Universal Design 2016: Learning from the Past, Designing for the Future
H. Petrie et al. (Eds.)

doi:10.3233/978-1-61499-684-2-528

Embodied and Distributed Parallel DJing

Birgitta CAPPELEN[a,1] and Anders-Petter ANDERSSON[b]
[a] *The Oslo School of Architecture and Design (AHO)*
[b] *The Oslo and Akershus University College of Applied Sciences*

Abstract. Everyone has a right to take part in cultural events and activities, such as music performances and music making. Enforcing that right, within Universal Design, is often limited to a focus on physical access to public areas, hearing aids etc., or groups of persons with special needs performing in traditional ways. The latter might be people with disabilities, being musicians playing traditional instruments, or actors playing theatre. In this paper we focus on the innovative potential of including people with special needs, when creating new cultural activities. In our project RHYME our goal was to create health promoting activities for children with severe disabilities, by developing new musical and multimedia technologies. Because of the users' extreme demands and rich contribution, we ended up creating both a new genre of musical instruments and a new art form. We call this new art form Embodied and Distributed Parallel DJing, and the new genre of instruments for Empowering Multi-Sensorial Things.

Keywords. music, health, multi-sensory environment, mse, empowerment, distributed communication, internet-of-things, music making

1. Introduction

Music and music related activities are important experiences and should be a right [36, 46] in every person's life [11, 14, 19]. Musical instruments and cultural artefacts, with or without computer technology, represent and offer various cultural and interactional possibilities for people with diverse abilities. Within research related to music technology for people with special needs, the focus has been on people's ability to control the interface of the instruments [4, 12, 29, 30, 31], often with an additional accessibility layer, such as larger switches and more accessible input sensors. Thereby, in our opinion, great possibilities and innovative solutions are neglected. Possibilities for creating novel cultural artefacts, where one for instance uses computers ability to listen, learn and answer "intelligently" and build narratives and relations over time. New interfaces and interaction forms, where diverse users can participate and co-create cultural and empowering [49] experiences together [7, 8, 9], on *their own terms*, *not only control* tools or perform *predefined tasks* [8].

In this paper we present an original creative practice and new hybrid genre of interactive musical instruments [10, 26, 48] and multi-sensory artefacts [18], designed and developed for people with diverse resources and abilities to participate and co-create on equal terms. We have chosen to call the new creative practice "Embodied and Distributed Parallel DJing" and the new genre of musical instruments for "Empowering

[1] Corresponding Author, Oslo School of Architecture and Design (AHO), PO Box 6768 St. Olavs plass, 0130 Oslo, Norway; E-mail: birgitta.cappelen@aho.no

Multi-Sensorial Things". We consider "Embodied and Distributed Parallel DJing" to be a new form of DJing, where several users simultaneously, in *parallel*, interact musically together using physical, moveable interactive devices, playing on and with musical tunes. Traditionally, DJing is an artistic practise, where a Disc Jockey (DJ) match dance-music together using two record players, now usually computers, for an audience. Both the combination of musical tunes and the way of matching (transitions, scratching over songs, volume change) is considered to be part of the DJs artistic practise and expression [33]. The DJ is usually standing on a stage, controlling the device with his hands. In contrast, with our "Embodied and Distributed Parallel DJing" *several persons* can deejay together, using their *whole body* [15] *and move* around (see Figure 2) when interacting with an interactive multi-sensorial and wireless device, or *thing*. Parallel DJing can be performed in the same room or in separate places, *distributed*, over the Internet [6] (see Figure 2, Compose APP).

In our research we combine perspectives from Tangible Interaction Design with empowerment and resource-oriented Music Therapy [35, 36], Sensory Integration [3] and Multi-Sensory Environments (MSE) [18, 34]. Tangible Interaction Design [22, 24] is one of many names concerning design of physical things with computer capabilities [47, 22]. Our focus is on the design and interaction possibilities that lie in the physical, "hybrid" artefact [27, 28], when including computer components such as sensors, network, hardware and software into cultural things. The artefact embodies cultural interpretation possibilities, which we build on when designing and using the artefact [15]. Interpretation of the artefact creates expectations in the user that develop through interaction and relation over time [2].

