

Designing Sound for Recreation and Well-Being

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ABSTRACT

In this paper we explore how we compose sound for an interactive tangible and mobile interface, where the goal is to improve health and well-being for families with children with disabilities. We describe the composition process of how we decompose a linear beat-based and vocal sound material and recombine it with real-time audio synthesis and composition rules into interactive Scenes. Scenes that make it possible for the users to select, explore and recreate different sound worlds. In order to recreate, the users interact with the tangible interface in different ways, as instrument, play with it as a friend, improvise and create music and relax with it as ambient sounding furniture. We discuss composition techniques for mixing sound, tangible-physical and lighting elements in the Scenes. Based on observations we explore how a diverse audience in the family and at school can recreate and improvise their own sound experience and play together in open and non-therapeutic everyday situations. We conclude by discussing the possible impact of our findings for the NIME-community; how the techniques of decomposing, recomposing and recreating sound, based on a relational perspective, could contribute to the design of new instruments for musical expression.

Keywords

decompose, recombine, recreate, mobile, tangible, well-being, SuperCollider, Inclusive Design, Assistive Technologies, relational

1. INTRODUCTION

It is normal in many composition traditions to borrow musical material from others. In classical, modern and popular music the composer tends to borrow musical elements and structures. In interactive computer based composition the focus normally is more on the development of new instruments; either as tools for the composition, but more often, as parts of the composition. A typical "NIME-interface" often is a unique interpretation of how action connects to sound, and "...understanding this interpretation can be as aesthetically rewarding as listening to the sound itself." [10, p. 57]

Our experience, though, is that something else happens if you bring the instruments out into the everyday world of amateurs. An interface such as Reactable (www.reactable.com) is more than a tool and composition. It has a physical presence. When Reactable is exhibited at a museum where children play, it creates many relations to its users. Yes, it becomes a tool for creating music, but also toys to play

with and ambient sounding furniture. We try to understand how we can compose dynamically changing music for many relations like these. Music that motivates users to act and shift roles between those relations. Something that according to our observations of families interacting contribute to health and well-being.

We know that musical activities are good for health and well-being, based on the last 15 years of research [3, 12, 8], and on practice in peoples everyday use of music as "soundtracks of our lives" for regulating emotions and social relations (6) and in Music Therapy. Music has a documented ability to evoke emotions, help mastering tasks and situations such as playing instruments, and managing the own body [12]. It further strengthens social relations through singing in choirs, dancing and listening. Finally music creates individual, cultural and social meaning and a sense of coherence in life [2, 12]. We like to call this perspective a relational and resource-oriented perspective emphasising what a person can do rather than his or her weakness or illness [11, 12]. The concept of relation is used by musicologist Christopher Small and is linked to his term "musicking" [13]. He describes music, not as an aesthetic object or work of Art, but as *potential relations* between persons, their experiences of music, and activities of all sorts of music making.

Many traditional and electronic music technologies used for well-being have limitations and even show negative effects on well-being and health. This is confirmed by Music Therapist and Music and Health researchers [9, 5] working with assistive technologies like the ultrasound sensor SoundBeam (<http://www.soundbeam.co.uk>) and switch-based Paletto (<http://www.kikre.com>). In our view, the reason for negative effects is a belief that users need to establish a causal understanding of stimuli-response prior to that they can start creating music, express relations and experience meaning. Even if the intention may be good, the focus on a tool-oriented cause-and-effect can make a physically or cognitively weak user experience fatigue and disempowerment before being able to master actions like hitting a particular sensor and create music [9, 5].

In previous papers we have showed an alternative strategy to building interfaces based on tool-oriented cause-and-effect [1, 5]. Instead we have expanded the role of the traditional music instrument [4]. As alternative we have designed computer based interactive music interfaces building on the relational and resource-oriented perspectives described above [13, 11, 12]. Interfaces that learn, remember, and adapt their responses after diverse users' abilities. Interfaces that are rich tangible multimedia that change the sound responses musically over time and with the user interaction. The result is that persons interacting are motivated to create, strengthen social relations, play and improvise, experience sense of coherence and well-being.

