte und Perspektiven*. Giessen. Gunter Narr Verlag.

Engeström, Y. (1994). *Perustietoa opetuksesta (2.–9. painos)*. (Basic information on teaching). Helsinki: Valtiovarainministerio

Fredriksson, M. (1994). *Spontaanit laulutoisinnot ja enkulturaatioprosessi : kognitiivis-etnomusikologinen näkökulma alle kolmevuotiaiden päiväkotilasten laulamiseen*. (Variants in spontaneous songs and the enculturation process: a cognitive-etnomusicological approach to the singing of children under the age of three in day care.) Academic dissertation. Jyväskylä studies in the arts. ISSN 0075-4633, 43.

Geist, E. A. (2012). A qualitative examination of two-year-olds interaction with tablet based interactive technology. *Journal of Instructional Psychology*, 39(1), 26-35.

- Hannaford, C. (2004a). *Oppimisen palapeli. Yksilölliset aivoprofiilit*. (A Finnish edition of *The Dominance Factor*, 1997, translated by Teija Salminen.) Kehitysvammaliitto.
- Hannaford, C. (2004b). *Viisaat liikkeet – aivojumballa apua oppimiseen* Originally 1995: Smart moves, why learning is not all in your head. A Finnish edition (5. ed.). Helsinki: Hakapaino Oy.
- Hodgson, S. (2013). *Action research: Early years students can use higher order thinking skills to independently create content in music using touch interface technology*. Retrieved from <http://ltt.cdnis.edu.hk/wp-content/uploads/2013/08/SHodgson.pdf>
- Juslin, P.N. (2001). "Communicating emotion in music performance: a review and theoretical framework." In *Music and emotion*, edited by Patrick N. Juslin, and John A. Sloboda, 2001, 309–337. New York, NY: Oxford University Press.
- Juslin, P. N. & Sloboda, J. A. (2010). The past, present, and future of music and emotion research. In Juslin P. N., Sloboda J. A. (Eds.), *Handbook of music and emotion: Theory, research, applications* (pp. 933–955). Oxford: Oxford University Press.
- Järvillehto, L. (2014). *Hauskan oppimisen vallankumous* (The revolution of learning with fun). PS-Kustannus.
- Kurkela, Kari (1994). *Mielen maisemat ja musiikki. Musiikin esittäminen ja luovan asenteen psykodynaamiikka*. (Music and mental landscapes. Musical performance and psychodynamics of a creative attitude, 2nd edition). EST-publications, 1. Helsinki: Hakapaino, Inc. ISBN: 9529658176.
- Le Berton, D., Ruschieski, C. & Howes, D. (2017). *Sensing the World: An Anthropology of the Senses*. ISSN 2052-3092. Taylor & Francis Group.
- Malloch, S.N. (1999/2000). Mothers and infants and communicative musicality. In *Musicae Scientiae. Special issue 1999/2000*, 29-57.
- Marjanen, K. (2021). "Multisensory Musical Design: Views for Music as a Phenomenal Framework for Human, Phenomena-Based Education ." *The International Journal of Arts Education* 15 (3): 15-47. doi:10.18848/2326-9944/CGP/v15i03/15-47.
- Marjanen, K. (2016). The Carnival of the Animals – an iPad App to Support Interaction. *R&M Source. Special Issue #5*, September 2016, Pädagogische Hochschule Niederösterreich. ISSN: 2313-1640. Retrieval in: <https://journal.ph-noe.ac.at/index.php/resource/issue/view/Special%20Issue%20%235>
- Marjanen, K. (2015). Towards the understanding of sound education - music education, language education and wellbeing. *CFMAE 2015 The Changing Face of Music and Art Education- Interdisciplinary Journal for Music and Art Pedagogy*. ISSN 2228-0715/ ISSN 2228-0723 (Online, pdf) Retrieval in: https://www.researchgate.net/publication/312027217_Towards_the_understanding_of_sound_education_-_music_education_language_education_and_well-being
- Marjanen, K. (2014a). Playful Musical Activities for iPad: The Carnival of the Animals as a Support for Musical Interaction. *International Society for Music Education, Early Childhood Seminar Proceedings*, Brazil, Brasilia, 15-19 July 2014
- Marjanen, K. (2014b). Language loves music - Creative sounds as a support for interaction. *Arts, technology and cultures – From invisible to visible*. 17th of October 2014, University of Helsinki. Conference abstract and paper presentation.
- Marjanen, K. (2009). *The Belly-Button Chord. Connections of Pre- and Postnatal Music Education with Early Mother-Child Interaction*. University of Jyväskylä. Jyväskylä Studies in Humanities 130. A music education dissertation. (Retrieval in <https://jyx.jyu.fi/dspace/bitstream/handle/123456789/22602/9789513937690.pdf>)

