# Cultural Artefacts with Virtual Capabilities Enhance Self-Expression Possibilities for Children with Special Needs

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**Abstract.** In this paper we discuss how new combinations of technology, art and culture enable children with special needs new ways to express themselves. UN declaration (UDHR) states "All human beings have the right to participate in cultural life, enjoy art...", later including children (CRC) and persons with disabilities (CRPD). To meet these UN demands, several countries have created cultural programs to offer children art and culture activities in school. In the Norwegian Cultural Schoolbag-program they emphasize that art and culture can provide experiences that may be decisive in order to develop the individual's personal identity, life quality and alternative worldviews. Since 2015 one county offers a unique "Accessible-Program" for children with special needs. From many years of research, we know the health-promoting value of artistic and musical activities. New technology opens up completely new ways to make art and culture accessible for all. In this paper, we show how we used music and *cultural artefacts* with musical and visual capabilities (RFID, AI), giving diverse users new musical, artistic, sensorial and creative experiences. We do this in relation to Ruud's concepts of *Health Affordance* and *Cultural Immunogen*. As a travelling interactive art installation, being part of the Norwegian "Accessible-Program", we made participatory observations in six schools. We experienced how the children expressed themselves, co-created, showed self-efficacy and made different cultural experiences, depending on disability and relations. With this paper, we emphasize that art and culture, in combination with technology, offers valuable new health-promoting potentialities, important for the UD community.

**Keywords.** Art, Health-Promotion, Health Affordances, Cultural Immunogen, Tangible Interaction, NFC, RFID, Children

## 1. Framework

### 1.1. UN States that Art is a Right

The *Universal Declaration of Human Rights* (UDHR) states that "All human beings have the right to participate in cultural life, enjoy art and scientific advancement and its benefits"[1]. Further in the *Convention on the Rights of the Child* (CRC)[2] it is stated that "Every child has the right to rest and leisure, to engage in play, participate freely in cultural life and the arts. The states shall respect and promote the right of the child to

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participate fully in cultural and artistic life". The *Convention on the Rights of Persons with Disabilities* (CRPD)[3] recognize the right of persons with disabilities "to take part on an equal basis with others in cultural life, play...". This shows the importance of art and culture, both on an individual and a social level.

## 1.2. The Value of Art - Cultural Art Programs

To meet these UN demands, several countries have created cultural programs to offer children art and culture activities in school [4]. In the Norwegian program they emphasize that art and culture can provide experiences that may be decisive in order to develop the individual's personal identity, life quality and alternative worldviews [5]. Since 2015 one county offers a unique "Accessible-Program" for children with special needs [6]. Arguments for the value of art and for why the government prioritize large resources in such an ambitious high quality program is stated in the Government-Report: "Art and culture can challenge established thinking patterns and provide an alternative understanding of the world. Art and culture can provide experiences that can be decisive in order to develop the individual's personality and quality of life. Art, culture and cultural heritage are the basis for developing our identity, and help make us aware of who we are and where we come from. This has value for the individual, but it also has the power to shape the society…"[7].

Other arguments for the value of art presented are: Art as a breathing space in our society, a free voice, an alternative world that challenges imagination and shakes our prejudices, a strong subject that invites us in and mobilizes our subjective will to create and express [8][9], connects with us and challenges our mind and will[10], and helps communities to grow[11][12][13].

## 1.3. Participatory Art

Participatory art are artworks where the audience contributes to create the art in various ways. One very famous example is the "Wish-tree" by Yoko Ono [14]. Here everyone is invited to share their wishes by writing them down on paper, and hang them on a tree. The goal is to involve and get the audience to act and participate in the co-creative process, to reflect on the wishes, themselves and their roles. Participatory art is often mediated as workshops, everyday conversations and play between audiences and artists, in situations outside art institutions, where the dividing line between everyday life and art is erased. It changes the relationship between the artist and the audience. The artist and artwork invites us in and challenge us, both our way of thinking, acting and our worldview. In doing so the artist uses a strong and engaging language and a seductive tone of voice to shape a clear character and consistent aesthetic experience.