Earlier studies of computer based music and assistive technologies for persons with disabilities that follow a relational perspective are rare to find. There are even fewer studies for this group investigating practical-creative work with composition techniques and expressive qualities of such computer based technologies. It makes our preliminary findings [4, 5, 1] unique.

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The research question we like to explore in this paper is how one can compose sound for an interactive mobile and tangible interface, motivating and strengthening well-being for families with children with severe disabilities.

Our practical example is the tangible interface Reflect, and our suggestion for composition techniques is a process of *decomposing*, *recomposing* and *recreating*. The composer decomposes linear music consisting of strong musical elements such as riffs, jingles and grooves or beats and recomposes and programs rules for them into what we call Scenes. The music is recreated by users interacting with the interface in real-time, creating relations to each other, the sounds and the interface.

2. METHOD

2.1 The Multidisciplinary Rhyme Project

The context for this paper is the 5-year research project Rhyme (<http://www.rhyme.no>) in the area of Internet-of-things, mobile computing and social media for health. The goal is to improve health and well-being for families with children with severe disabilities in open, non-therapeutic everyday situations. We have so far explored multimodal, tangible and mobile computer based designs to motivate persons on different levels of musical mastery, activity levels and with different abilities [14, 15, 5].

The design and research is multidisciplinary and made in a group consisting of an industrial designer and interaction designer, a musicologist and a composer and programmer. The development is done in 4 generations of prototypes in collaboration with users and experts in Music and Health and Music Therapy. We have the advantage of continuous contact with the same 8 individuals and their families over as long as 4 years time. That makes it possible to follow-up on design choices and the users' experiences that happened from one week to the other and as long as three years back.

We and our colleagues in Music and Health research have been writing about our findings in earlier texts for the NIME community and elsewhere [1, 4, 14, 15].

The case focus on one family and discusses composition based on a relational perspective of music and well-being.

2.2 Decomposing, Recomposing, Recreating

When it comes to the practical work of adopting a relational perspective [13] to composition, our suggestion is to divide the work into three processes; *decomposing*, *recomposing* and *recreating*.

We define *decomposing* as the process of selecting and analysing music, based on the *music preferences* [7] of individual children and their families. The selection is based on an understanding of the relations between *musical elements*, structures, genres, and songs, on *how the persons use* the music and how it creates relations in their cultural context. In order to build on already established relations, we analyse music that is well known to the persons with disability and shared with their families. It is therefore important that the selection is based on the users' individual preferences. A consequence is that the selection can be wider or targeted to one genre, e.g. avant-garde, contemporary music. If the selection is wider, it can for instance consist of a mix of popular up-tempo grooves or rock-based songs, combined with folk music, or soft lullabies and ambient music. In order to understand and suggest potential use of the music, a person who is *decomposing* also analyse *non-musical elements*, movements, tangible and visual expressions that are relevant when appreciating the music, e.g. disco dance movements, rock guitar playing, stroking and hugging, etc.

We define *recomposing* as the act to, create potential relations based on significant parameters and structures in the music and/or vocal material, such as timbre, harmonic progressions, melodies, beats, bridges, riffs and choruses. Further to *recompose* them into *sound chunks* and *program composition rules*, so that they can be