The resource-oriented and empowerment perspectives [35, 36] in Music Therapy focuses on the abilities and strengths of the person, not on their weaknesses. The goal is to improve vitality, self-esteem, social relationships and participation through mutual and equal, positive [36], musical experiences [29, 30, 31, 32]. To design music technology with such goals, the challenges shift from the interface to the relation building potentialities of the designs. The focus shifts *from controlling* the interface [29, 30] to motivate and reward participation, *social interaction and co-creation*. When designing for people with different abilities, motivations and activity intensities, we have to offer many possibilities at the *same time*, in order to make them share the "musicking", i.e., active music creating experience [42].

The paper is structured as follows: In the section, "From Playing Music to Embodied and Distributed Parallel DJing", we will first present work we build on from the fields of Music Therapy, Music and Health, Assistive Technology related to music, HCI and Tangible Interaction . In the next section we present the RHYME research project, with the goal to improve health and life quality for persons with severe disabilities, with use of computer-based, networked and multimodal things. Further we present the fourth generation of technology, named Polly World. In the section "Action-Oriented Design" we present and discuss how Embodied Distributed Parallel DJing was *created by the children*, and the creative potential working with people with severe disabilities represents. We conclude with, how users with special needs, abilities, sensorial profiles and sensitivities, represent huge innovative and creative potentials, because they implicitly are questioning the existing, demand other things and open up for new solutions.

2. From Playing Music to Embodied and Distributed Parallel DJing

We build on earlier works within the field of Assistive Technology related to music, where the focus is on making musical technologies and interfaces for listening and music making accessible for persons with special needs [4, 12, 19, 29, 30]. We also build on Musicology that explores how humans experience, create and engage with music and music technology in different cultures and times [32, 13, 20, 25]. From the fields of Human-Computer Interaction (HCI) and Tangible Interaction we gain knowledge of how to analyse and design computer technology with and for human interaction [15, 23, 24, 47]. We also build on the fields of Music Therapy and Music and Health, which study the health potentialities of music in therapy and everyday life. The fields have a holistic view on health, humans and their relations in an environment [5]. In accordance with a holistic view they consider health to be a person's potential resources to become empowered [35, 36], and not only the absence of illness [1]. These health resources empower the person by strengthening positive experiences, offering many ways for the individual to master and express oneself, to participate on equal terms, in collaboration with other persons, sharing a sense of coherence and meaning [1, 38], while experiencing and creating with music. For example creating music and sharing his or her resources together with persons with other types of resources, such as family members, older siblings, school mates, etc. Human resources that could become empowering resources for any individual that is involved. To reach the goal to strengthen resources to empower the individual, the music therapist or Music and Health researchers try to find musical instruments that a person with particular disabilities can handle. Often they chose easy-to-use instruments such as a drum to hit, wind chimes to stroke or an electronic switch to turn on/off a single sound. With the best intentions, music therapists often leave out more complex instruments that require years of training to master, such as the guitar and the synthesizer, since these instruments are more difficult for the person with severe disabilities to master. A drawback is that persons with disabilities have to adapt to the expressive limitations of the easy-to-use instrument. In many cases this leads to a situation where he or she do not have the possibility to experienced what it is to create, master and share more complex musical experiences, such as playing with several persons in harmony, using chords, dynamics and melodies with variations, playing whole songs, etc.

A common variation of the easy-to-use traditional instruments in Music Therapy is switch-oriented technologies. The rationale behind a switch is to make it easier to master a task by always giving the same direct response to similar stimuli. We have found that direct response is necessary, but that it never should be the *only* present option [9, 7]. The reason for that is if a person does not manage to master the switch and it is the only possibility a system offer to get a response, then the risk is that the lack of response creates a negative experience. If this is repeated many times it becomes a reminder of what you *do not* master. Music therapists and Music and Health researchers agree and have pointed out problems for persons with severe disabilities to use switch-oriented music technologies, such as the popular SoundBeam [29, 30]. Instead of promoting mastery and empowerment, they report that the technologies decrease motivation and create fatigue and disempowerment. Too heavy stress on providing the same response to a stimulus risks to weaken, rather than strengthening, the individual's motivation. In an earlier paper based on the design and user-observations of earlier generations of interactive music technologies in the RHYME project, we have argued that music technology instead ought to offer many positive

experiences at once, offer many roles to take and be both simple and complex at the same time [7], and always offer positive experiences. Our alternative that we developed in the RHYME project and present here combines instruments and embedded computers.