*Interactive art* is participatory art in which the audience co-creates in an intelligent technical interactive medium, which can be both virtual and tangible. It looks much like a computer game, but lacks a game momentum. Artists, however, often lack knowledge and focus about how to make the art available for people with special needs. Knowledge that occupational therapists and designers with specialization in Universal Design have.

## 1.4. Health and Health-Promotion

The World Health Organization (WHO) states that "Health is a state of complete physical, mental and social well-being and not only the absence of disease or infirmity ..."[15].

Traditionally within health research, we divide health in two main areas, the biomedical and humanistic [16]. The biomedical health perspective focuses on the patient's diagnosis and disease. The humanist health perspective focuses on the person's resources, not his weaknesses, and on strengthening these resources. Here it is important to look at the entire context around the person and create the basis for *positive mastering experiences*, (including self-expression; self-regulation [17]; self-efficacy [18]; salutogenese [19]; flow [20], *participation* on equal level (empowering) and *shared experience-of-meaning* with others (sense-of-belonging, sense-of-coherence). This is usually called *health-promotion*, formulated first in the Ottawa charter in 1986[21].

## 1.5. Cultural Immunogen - Conditions for Health Processes

The influential professor in Music Therapy and Psychologist Even Ruud has developed the term "cultural immunogen" to emphasise how arts and culture contribute to strengthening the immune-system and health. Ruud distinguishes between six conditions for cultural activities to be health-promoting [13].

The first condition, *Pragmatic concept of music*, is related to the user's understanding of music and cultural activities, as health related activities, when listening, singing, dancing and creating music in everyday life. This is often referred to as "musicking", a term defined by musicologist Christopher Small [22], viewing music as an activity, not an art object. Such perspective involves using musicking and cultural activities to express oneself, regulate feelings or a way to experience community, i.e. health-promoting activities. The second condition, *music as social and emotional resource*, is to *establish conscious links* between a person's everyday use of music/cultural activities and embodied emotions and social experiences. Music and cultural activities then become a medium and resource for being together and to express emotions. The third condition is to *actually use* music/cultural activities as a *supportive-self-object*, that motivates us and regulate our emotions, when we feel or want to feel something. The fourth condition, *musical competency*, is to increase musical/cultural training, competency, interest and skill, in order to intensify the health potential. The fifth condition is the *ritual*, where the musicking or cultural activity take place. It can be a formal, social structure, or just informal and individual, e.g. dancing in the morning, listening on the way to work, or to a lullaby at bedtime.

The sixth condition, *locus-of-control*, is to use music/cultural activities as a place, a stage, where one experience to be in control and self-efficacy, regulate feelings and express one-self. The cultural *immunogen conditions* are the prerequisites that must be present for the cultural activities to be health-promoting.

## 1.6. Health Affordance

"Affordance" is an important term within many relevant fields such as Psychology, Pedagogics, Human-Computer-Interaction and diverse Design fields. It was first defined by cultural psychologist James Gibson [23] to describe all of the actions that are physically possible with a given object and environment. For instance how a ball affords being rolled, or a bed being laid on. It also relates to a person's awareness of the meaning of different affordances. Even Ruud develops this concept further in relation to health [24][25]. He defines *4 types of health affordances*: How cultural artefacts and activities (musicking) can become a provider of vitality, through emotional stimulation, regulation and expression; further how artefacts become a tool for developing agency and

empowerment; a resource for creating a sense of belonging and; means of achieving meaning and coherence in life.

Seen from a *design perspective* health affordances are the *artefact qualities* which *invite to (afford)* health-promotion activities (evoke positive emotions, expressing oneself, regulate feelings, mastering, participation and sharing community with others).

## 1.7. Designing for Health-Promotion

Designing for health-promotion represents a much more ambitious and complex design challenge than the 7 Principles of Universal Design represent [26]. Among other things, it represents that design has to offer the user; many roles to take, many positive experiences to make in every situation, where there are no wrong actions or failing possibilities and few dependencies and no closed paths. It has to offer many ways to express oneself act and build competence over time. Further, it has to offer many ways to develop and build relations to things, people, and actions. In other words many ways to share, relate, participate and create meaning over time.