combined dynamically by the users over time. Our earlier findings (1, 4, 5, 14, 15) show that musical variation and change over time is important for creating expectations and motivate persons on different levels of mastery to continue to be active and create relations. Again this is a complement to the tool-oriented focus on cause-and-effect discussed above. Further, when *recomposing* rules for change over time, the composer take into consideration both the musical possibilities to create expectations and the users' everyday stories in relation to the particular piece. For instance expecting a guitar riff in an up-coming chorus motivates the users to dance and mimic playing the guitar. The composer therefore needs to consider movement, visuals and lighting response that goes with the music, and get help to design them into Scenes. A single sound, light or movement chunk and its composition rules are designed so that they are possible to change dynamically when the person interacting, changes his or her relationship with the music. Consequently, it is not enough to attach a static sounding sample to an interactive object. A user goes from viewing the music as a *tool*, getting motivated by short accentuated and repeated sounds, separating the sound events stressing the break and the causal relation between action and sound, to *dialogue*. A dialogue with the interactive tangible interface, considering it as a *co-player* that answers back with over time varying sound and light.

We define *recreation* as the users' activities to interpret and co-create content with the system and other humans. It is possible if the composer is doing an analysis of what activities the amateur users find meaningful, in combination with creating the chunks so that they are coherent with the character of the Scenes and the music.

In summary, the composer is looking for relations between the original music, that he or she *decomposes* into parts, and over time potentially motivating relations in the process of *recomposing* for new situations, based on the understanding of the users interpretations in the process of *recreation*

3. RESULTS

3.1 Reflect



Figure 1. Man holding Reflect's belly and pointing its trunk with RFID-reader against a RFID-tag playing beats

Reflect is a mobile and wireless interactive tangible installation. It offers people possibilities to select and play with music and with others, and thereby reflect on their actions. It consists of a lumber-like soft thing that you can play with on the floor, hold in your arms, or over the shoulder while dancing. Reflect's embedded sensors, such as

touchable glowing stars, its speakers and lighting makes it possible for the user to create music and light.

Reflect uses a RFID-reader at the end of its trunk (see figure no. 1) to collect and dynamically change music samples from any other thing with RFID-tags in plastic key cards attached to them (see figure no. 2), and touch and bend sensor to dynamically mix, manipulate musically and play on and with the samples.

Technically the software in Reflect is written in the object oriented programming language SuperCollider (<http://supercollider.github.io>) and is running on an iPod Touch. The hardware is a mixture of custom-built circuits for sensors and light, and standard mobile phone technology like portable speaker and battery pack. It makes the platform self-sufficient and wireless.



Figure 2. Maracas and Monkey with white RFID-tags

Apart from reading the plastic RFID-tags that can be attached to things like toys, instruments and playback sound samples and trigger lighting, the 2 digital bend sensors and 5 analogue touch sensors can filter the sound and add effects and synthesized sounds.

3.2 Decompose Children Songs, Disco, Maracas, Rubber Ducks and Bongos

We interviewed 8 children with families and asked what songs they would like to work with. Here we concentrate on one child and her family consisting of child, mother, father and grandmother.

Their favourites were Abba's *Mamma Mia*; and *Gimme, Gimme, Gimme*; Alexander Rybak's *Fairy Tale*; children songs like the Norwegian *The Animals in Africa/Dyrene i Afrika* by Torbjørn Egner; and *Captain Sabertooth/Kaptein Sabeltann* by Terje Formoe; *Philly soul* disco groove beats; and Claude Debussy's *Prelude to the Afternoon of a Faun*.

Apart from the music we looked for sounds for all sorts of playful objects that a family with children could relate to, such as toys, toy cars, dolls, rubber ducks, small music instruments like maracas and bongo drums and soft cute or fury objects that could go well with each song.

One example was the popular song text to the *Animals in Africa*, where chattering monkeys, soprano frogs and baritone lions all had their own choruses. These are animals that children are used to mimic as they sing the song and therefore have a relation to. We found matching dolls and sounds of monkeys, frogs and lions to go with them (see figure 2). The beats in the song were cut in 2-4 bars, 8-15 seconds long chunks, synchronised to the pulse, so it was possible to loop them. We also edited and selected a part of each song to become a jingle.