The advantage of embedding computers into musical instruments is that the person interacting do not need to adapt to the constraints of traditional instruments. Instead it is the computer programme that adapts to the individual, in different situations and environments. It remembers and learns, and in addition answers directly just like the switch does. Compared to the traditional musical instrument the computer therefore can contribute in ways that change with the person interacting, the physical design, the situation and the musical genre. For instance it can answer to a *weak* action with a *strong* sound, to a *simple* action with a *complex* response. The computer can also create expectations by adding changing variations that are consistent with the song and musical genre, etc. In our view all these possibilities represent potentials for persons with disabilities to experience health by becoming empowered, active, creative and involved, using their whole bodies, in music making activities.

Again and again, we have seen new emerging technologies being used in music making and in creating new art forms [13, 33, 31, 45, 48]. Many times new technologies are used and developed in art before they are being used in everyday commodities [13, 10]. An example is the magnetic tape recorder developed and used by the German military in WWII and adopted by electronic music pioneers in the late 40ies. At the time, at the French radio in Paris, composer Pierre Schaeffer based an entire new art form, "Musique Concrète", on the possibilities to record everyday sounds, or "found sounds" as he called them, and to cut and re-compose them. Only later the magnetic tape technology took off as a mass-consumer product in the form of the "compact cassette", which was the most common recording device in 1970-2000. Parallel to the magnetic tape, records in vinyl was used by Disc Jockeys at radio stations already in the 1930ies and 1940ies to mix two records within certain limits. Later with the introduction of Hip Hop culture in the 1970ies, vinyl records was used as an instrument of its own right, to create new sounds, by the DJ together with other musicians scratching, i.e. rhythmisise by stopping, changing direction, repeating and creating effects. The DJs went from mixing to inventing a new artistic practice and a new art form described as scratching and turntablism, named after the turntable [33].

Further on we will show how we as researchers and designers in the RHYME project experienced a similar move towards a new artistic practice and art form. A move made by *the persons with disabilities* and their demands towards our new designs and latest embodied and distributed technologies. Technologies that we embedded into the designs, such as computers, RFID-readers for detecting keycard tags that we used on toys and other objects to play sounds and images, WiFi modules, handheld webcam and handheld laser projectors (see Figure 1). It is a change from a practice where one person at a time, creates with sounds and music in one isolated song, to Parallel DJing, where many persons play together, combining several songs, recording, adding and co-creating new sounds and new compositions.

We put WiFi technology into the new designs, in order to meet the demands of making family members on different places able to co-create together. Therefore we call the new DJing practise *distributed* since family members can create music together in separate spaces over the Internet, using both the physical things and a graphical or twitter screen interface. The change in DJing practise is also caused by the physical and *embodied* and tangible interaction possibilities (see Figure 2). These possibilities were

our design answer to enable people with diverse and severe disabilities and resources to interact on their own terms together with family and friends. Our new designs emphasize the users as social and embodied, constituted through their interactions and movements in space with other people, rather than solely through their cognitive capabilities [15, 7]. It contributed to Parallel DJing as a new artistic practice. A practice with the possibilities of users to co-create and interact based on their resources, rather than on their disability and on the changeable and musically motivating possibilities of the "Empowering Multi-Sensorial Things", rather than on traditional instruments' limitations.

3. The RHYME Research Project

The basis for this paper is the RHYME research project (2011-2016, www.RHYME.no), where the goal is to improve health and life quality for persons with severe disabilities, with use of computer-based, networked and multimodal things. In this paper we present the fourth generation of interactive musical artefacts, or things, developed in the project *Polly World*. It shows how the technology became both *simple and advanced at the same time*, during the project period, just because of the children's severe disabilities and needs and that they should be able to participate on their own terms. Details regarding the design and development of the interactive multi-sensorial things from one generation to another is thoroughly documented in our article "Designing Four Generations of 'Musicking Tangibles'" [7], and other articles in the anthology "Music, Health, Technology and Design" [43, 37].