## 1.8. Health-Promoting Technology Design

Within the Health Technology field, there are some relevant design-related approaches: "Persuasive technologies" focus on changing attitudes or behaviors of the users through persuasion and social influence [27]. ''Positive Computing''[28] inspired by Positive Psychology promotes positive flourishing experiences, and "Positive technology"[29] focusing on tangible interaction design for persons with special needs.

## 1.9. Health-Promoting Participatory Interactive Art

Art has an important role in many therapy forms such as Art Therapy, Music Therapy and Psychodrama. Art therapy, a part from Music Therapy, has to a very little extent used technology as an art media. Music Therapy is the most technified field because music instruments and equipment often are technology-based. But even Music Therapy has traditionally used acoustic music instruments when working with people with special needs. To some extent technology has been used as aid and accessible tailored switches, to make an instrument accessible for the individual user. There are some products and toys that are often used in Music Therapy for the special needs use group such as Paletto [30] and Sound Beam[31].

Within Occupational Therapy and rehabilitation there are a few art installations that has been developed to products such as "Reactable"[32], a table-top product used to train social abilities with children with autism[33]. There are several interactive toys such as therapy seal "Paro"[34] and "Joy for all" companion pets[35] with less artistic qualities used for health-promotion. There are several apps developed for health-promotion but few have tangible user interfaces.

Art is also used to a large extent at schools and health institutions, but mostly as decoration or entertainment, but to a lesser extent in health-promotion.

Our work builds on all these presented perspectives, but our focus is on music and multi-sensory interaction. Originally based as an art-group, MusicalFieldsForever [36], creating interactive installations at galleries, we have evolved into the research-field of designing health-technology. Through 15 years of research we have experienced the shift from viewing the installations as a thing or tool, such as a musical instrument [37], to

become an empowering, hybrid digital and physical arena[38] that affords health promoting activities.

## 2. Method

This paper is based on work developed in the 5-year action-based research-project RHYME [39]. The goal was to develop musical and multi-sensorial internet-of-things to improve the health and well-being for children with special needs.

Extensive user-oriented and participatory design methods were used in multidisciplinary collaboration through 4 generations of technology development over 5 years. The final design and development was made by MusicalFieldsForever.

The latest generation of technology became the interactive installation PollyWorld (Fig.1). PollyWorld was offered to participate in the "Accessible-Program". We have traveled to 6 schools and 78 children have in total experienced PollyWorld. We were one to two days at each school. All children were active from 20 minutes to 2 hours. We participated actively as artists and made observations while interacting. The sessions were video-documented. Afterwards we made open interviews with teachers. In this paper we will present two relevant cases that show different ways the children used the cultural artefacts, with an additional technological layer, to express themselves, and other health-promoting actions.

### 2.1. The PollyWorld Installation

PollyWorld is the fourth generation of interactive things developed in the RHYME-project [39]. PollyWorld is consciously designed to be ambiguous, to afford different interpretations and actions, to invite to health promoting, musicking activities on equal terms. For instance a pillow to sleep on, a musical instrument to play on, a multi-sensory environment to be in, a playground to co-create in, a stage to perform on or a sculpture to look at. PollyWorld [40][38] is a complex hybrid between the physical and virtual, between a cultural artefact and intelligent technology, that dynamically open up and afford new interpretations, actions and health-promoting experiences.

This PollyWorld consists of three wireless interactive objects in grey wool with contrasting active areas with sensors (RFID-reader, microphone, bend, touch, move) and *actuators* (speaker, LED). The shapes are based on familiar artefacts like a ball, blanket and banana cushion(PollyOcean,Fig.1), but also open up to other interpretations.

PollyWorld includes over 60 RFID-tagged music CD-covers with interactive music based on familiar tunes, for infinite improvisation with the chosen tune. Additionally PollyWorld includes about 100 other RFID-tagged familiar artefacts, such as instruments, toys, kitchenware and accessories, "tagged-things". When holding the RFID-tag over the RFID-reader it lights up and plays and vary the tune musically, e.g. the toy-train whistles musically.

