

# Designing a Music Performance Space for Persons with Intellectual Learning Disabilities

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## ABSTRACT

This paper outlines the design and development process of the ‘DIYSE Music Creation Tool’ concept, by presenting key questions, the used methodology, the music instrument prototype development process and user research activities. The aim of this research is to study how music therapists (or instructors) can utilize novel technologies and study new performing opportunities in the music therapy context, with people who have intellectual learning disabilities.

The research applies an action research approach to develop new music technologies by co-designing with the music therapists, in order to develop in situ and improve the adoption of novel technologies. The proof-of-concept software utilizes Guitar Hero guitar controllers, and the software allows the music therapist to personalize interaction mappings between the physical and digital instrument components. By means of the guitars, the users are able to participate in various musical activities; they are able to play prepared musical compositions without extensive training, play together and perform for others. User research studies included the evaluation of the tool and research for performance opportunities.

## Keywords

Music interfaces, music therapy, modifiable interfaces, design tools, Human-Technology Interaction (HTI), User-Centred Design (UCD), design for all (DfA), prototyping, performance.

## 1. INTRODUCTION

The Do It Yourself Smart Experiences (DIYSE) project<sup>1</sup> aims at enabling ordinary people to easily create setup and control applications in their smart living environments as well as in the public Internet-of-Things space, allowing them to leverage aware services and smart objects for obtaining highly personalized, social, interactive, flowing experiences at home and in the city. The development of the ‘DIYSE Music Creation Tool’ and the user research studies were based on a preliminary study within the DIYSE-project. The study outlined the everyday life of people with intellectual learning disabilities<sup>2</sup> concerning new technologies. Based on this

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<sup>1</sup> <http://www.dyse.org>

<sup>2</sup> People who have a mild or moderate intellectual learning disability (Diagnosis ICD-10).

preliminary research, the music therapy context was chosen for the research framework.

Learning to play a traditional musical instrument requires long-term training, and consequently many beginners never succeed to develop the necessary fine-motor skills to play music. This is especially the case with the end-user group of this study; people with intellectual learning disabilities. This user group needs musical interfaces that are extremely easy to understand and to adopt: the paradigm is also found in the studies of Machover [6] and Benveniste [1]. Therefore, the aim of this study has been to design easy-to-learn interactive music instruments and develop alternative methods for music creation. This paper presents the challenges of interaction design related to the music creation context, and describes the prototype development and the user-centred design research processes [5].

## 2. INTERACTION DESIGN FOR A MUSIC CONTEXT

In the field of interaction design research, there is a demand for new design tools that enable creativity by means of explorative interaction, as opposed to limited executive and mission-based interaction (e.g. [3], [5] & [6]). Petersen et al. have proposed that the aesthetical interaction perspective offers an alternative to traditional interaction ideals [6]. In aesthetic interaction, the user is seen as an improvisator and the interaction between the human and the technology is a situation of play. According to Petersen, aesthetic interaction is found in the concept of intrigue that is connected to experience, surprise and serendipity in the use of interactive systems (ibid p. 274). In the light of Petersen’s theory, equal attention should be paid to the players’ cognitive skills, emotional values and bodily capabilities in the design of creativity-supporting music tools. A music-playing learning situation should enable the player to imagine, create, play, share and reflect on musical actions [7]. The playing situation involves an interaction feedback loop between the participants, their instruments and produced sounds. In an ideal state, a playing situation should encourage players to improvise and express themselves through playing and experiencing immersion.

## 3. METHODS AND TOOLS

### 3.1 Prototyping

In the pursue of finding means to support the musical activities of persons with intellectual learning disabilities, we began by simplifying the music creation process and concentrated on finding interactive technologies that were easily available and easy to use. According to the preliminary research, we had learned that the target group end-users had various, and often multiple, disabilities and that they were enthusiastic about

music. In the initial research phase, various sensor technologies were tried out and observed with the end-users. The prototyping phase was carried out through an iterative co-design process between the designers and a music therapist. The co-operation with the professional music therapist was an essential part of developing the prototype. For developing the digital user interface we used the Max MSP graphical programming language [9]. Nintendo Wii Remotes [10] and Guitar Hero controllers were chosen for our physical controller framework. Both of the technologies offered good technological support for realizing proof of concept prototypes because of their reliability and active open source and sharing communities.

### 3.2 Music Therapy Context

The use of the ‘DIYSE Music Creation Tool’ was observed and evaluated in a natural music therapy context (see figure 1), in order to gather information about the adoption and usability of the software and the instruments. Rinnekoti Foundation, a service provider for disabled people and partner in the project, provided the facilities for the evaluation of the ‘DIYSE Music Creation Tool’: a computer, three guitars and the software, were brought to the music therapy studio. The therapist chose the players based on their capability to benefit from the new means to make music and based on their availability for the whole observation period. On proposal of the music therapist, the observation period culminated into a final concert, in which the participants performed the music piece for an audience with the instruments accompanied by an acoustic drum kit. The concert was part of the DIYSE project research consortium meeting (see video link in the appendices section).