The RHYME project is multidisciplinary and builds on a humanistic and ecological health approach [5]. We use user-centred and research-by-design [40, 41] design methods, and action based user studies. We have conducted four action based studies [43] of four weeks, one each year for each new generation of interactive things. There were five children with severe disabilities, their families and care persons, which participated over the five year period. The studies were conducted at their school, and we did video observations and complementary surveys of each action. After each action we made changes based on the observations and the multidisciplinary discussions among all of the project participants. It was through these many actions the children and all participants expressed their design ideas, wishes and needs, which ended up with Polly World, were we tried to put it all together.

3.1. Polly World

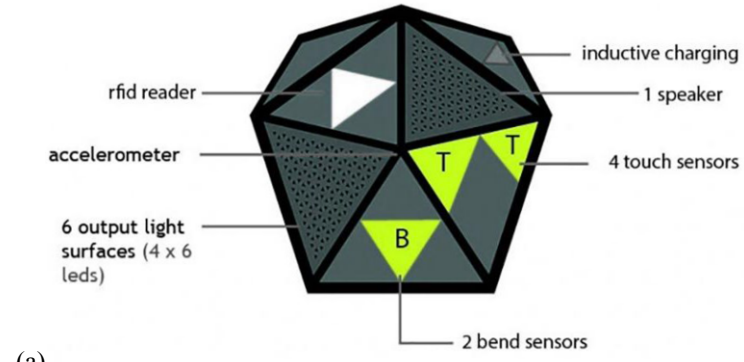
Polly World is the fourth generation of interactive things developed in the RHYME project. Polly World can be viewed as many possible things, as a computer-based musical instrument, an interactive furniture or toy, an interactive art installation, an interactive multi-sensory environment (MSE), a multi-sensorial health technology, depending on what you focus on, and what tradition you represent. Within the RHYME project, and over the project period we changed our understanding of what we create, and how it should be understood and categorised, depending on where we come from and what we focus on. Polly World is a complex hybrid between the physical and virtual, between a cultural artefact like a musical instrument, a furniture or a toy, and an interactive, net-based media and service, that enables to co-create musical experiences over the Internet.

The musical therapists are used to consider their tool to be a musical instrument that musicians control. But during the generations of development and observations of how the children treated and acted towards the interactive things, we developed software that took *initiative and invited* to collaboration, structured the musical actions with beats and musical variation and offer seating and comfort. We included interactive camera and projection to offer the users possibility to play with their own image (mirroring) and surroundings in a self-reflective or artistic way. All this explodes the boundaries of a musical instrument. The instrument expands to become both a tool for self-expression, but also an actor in the game or an arena for co-creation [10]. In this paper we have chosen to call Polly World an *Empowering Multi-Sensorial Thing*, because of its empowering ambition, its aesthetic and multisensorial stimulation possibilities and its relation to the emerging field of Internet-of-Things.

The name Polly comes from "poly", the Greek prefix for many, because it is many folded in a multitude of ways. Polly World offers many ways to interpret, relate and interact, many musical tunes and visual expressions to cut, combine, co-create and compose with. The shape of the interactive objects is built up of many joint polygon parts, with diverse sensory stimulating qualities. The installation offers many possible embodied, sensorial experiences and many ways to participate socially (see Figure 1).

Figure 1. Family playing in Polly World.

The Polly World consists of one wired (Polly Land see Figure 1), three wireless interactive objects (Polly Ocean, Polly Planet (see Figure 2) and Polly Fire) and two APPs. One APP, Polly Compose (see Figure 2), enables distributed interaction over the Internet with the physical objects using a Smartphone/Tablet and a graphical or text based (high-level Twitter language).



(a)

(b)

(c)

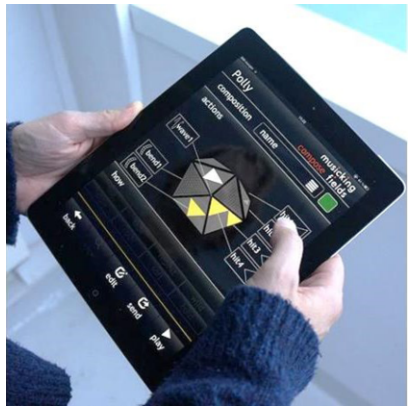


Figure 2. (a)Technical Drawing of Polly Planet, (b) Embodied interaction with Polly Planet, (c) Polly Compose APP for distributed interaction and sending composition to Polly Planet.