When the user interacts with the RFID-tag, the music vary, based on musically intelligent and communicative algorithms (Artificial Intelligence,AI)
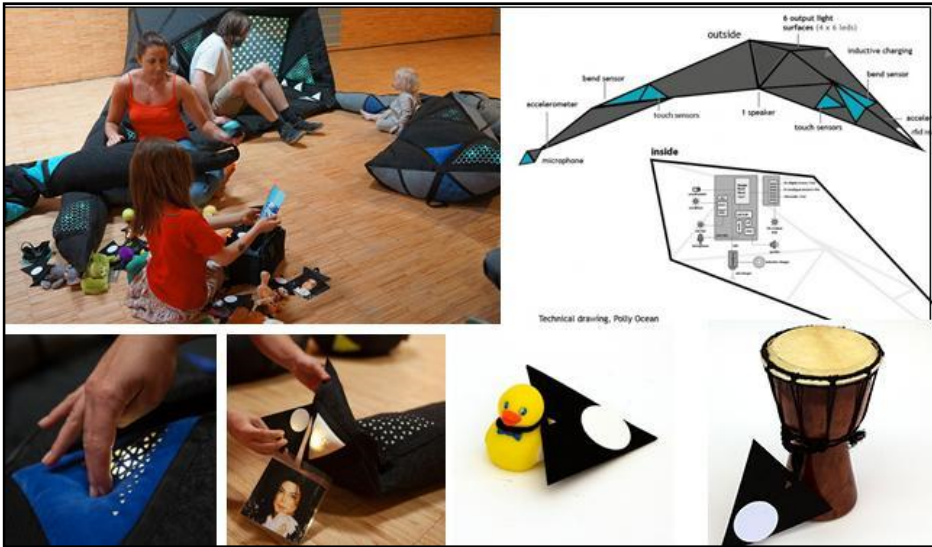
**Figure 1.** PollyWorld.:Family interacting on their own terms, PollyOcean technical drawing.
Touch-sensor with LED-response, RFID-tagged CD-Cover and Tagged-things: Duck and Drum.

The large amount of music and artefacts to choose from make us able to stage and re-stage based on the situation and users' liking. Playing music people dislike can be very annoying, creating stress. Additionally we have a full dynamic projection wall, that vary algorithmically related to the choice of music and interaction.

## 3. Use-Cases and Discussion

In the following we will present and discuss 2 relevant use-cases from our many improvisation events with participatory observations, when touring as part of the Cultural Schoolbag "Accessible-Program". We will use Ruud's concepts of *health affordance* and *cultural immunogen*[13][25] as a background to understand the cases.

### 3.1. Self-Expression Case1: Blind Beatrice and the Powering Spider

Beatrice was a blind and very shy girl at one of the schools. She came into the PollyWorld-room with her teacher and several other children. She sat down on the carpet, and I wrapped the banana cushion PollyOcean around her (Fig.1). I explained that it sang, and asked her what songs she liked. We found "Itsy-bitsy-spider" among the cover-collection. Her teacher led her hands along the triangle shaped RFID-reader and the RFID-tag that is mounted to all the "tagged-things". She did not accept me, as a stranger, to touch her in the beginning. In under a minute she learned to relate the *triangle-shaped* tag to the *triangle-shaped* bulged RFID-reader (Fig.1). She could feel the shape, but could not see the light that lit by activation, but she heard the sound that immediately responded. At first she became a little scared, but when she heard it was "Itsy-bitsy-spider" she laughed recognisingly. I began to improvise with the sensors and gave her things she could reach on the carpet between us. Her teacher gave her one "tagged-thing"

at a time, talked about it, and tested on the RFID-reader. Her exploration went faster and faster and she started interacting directly with me. It was the first time I had improvised with a blind child. I had to adapt myself to the situation by sitting in the same place, using form instead of colour to communicate through. I found the rubbery spider with the scary sound. She recognized the spider's shape and the rubbery silicone material and tried its RFID-tag against the RFID-reader. The spider screamed and frightened us all. She tried it again and the teacher said "No, it's so nasty". But Beatrice tried it again. The teacher shouted again and it developed into a "power-game". PollyWorld became an arena that awakened feelings of joy, where she could experience self-efficacy, mastering and co-creation with others. In a conversation with the teacher later on, she said that Beatrice had rarely been so active and happy, and she had sung "Itsy bitsy spider" for the rest of the day.