- Marjanen, K & Cslovjecssek, M. (2017). The Carnival of the Animals (COA) - iPad app as a tool for the students' professional growth via practice oriented research on culture-based interaction, 338- *EAPRIL 2017 Proceedings*. Retrievable in: https://eapril.org/sites/default/files/2017-03/Proceedings-final_0.pdf
- Marjanen, K. & Cslovjecssek, M. (2016). The design and method of the Carnival of the Animals: an international study to explore children's interactivity with an app for iPad. Symposium. *32nd World Conference of the International Society for Music Education ISME: 24-29 July 2016, Glasgow, UK*.
- Marjanen, K. & Cslovjecssek M. (2014). Transversal Processes - Learning More about the Teaching Profession through Music. *The European Journal of Social & Behavioural Sciences (EJSBS) VII Design in Mind 4*: 1234-1243.
- McPherson, G. & Hallam, S. (2009). Musical potential. In S. Hallam, I. Cross & M. Thaut. (Eds.) *The Oxford handbook of music psychology*. New York: Oxford University Press, 255- 264.
- Meissner, F. J. (2010). Gab es eine Mehrsprachigkeitsdidaktik ante litteram? Ein historisches Aperçu. In Gnutzmann, Claus & Königs, Frank G. (Koord.): *Geschichte des Fremdsprachenunterrichts. Fremdsprachen lehren und lernen 39*, 132144.
- Papoušek, Methild (1996). Intuitive parenting: a hidden source of musical stimulation in infancy. In Déliege, I. & Sloboda, J. (eds.) *Musical beginnings. Origins and development of musical competence*. Oxford University Press: New York, 88-112.
- Patel, A. D. (2008). *Music, language and the brain*. New York: Oxford University Press.
- Plant, R., & Ryan, R. M. (1985). Intrinsic motivation and the effects of self-consciousness, self- awareness, and ego-involvement: An investigation of internally controlling styles. *Journal of Personality*, 53, 435–449.
- Polanyi, M. (1966/1983). *The Tacit Dimension*. First published Doubleday & Co, 1966. Reprinted Peter Smith, Gloucester, Mass, 1983.
- Pullinen, J. (2003). *Mestarin käden jäljillä. Kuvallinen dialogi filosofisen hermeneutiikan näkökulmasta*. (At the steps of the master. Visual dialogues from the views of philosophical hermeneutics.) Taideteollisen korkeakoulun julkaisu A 40
- Pöyhönen, M. (2011). *Muusikon tietämisen tavat: Moniälykyys, hiljainen tieto ja musiikin esittämisen taito korkeakoulun instrumenttituntien näkökulmasta*. Väitöskirja. Jyväskylä Studies in Humanities, 164. Saatavana verkkoversiona osoitteesta <http://urn.fi/URN:ISBN:978-951-39-4516-9> , painettu versio ostettavissa osoitteesta <http://julkaisut.jyu.fi/?id=978-951-39-4516-9>. (The ways of knowing of a musician. Multiple intelligences, tacit knowledge and the art of performing seen through instrumental lessons of bachelor and postgraduate students. Doctoral dissertation with Summary and Abstract in English.)
- Regelski, T. A. (2017). *A Brief Introduction to Music and Music Education Philosophy as a Social Praxis*. London: Routledge.
- Ryan, R. M., & Deci, E. L. (2006). Self-regulation and the problem of human autonomy: does psychology need choice, self-determination, and will?. *Journal of personality*, 74(6), 1557-1586. Richtel, M (2010, June 6). Your brain on computers: Attached to technology and paying a price. *The New York Times*. Retrieved from <http://www.nytimes.com/2010/06/07/technology/07brain.html?pagewanted=all&_r=0>
- Richtel, M (2010, June 6). Your brain on computers: Attached to technology and paying a price. *The New York Times*. Retrieved from <http://www.nytimes.com/2010/06/07/technology/07brain.html?pagewanted=all&_r=0>
- Räty, M. (2015). *The multisensory space method*. In <http://www.aistienmenetelma.net/introduction>; and in <https://www.laurea.fi/en/projects/with-all-senses>