The physical wireless interactive objects, like Polly Planet above, is soft and created in grey wool polygons, with coloured active areas, and have various sensors (RFID, bend, touch, accelerometer and microphone) and actuators embedded (LEDs and speakers (see Figure 2). The shapes is based on familiar artefacts like a ball (Planet), blanket (Fire) and banana cushion (Ocean), but also opens up to other interpretations.

In Polly World the users can experience many new, embodied ways to cut, combine, compose and co-create with musical, visual, tangible and social media [7]. Familiar music tunes, chosen by the users [7, 43, 36, 44], are cut into significant parts and can be combined in infinite ways through user-interaction with RFID-tags and sensors, interpreted by pre-programmed musical algorithms. Voice-input can be recorded through microphone input and cut up, combined and co-created into new unique musical compositions and experiences. Original music scores are remixed and, when users interact with several interactive Polly objects at the same time. The co-creation and composition, in the physical installation, can be extended further by distant, distributed, interaction on a tablet/smartphone in a graphical user interface, or a high-level Polly Twitter Language. In this way the Polly World enables a shift of roles [27, 28] between professional musicians and amateurs, between present and non-present audiences, between old compositions and new improvisations, between

musical, visual and tangible media. This represents a disruption and shifting of roles, spaces, times and musical practises such as composing, performing and listening, into a hybrid multi-sensorial, embodied experience. Functionality that was developed as an answer to the children's special needs, wishes and suggestions.

4. Action-Oriented Designing

During the years, and the four generations of design, development, tests and user-observation actions, we have experienced how important interpretation and expectation are for the user interaction and design. The users of Polly World had knowledge and experience and thereby expectations related to cultural artefacts like musical instruments, equipment, toys and furniture that we could build on when designing [37]. The children were used to use musical instruments, microphones, speakers and recording equipment in their music lessons. So very fast they understood how to talk into the microphone and how to play and vary and play with the recorded voice, when activating the sensors. This programmed musical variation, that we developed into the system not only played back the recorded input, but answered varied and delayed as in human communication and musical improvisation. With this advanced technology, very different from traditional record and play, the children got familiar with very fast, and started behaving toward it as if it were a living creature, even holding a soft textile microphone. This is one simple example of how fast the children accepted the hybrid between artefacts like a microphone and a living creature, a very advanced technology.

For instance one child had long conversations with the 2nd generation RHYME interactive thing, about the food she liked, asking what the interactive thing liked. Next year, we added a RFID-reader into a trunk on a totally new object. The girl started to talk into it. It was obvious that she *expected* to get a response, even if there was no microphone there and it was shaped very differently from last generation. So in Polly, the fourth generation, we added both microphone and RFID-reader, but this time shaped them differently affording the interaction form. The RFID-reader was a solution to be able to choose one's favourite music in a simple way, which was very important for self-regulation and self-expression reasons. We used laminated cards with RFID-tags, shaped as a hybrid between AAC-cards for communication and CD covers with RFID tags, with both pictures and names, for those that could read. Extremely fast they were able to handle both singing and playing with their voice recordings, choosing and playing with the musical tunes with the RFID-technology and playing with the handheld embedded camera. They were handling and using advanced technology in very unproblematic ways.

Most children they also had extensive experiences with lots of cultural artefacts such as toys, furniture and other cultural artefact we could build on when designing. We have therefore very consciously designed the things to be as ambiguous as possible to open up towards many interpretations and interaction forms to motivate the children to relate and interact, explore and co-create as much as possible. Inspired by Small's concept of "musicking" [42] and Antonovsky's term of "sense of coherence" [1], we developed a much wider understanding of musical actions and co-creation. Some of the children got tired and needed to rest, and often wanted to lie down with their care persons, but still be in the musical environment. Therefore we developed music technologies that also offered both music relaxing and active music playing as part of the musicking environment (see Figure 1). We also added dynamic visual interaction

inspired by the art form VJing (Video Jockey) into the musical experience to provide more interaction possibilities. So we took concepts and solutions from art and the most advanced technologies available, to create interactive things with the simplest interface and most advanced interactive possibilities We added sensors and actuators, advanced algorithms and narrative rules to offer many positive experiences and infinite mastering and co-creative challenges over long time.