3.3 Recompose Sounds Coherent with Scenes

Slowly the scenes took shape with tangible dolls and objects and sounds to go with them. In order to make the scenes coherent with the characters of each song and the objects in each scene; the sounds also had to vary with the role and relation that the user wanted to take in a certain situation.

For the person trying to master the dolls as instruments, it was important that the dolls firstly had a sound; and secondly, a characteristic sound that matched or added something to the physical

character and differentiated it from the others; as the frog sound, lion sound, monkey sound, etc.

For the persons that wanted to play with the dolls and develop relations to them as friends or co-players, we added three voice variations to each doll to toggle between to motivate dialogue.

We also created composition rules to vary the objects sounds depending on the active Scene. For instance did all objects play a four-note motive based on Mam-ma-Mi-a whenever a beat was activated in Abba's song. The rubber duck sounded Quack-quack-Quack-quack. The bongo drum went Boing-boing-Boing-boing, etc.

In the song about the animals in Africa we created coherent variations through relation between the animal doll and the matching verse. Consequently, we created a composition rule that let the animal a person interacted with select the matching beat, pitch range and timbre from a verse about the same animal. When the user selected another animal the sound changed on the first beat of the next bar. The result was variation that *followed the users choice* and still was *coherent with the character in the story* and the particular animal the user had chosen.

In addition we used the Reflect lumber-like object's tangible qualities to motivate hugging and patting by adding star-like glowing touch sensors to its body. The stars made squeaky high-pitched synthetic sounds when pushed as contrast to the acoustic voices. A bending sensor in one arm worked as guitar whammy, making noises and changes in pitch to the playing sample. These things motivated persons that wanted to dance and move to pick up Reflect and hold it as if it was a guitar or a dance partner. During user tests we added a strap so that persons could strap Reflect on to mimic a real guitar.

3.4 Recreate Motivating Relations

Wendy, a teenage girl with Downs syndrome and her family entered the music room at the school. Wendy was curious and excited of what she was about to meet. She smiled when she saw Reflect. The bean shaped object in soft velvet textile in huggable size was lying on a mat on the floor. Spread around it was 20 hand sized toys and instruments, such as rubber ducks, fluffy balls, small congas and maracas. Wendy expected it to answer to her actions and her voice in music and lighting. Her expectations were based on earlier experiences, one and two years ago. As a participant in the 5-year research project she had already tried similar interactive music technologies. One of the researchers showed how Reflect worked. Wendy threw herself on to the mat and started to hug Reflect. As she hugged it she squeezed the body and activated the touch sensors looking like stars. The stars immediately lit up and made high-pitched whistle sounds as if Reflect where taking to her. She took a grip around the neck and asked it back by talking into the trunk/nose at the end as if it was a microphone: "Say taco", Wendy said. Nothing happened until she bent the neck and it made swoosh sounds. Wendy's father gave her one of the fuzzy balls in pink that had a RFID tag attached. He asked her to hold the tag against the nose containing a RFID reader. Wendy tried it out and Reflect started to play a looping beat in the song *Mamma Mia* by Abba. Both she and her mother immediately started to dance and moved their bodies to the beat and sang along with the repeating text *Mamma Mia*. Wendy picked up the rubber duck and held it against the nose all by her self. Reflect played back a duck's voice on the same melody and four-syllable rhythm as Mam-ma-Mi-a: "Quack-quack-Quack-quack". The mother and Wendy echoed the phrase with the original text, singing in consonant: "Mam-ma Mi-a" over and over again while dancing. Wendy turned the beat off and signalled to the mother that she wanted to rest and lie down on the mat and some cushions, using Reflect as a blanket. Wendy invited the mother to lie down beside her and started to cuddle with Reflect that lit up and made tiny high-pitched sounds every time she hugged it and touched the stars. The mother was lying down and together with her daughter created an intimate and safe environment where the sounds from Reflect was part of the ambience where they made small talk, caressing the

Reflect while relaxing together. After a while Wendy started to talk into Reflect's nose again, talking to it as if Reflect was a person. On her back she continued to explore the cushion's form, materiality and rubber band with her hands and feet.