- Seibert, G., Hug, D. & Cslovjecssek, M. (2015). Towards an Enactive Swimming Sonification: Exploring Multisensory Design and Musical Interpretation. *Proceedings of the Audio Mostly 2015 on Interaction With Sound*. ACM New York, NY, USA ©2015
- St. John, P.A. (2004). *A Community of Learners: An Investigation of the Relationship between Flow Experience and the Role of Scaffolding in a Kindermusik Classroom*, unpublished doctoral dissertation, Teachers College/Columbia University. New York.
- Tomatis, Alfred A. (1963/1997). *The ear and language*. Toronto: Storrard Publishing co.
- Tu, C., Cslovjecssek, M., Pérez, J., Blakey, J. & Shappard, E. (2014). Assessing the Interactivity of 3-year-old Children with an iPad App: The Carnival of the Animals. *Perspectives, Journal of the early childhood music and movement association*. 9 (3), 15-18.
- Tu, C. (2017a). A two-year study on young human's interactivity with an iPad App: The Carnival of the Animals (COA). In Bugos, J. A. (Ed.), *Contemporary research in music learning across the lifespan: Music education and human development*(pp. 97-110). New York, NY: Routledge.
- Tu, C. (2017b). Interactivities with the Carnival of the Animals (COA) App: A cross-sectional study. *Perspectives, Journal of the Early Childhood Music and Movement Association*, 12(4), 12-19.
- Vygotsky, L. (1978). Interaction between learning and development. *Mind and society*, 79-91. Cambridge, MA: Harvard University Press.
- Wenger, E. (1998). *Communities of practice: learning, meaning, and identity*. Cambridge University Press.
- Wilkinson, A. (2010). *iPads as an educational tool for the prekindergarten classroom* (Unpublished master's thesis). University of St. Thomas.
- Zentner, M. & Eerola, T. (2010). Rhythmic engagement with music in infancy. *Proceedings of the National Academy of Sciences* 107(13):5768-73. DOI: 10.1073/pnas.1000121107

Artwork and tables with captions

Figures

Figure 1: Comparing of the first preferred object: American and Finnish 6-year-olds.

Figure 2: Comparing the rank of first preferred objects within the nine subcategories between the Finnish and American 6-year-olds.

Figure 3: The session durations: Finnish participants' motivation and interests towards the App.

Attachments

Attachment 1: Table 1. Musical-linguistic and artistic elements in education.

Table 1. Musical-linguistic and artistic elements in education.

SKILLS AND ARTS FIELDS AS DIALOGIES IN SCHOOL SUBJECTS		MUSIC AND AUDITIVE ARTS; SOUND EDUCATION	DANCE, (MUSIC &) MOVEMENT, CIRCUS	DRAMA, MOVIE, MEDIA, PERFORMANCE	VISUAL ARTS, PHOTOGRAPHY, CARTOON	LANGUAGES, WORD ARTS (POETRY, LITERATURE, SPEECH ART..)
MUSICAL-LINGUISTIC ELEMENTS AS STRUCTURES FOR ARTS AND SKILLS SUBJECTS	Dynamics, nuances (force, power)	Dynamic nuances in sound, expressive tools; prosody	The expressional power of the movement	Focus and contrasts	The expressional power of the image/vision, size, colour and value; dynamics in space	Intonation, prosody
	Pitch, melody	Changes in pitches (up, down, steady, gradual movement, intervals, jumps); prosody	What/ how it is being moved (levels, directions; changes of levels)	Expressional intonation, ways of using one's voice, dialogues (question -answer)	A line, the expressive elements of a picture	Pitch, prosody
	Tone, sound	Changes in tones; various tones of human individuals and musical instruments, tones in sound environments; prosody	Space – where and how to move; changes of levels in a space	Emotion, feeling, space	Tone, atmosphere; multiple lines	Tone, sound, prosody
	Structure, form	Motives, phrases, lines and verses. Parts of compositions in various forms (AB, ABA, ABC, ABACADA...the sonata form)	Structure (form, unit)	The tension of drama (curve)	Composition (dots, lines, surfaces, forms, colours and spaces). Sharpness.	Structure (syllables, sentences, paragraphs...)
	Rhythm, duration	Basic beat (pulse), melody rhythm (word rhythms), pace types, rhythmic ideas (repetitions etc); prosody	Tension, encounters	The rhythm of drama (curve)	Free or bound elements within visual rhythms, spatial repetitions	Rhythm, stress, prosody
	Tempo (speed)	Musical tempo and its variation, tempo markings; prosody	When, how and for how long to move	Rhythm, dramaturgy	<i>No equivalency / correspondence?</i>	Tempo, prosody
	Harmony	Simultaneously sounding tunes, chords (major, minor, clusters... dissonance, consonance). Keys.	One / many	The participative actors/ the audience's drama; drama adaptations	The holistic balance and harmony of the work; golden ratio; tension through contrasts	One / many
	Distance	The sounds or voices experienced with the distance from the listener.	The distance between dancers/ between the dancers and the audience	The participative actors/ the audience's drama; drama adaptations	The composition and placement of pictorial elements (connected with structure, rhythm and harmony)	The distance between speakers and the audience
	Direction	The sounds or voices experienced with the directions from the listener and his/her postures.	The dance directions in space, mutually, in regard to the audience	Coreography and postures/ positions	Horizontal, vertical and diagonal directions; forms	The direction of the sound coming and going