Our goal was to create health promoting interactive music instruments, where everyone could create and participate in the musicking [42] *together on equal terms*. Because of our health goals, we needed to offer very diverse users positive and vitalising experiences, all users ability to master, co-create and participate and share an experience of meaning. Because we wanted to create something, where very different people, with various abilities and motivations, could create music together, we had to create something that could be perceived and related to in many ways. By observing, listening and reflecting on what users did, expected and wished, we ended up creating Polly World which is very technologically advanced and ambiguous, but also very trivial since it is *also only* a big cushion to hug or sleep on. It is extremely easy, and the children learned it in seconds, to put on a favourite song using RFID-tags (Scene Card), record and play with their voices, but potentially extremely advanced as an artistic performance instrument to create original compositions on. Since everything could be combined with everything the user could choose a music cover card (Scene Card) with their favourite music on each of the interactive objects (Polly Land, Planet, Ocean, Fire), which they did. But being together made them also conscious of each other not only their own interaction, but on what the others did. After some time of cacophony trying to drown out each other, they started to interact in synchronicity with each other. It was then we realised that they had created a potential new art form, parallel DJing. They used their whole body and voice when interacting, with each other. Therefore we call it Embodied Parallel DJing. Since the music tunes are cut up and joined together based on musical algorithms the musical expression became different and more musical than when scratching on traditional musical tunes as ordinary DJs do. Therefore the expression also became surprisingly musical, caused by the advanced underlying musical system. It became obvious for us that because of the ambition to create something engaging for the whole family not something that looked and was like the genre of assistive musical instruments, often childish in hard plastic with low MIDI sound we ended up creating something quite unique. In order to create something engaging for siblings, grandmother, parents, friends and children with severe disabilities, we created something very new. Something very advanced and simple at the same time. A new genre of health technology, musical instrument or interactive things. And the children created a potential new art form. Therefor we should not only include persons with special needs into the design process because of Universal Design demands, but also because of its creative and innovative potential [16].

This is one example of the creative potential designing for and with people with special needs, caused by a democratic ideal to design for diverse users to create and *act together* on equal terms, not in the same manner.

5. Conclusion

In this paper we have presented our experience of *designing for people with special needs, and the innovative and creative potential it represents*. Our original goal was to

create interactive music technology, to improve health and empowerment for people with special needs, not simply to adapt existing musical instruments for specific users. In order to be health promoting and empowering, the new musical instruments had to offer positive and vitalising experiences for diverse users in all situations, offer many ways to interact, master and express oneself, many ways to participate and co-create music together and give all the diverse users a shared experience of meaning [38] ("sense of coherence" [1]).

Creating interactive music instruments to meet this demand was a huge design challenge, where we had to draw on several perspectives and knowledge fields to reach our goals. Through many design, test and observation loops, in an action-oriented research manner, we developed four generations of interactive music technologies, where people with diverse capabilities and special needs could play and make music and participate in musical experiences together ("musicking" [42]), on equal terms with their family and care persons. In this paper we presented the fourth generation of this technology, Polly World. Because of the extreme diversity and abilities among the users, we ended up creating a new genre of music instruments, a kind of hybrid between Multi-Sensory Environments (MSE) [18, 34], interactive furniture, interactive toys and Social Media. A new genre of Internet-of-Things, we call *Empowering Multi-Sensorial Things*, which has the potential to become a new genre within health and welfare technology and a new treatment paradigm [43].

Further we observed, since everything had to be able to be used together without rules or user manuals, a new interaction form, which we call *Embodied and Distributed Parallel DJing*. We consider this to be a new art form and potential new artistic practice, developed by the users through the design and use process. A *new art form* and artistic practice, such as Scratching and Web-Jamming [48], related to DJing and interactive gaming. A new art form directly based on the design for and with people with special needs, their capabilities, interests, knowledge and *freedom from traditional genre boundaries*.

6. Acknowledgements

We like to thank the Research Council of Norway and the VERDIKT programme for their financial support of the RHYME project and all project members for their contribution. We especially like to thank Fredrik Olofsson for contributing with his unique artistic and technological competence in development of music, hardware and software. Polly World and earlier generations would not have been possible to create without him.