The following week and the second time Wendy interacted with the Reflect, she brought her mother and grandmother. The grandmother sat down in a sofa facing her daughter and granddaughter that danced and played with the toys. Wendy put the Reflect cushion into the grandmothers lap, gave her two toys and showed her how to hold the tags against the trunk. When the grandmother didn't manage to change the sound, Wendy showed her one more time until she got impatient and took Reflect off the grandmother's lap and strapped it on to her own body, with a bouncing rubber strap around her neck as if holding a guitar. The mother still dancing made the association and asked: "Are you playing the guitar?" Wendy swung her hand back and forth as if playing on invisible strings while dancing and sharing together with the mother and the grandmother, sitting in the sofa and moving her feet to the musical pulse.

4. ANALYSIS

Reflect created different relations to its users, by changing its answer depending on different musical Scenes and user activities. Reflect took the role of a teddy bear and a friend. For instance as Wendy talked to Reflect, asking it to "Say taco", as if it was a person. Further, Reflect took the role of a fellow improvising musician as when the duck responded with a variation to the motive "Mam-ma Mi-a" with "Quack-quack-Quack-quack", strengthening the role of Wendy and her mother as co-players. Or, the role of a tool to be pushed when Wendy assumed a teacher's role, teaching her grandmother how to play. Or, the role of ambient landscape and furniture for Wendy and the mother to lay down and feel safe in. A furniture to play out an intimate relation, normally associated with a home-environment, and not a public office.

The observations also show how Wendy from the very first minute found it meaningful to start interacting, even if she then didn't know how to make sounds and operate Reflect. Even if she at that point *didn't understand the causality* between her action and the sound coming from Reflect, she was motivated by the sound and light while she was hugging Reflect and continued to interact.

5. DISCUSSION

From Wendy's interaction and how she switched between roles and relations in the different Scenes, and with her family, we believe that computer based interactive tangibles can offer new possibilities leading to well-being. Well-being as the possibility to master, create, strengthen relations and sense-of-coherence based on a relational perspective on musicking [13]. A future development could be to offer Reflect on a 24/7 basis, and program even more dynamic rules changing the music to be motivating for longer time. Another possibility would be for users to add music on their own, in order to extend users' freedom and the possibilities to make decisions [13, 6].

To create computer based interactive tangibles that are meaningful for amateurs, we believe designers and composers, need to work *relational* and with all three processes from decomposing, recomposing to recreating.

They need to take responsibility for doing the selecting and *decomposing* of genres, songs and sounds, with an understanding of the persons who should play and *recreate* with the music. In the *recomposing* of the material and the writing of composition rules they should not leave the interaction design to a person without musical and aesthetical understanding and craftsmanship.

Finally, we need to upgrade the status of working with users of all kinds. We call it recreation because it is *creative*; the material is composed to exceed the initial ideas. The user is part of creating the music. At the same time the composer is needed more than ever. Our

findings show that music's ability to change over time and create content that is coherent is motivating for everybody involved, leading to active persons, well-being and health.

6. CONCLUSION

We have explored how to compose sound for the interactive tangible and mobile interface Reflect, promoting health and well-being for families with children with disabilities.

We have investigated the composition process from decomposing a linear beat-based and vocal sound material. How a user can recreate it with real-time audio synthesis into Scenes. Scenes that made it possible for persons with diverse abilities to develop personal relations to the music, each other and the tangible interface as an instrument, improvise and play with it, hugging it as a friend and to relax and use as ambient sounding furniture.

Based on observations we have explored how a family can recreate and play with Reflect.

We have discusses how NIME's readers could go further by working in all three phases of decomposing, recomposing and recreating as part of their compositional and reflective practices. NIME could make a difference in peoples lives and have impact on health and well-being through improvisation in sound and music.

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