From before, Beatrice had an experience from the Cultural Schoolbag as something positive, but she had no previous experience or relationship with a singing interactive installation. She recognized most tagged artifacts/toys such as rubber ducks (Fig.1), trains, cards, furry balls, instruments and even spiders. She could use her knowledge of them when interacting, learning and mastering the new technological capabilities such as the embedded sensors and the AI-based musical algorithms. The music and the recognizable toys were a resource for her to express herself and regulate the event, play and experience positive creative things alone and with others. Through the addition of the RFID-functionality and the musical sequences, she could improvise with her favorite song with infinite musical variations for one hour, not only 3 minutes that the traditional linear tune lasted. The AI-based musical variation made it satisfying and motivating to play over very long time.

## 3.2. Self-Expression Case2: Rolf Expanding the Drum Improvisation Repertoire

Rolf entered the PollyWorld-room at the only high-school we visited. PollyWorld was developed with children in elementary school and we had no former experience with high-school students. Rolf has complex disabilities, but his teacher said he was very fond of music. I started as usual by improvising in PollyWorld. I played with the "tagged-things", showed him how the tag and RFID-reader lit up and sounded. I gave him artefacts consecutively, a duck, a sheep, a ball, trying to evoke his interest.

He threw things far away and became more and more aggressive. I became reluctant. Then I took the drum and asked if he knew this instrument. He obviously became more interested, took it from me, and started playing on it, uninterested in the mounted RFID-tag. I took another instrument, a maraca, in the collection of "tagged-things". Rolf and I started to play with each other. Rolf on the drum and me on maraca. I tried to show him how the RFID-tag on the maraca worked. He stopped because he heard the additional sound that caught interest: A varied and professional maraca variation that obviously I could not have created. He carefully tried the RFID-tag on the drum and was clearly surprised by the light and of what he heard. He laughed and unconsciously removed the tag from the RFID-reader. Then he realized what happened. Each time he led the tag on the drum over the triangle shaped RFID-reader it sounded, and he heard much more advanced drumming than he initially played. But it was he who was in charge of the playing. We continued to play against each other with each of our rhythm instruments and one RFID-reader each. We became better and better. We could both hear it. The improvisation-session lasted for almost an hour. I was totally exhausted not being a professional musician, but Rolf was in a flow, and wanted to continue. It was clear that

he had experienced himself as a co-creating musician like never before. PollyWorld had given him a unique experience of mastering, becoming better and more advanced very fast because of its easy-to-master user interface and advanced musical AI-based algorithms. PollyWorld with its recognizable musical instruments and advanced technological possibilities made him a musical champion. The possibility to remove the toys that made him a child, and use the professional instruments, that made him a musician was an important feature to make PollyWorld an empowering arena. Both in his own performing experience and for his fellow students and teachers. The PollyWorld experience became something none of them had experienced on this level before, a future health promoting resource, a cultural immunogen.

## 4. Conclusion

In this paper, we discuss and show how innovations based on *art* and *culture in combination* with technology offer new *health-promotion activities*. Specifically we show how innovations including cultural artefacts with NFC/RFID and musical AI-capabilities offers and enable children with special needs new ways to express themselves, experience mastery, participation on equal terms and community with others. We observed how the artefacts with NFC-based multisensorial capabilities lowered the threshold for interaction and enhanced the expressive possibilities. The innovation became a provider of emotional stimulation and a media and arena to express oneself and experiencing self-efficacy and self-regulation and sharing. Used over time the innovation could become an arena for developing agency and empowerment, and a resource for creating a sense-of-belonging and mediation for experiencing meaning and coherence in life. The health-promoting potentiality that lies in the medial intersection between art, culture and technology is a field we therefore emphasize should be explored further within the UD-community. However, this requires that technicians and health professionals collaborate with artists and designers and build respect for each other's profession and contribution. We believe that the co-creation between these fields has great potential in a time when we see increasing demands for technological solutions to solve future health and welfare challenges.

The use of cultural artifacts, NFC and AI in particular, we believe has great potential for other user groups, such as elderly and persons with dementia, for stimulating vitality and reminiscence training. Further, we believe there is a great potential to use art and culture, in *combination with technology* to develop arenas to strengthen health and our immune-systems, in a world where loneliness, complexity and stress only increase.

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