7. References

[1] Antonovsky, A. *Unraveling The Mystery of Health - How People Manage Stress and Stay Well*. San Francisco: Jossey-Bass Publishers, 1987

[2] Appadurai, A. 1986. The Social Life of Things: Commodities in Cultural Perspective. Cambridge University Press. New York.

[3] Ayres, A. J. *The Development of Sensory Integrative Theory and Practice: A Collection of the Works of A. Jean Ayres.* Kendall/Hunt Publishing Company, 1974

[4] Betke, M. 2010. Intelligent Interfaces to Empower People with Disabilities. H. Nakashima et al (Eds.), *Handbook of Ambient Intelligence and Smart Environments*. Springer.

[5] Blaxter, M. 2010. *Health*. Polity. Key Concepts. Cambridge.
[6] Brereton, M., et al. 2015. The Messaging Kettle: Prototyping Connection over a Distance between Adult Children and Older Parents. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, CHI 2015, ACM. NY. pp. 713–716.*
[7] Cappelen, B., Andersson, A. 2014. Designing four generations of 'Musicking Tangibles*'. Music, Health, Technology and Design*. NMH-publications, Vol 8. Stensæth, K. (Ed). Page 1-20. ISSN 1893-3580.
[8] Cappelen, B., Andersson, A. 2013. Towards an Empowering Tangible Interaction Design for Diversity. Proceedings, The Include Asia Conference, Helen Hamlyn Centre for Design, Royal College of Art, London, Hong Kong Design Institute, Hong Kong. ISBN 978-1-907342-70-7.
[9] Cappelen, B., Andersson, A. 2012. Musicking Tangibles for Empowerment. Miesenberger et al (Eds.): *ICCHP 2012, Part I, LNCS 7382. pp. 254–261*.
[10] Cappelen, B., Andersson, A. 2011. Expanding the Role of the Instrument. *Proceedings of the New Interfaces for Musical Expression NIME2011 Conference* (Oslo, May 30-June 1). 511-514.
[11] Cappelen, B. Andersson A. 2012. Designing for Musicking, Proceedings, *UD2012, International Conference of Universal Design*, University of Oslo.
[12] Challis B, Challis K. 2008. Applications for Proximity Sensors in Music and Sound Performance. Miesenberger et al (Eds.), *ICCHP 2008, LNCS 5105*, Springer. 1220-1227.
[13] Cook, N. 2003. Music as Performance. *The Cultural study of music: A Critical Introduction*. Routledge. London. pp. 204-214.
[14] DeNora, T. 2000. *Music in Everyday Life*. Cambridge University Press. Cambridge Mass.
[15] Dourisch, P. 2004. *Where The Action Is: The Foundations of Embodied Interaction.* MIT Press. Cambridge Mass.
[16] Eikhaug, O., Gheerawo, R., Plumbe, C. and Støren Berg, M. 2010. *Innovating with People: The Business of Inclusive Design*. Norsk Designråd.
[17] Erkkilä J., Lartillot, O., Luck, G., Riikilä, K., Toiviainen, P. 2004. Intelligent Music Systems in Music Therapy. *Music Therapy Today, Vol. V (5)*, November.
[18] Fowler, F. Multisensory Rooms and Environments: Controlled Sensory Experiences for People with Profound and Multiple Disabilities. Jessica Kingsley Publishers, 2008.
[19] Gerino, et al. 2014. MathMelodies: Inclusive Design of a Didactic Game to Practice Mathematics. K. Miesenberger et al. (Eds.): *ICCHP 2014, Part I, LNCS 8547*, pp. 564–571.
[20] Godøy, R. I. 2001. Imagined Action, Excitation, and Resonance. R.I. Godøy, H. Jørgensen (Eds.), *Musical Imagery, Studies in New Music Research*. Swets & Zeitlinger. Lisse. pp. 237-250.
[21] Harmonix Music Systems. 2005. *GuitarHero*. PlayStation2, RedOctane, Montain View.
[22] Hornecker, E., Buur, J. 2006. Getting a Grip on Tangible Interaction: A Framework on Physical Space and Social Interaction. *Proceedings CHI'06.* ACM. 437-446.
[23] Hunt, A. et al. 2004. Multiple Media Interfaces for Music Therapy, *IEEE MultiMedia*, July–September 2004. 51-58.
[24] Ishii, H., Ullmer, B. 1997. Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms. *Proceedings CHI'97.* ACM. pp. 234-241.
[25] Jensenius, A. 2007. Action – Sound: Developing Methods and Tools to Study Music-related Body Movement. PhD Thesis. University of Oslo.
[26] Jordà, S. 2007. Interactivity and Live Computer Music.N. Collins, J. d'Escriván (Eds.), *The Cambridge Companion to Electronic Music*, Cambridge University Press. Cambridge. pp. 89-106.
[27] Latour, B. 1999. Pandora's hope: essays on the reality of science studies. Harvard Univ. Press. Cambridge Mass.
[28] Latour, B. 2005. Reassembling the Social: An Introduction to Actor-Network-Theory. Oxford Univ. Press.
[29] Magee W., Burland, K. 2008. An Exploratory Study of the Use of Electronic Music Technologies in Clinical Music Therapy. *Nordic Journal of Music Therapy, 17(2)*. pp. 124-141.
[30] Magee, W. 2011. Music Technology for Health and Well-Being: The Bridge Between the Arts and Science. *Music and Medicine, 3(3)*. Sage Publications. pp. 131-133.
[31] Mathews, M. 1963. The Digital Computer as a Musical Instrument. *Science. New Series* ISSN: 00368075
[32] Meyer, L.B. 1956. *Emotion and Meaning in Music*. University of Chicago Press. Chicago.
[33] Oswald, J. 2004. Bettered by the Borrower: The Ethics of Musical Debt, in *Audio Culture: Readings in Modern Music*, C. Cox and D. Warner, Eds. A&C Black.
[34] Pagliano, P. 1999. *Multisensory Environments*. David Fulton Publishers. NY.
[35] Rolvsjord, R. 2004. Therapy as Empowerment, Clinical and Political Implications of Empowerment. Philosophy in Mental Health Practices of Music Therapy. *Nordic Journal of Music Therapy 13(2)*. p. 99-111.

[36] Rolvsjord, R. 2010. A *Resource Oriented Perspective on Music Therapy*. NH: Barcelona Publishers.
[37] Ruud, E. 2014. Health Affordances of the RHYME Artefacts. *Music, Health, Technology and Design*. NMH-publications, Vol 8. Stensæth, K. (Ed). Page 141-156. ISSN 1893-3580.
[38] Ruud, E. 2010. *Music Therapy: A Perspective from the Humanities*. Gilsum, NH: Barcelona Publishers.
[39] Ruud, E. 1998. *Music Therapy: Improvisation, Communication, and Culture.* Gilsum, NH: Barcelona Publishers.
[40] Schön, D. 1983. *The Reflective Practitioner: How Professionals Think in Action.* Temple Smith. London.
[41] Sevaldson, B. 2010. Discussions & Movements in Design Research, A Systems Approach to Practice Research in Design. *FORM akademisk, Vol.3 Nr.1*. pp. 8-35.
[42] Small, C. 1998. *Musicking: The Meanings of Performing and Listening*. Wesleyan University Press. Connecticut.
[43] Stensæth, K., Ruud, E. (2014). An interactive technology for health. *Music, Health, Technology and Design*. NMH-publications, Vol 8. Stensæth, K. (Ed). Page 39-66. ISSN 1893-3580.
[44] Stige, B. 2002. *Culture-Centered Music Therapy*. Gilsum, N.H.: Barcelona Publishers,.
[45] Tanaka, A. 2009. Sensor-Based Musical Instruments and Interactive Music. *Oxford Handbook of Computer Music*. R. Dean, (Ed.). Oxford University Press. pp. 233-257.
[46] UN Article 30, Participation in cultural life, recreation, leisure and sport. http://www.un.org/disabilities/default.asp?id=290, visited January 31, 2016.
[47] Weiser, M. 1991. The Computer for the Twenty-First Century, *Scientific American, 256(3)*. pp. 94-104.
[48] Wilson, S., Cottle, D. & Collins, N. (Eds.) (2011) *The SuperCollider Book*. Cambridge, MA: MIT Press.
[49] Zimmerman, M. 2000. Empowerment Theory. Psychological, Organizational and Community levels of Analyses. In: E. Seidman et al (Eds.), *Handbook of Community Psychology*. NY: Kluwer Academic.