Figure 1. ‘Music therapy session: learning to play and practicing for a performance.’

### 3.3 Prototype Evaluations

The ‘DIYSE Music Creation Tool’ was evaluated in two phases. The first evaluation session was arranged in August 2010, at the Rinnekoti Foundation, Espoo, Finland. The participants were 26 – 58 years of age. All of the interviewees knew each other beforehand and were accustomed to participate in music therapy sessions. The research methods included observations and semi-structured interviews [4] and there were two objectives for the evaluations. Firstly, the initial goal was to determine technical requirements by utilizing co-design, and therefore the music software was introduced to the music

therapist. Secondly, the acceptance and the user experience were evaluated with the players. At the end of the evaluation session, there was a short ‘Sonic Sketching’ workshop that was aimed to encourage participants to innovate surprising and inspiring ideas for novel music instruments.

The second evaluation phase was held between October/November 2010, at the Rinnekoti Foundation and the participants were mostly the same as in the first phase. The observation framework was arranged for 1.5 weeks observation period, and the music therapist was responsible for the therapy context within the given framework. The therapist carried out most of the therapy sessions individually. The video observation period lasted ten days, and seven music therapy sessions were video-recorded in that time scale. The recorded video material was analyzed based on the ‘interaction analysis lab’ method [2]. In the method, the observers comment about the context of the video material, create a hypothesis about what is occurring in the recording, and discuss about the context [8]. During the analysis, the material was observed according to four topics: supporting creativity, learning, user frustration and independent playing.

## 4. RESULTS

### 4.1 Prototype

The software features the following three functionalities: 1. Composing and restoring music tracks in the software. 2. Design of interaction mapping strategies between the guitar’s interface elements and played sounds. 3. Choose sounds for the guitar. Figure 2 presents the software’s interface layout.

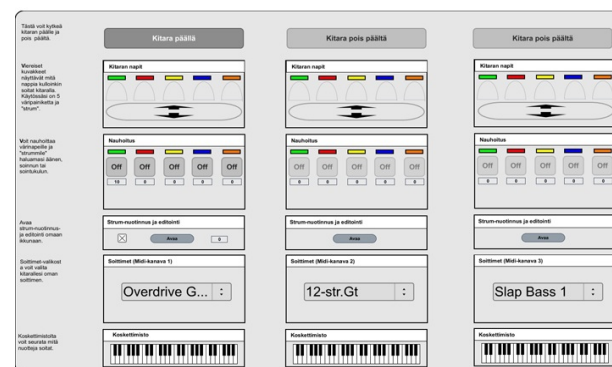


Figure 2. ‘DIYSE Music Creation Tool’ software’s main window: functionalities for recording, mapping interactions and choosing sounds.

#### 4.1.1 Prototype in Use

The music therapist prepared the therapy sessions by recording song arrangements into the software using a midi keyboard. The music in the first evaluation session was a general 12 bar ‘blues’ theme. For the second session, the therapist chose a song composed called ‘Egyptian Reggae’, by Richman Jonathan. The first song was used for practicing purposes and the latter was rehearsed to be performed in the concert. According to the therapist, the chosen genres – the blues and the reggae – were stated to provide a ‘good groove’ and were therefore suitable for the therapy group. In addition, the songs’ musical elements were easy to arrange for the three guitars. The therapist arranged the musical elements as follows: 1. bass guitar, 2. rhythm guitar and 3. solo guitar.

The software assisted to map the arranged sound elements to the three guitars interface elements. The bass guitar was played

using the controller's strum switch. The switch triggered single notes from a step-sequencer's timeline in sequential order. The bass guitar was meant to be the easiest instrument to learn as it produced meaningful musical structures through simple switch triggering. The rhythm guitar and the solo guitar were played by pressing the color buttons attached on the controller's neck. The rhythm guitar's idea was to challenge the player to play chords in the right order and time. The solo guitar was designed to support an idea of free playing and expression. Using only harmonic notes, each mapped to the guitar's colored buttons, the audible result was designed to be pleasing as there were no dissonant notes.

## 4.2 Interviews and Observations

According to the interviews and observations, the most satisfactory attribute of the 'DIYSE Music Creation Tool' was the experience itself; the joy of creating and generating music and the feel of accomplishing something in a short period of time, even if the players lacked the skills to play musical instruments. This sense of easiness was consequence of the fact that some music pieces were composed beforehand and thereby there were "no wrong notes" i.e. if the player pressed the bass guitar's strum, the music flowed and sounded pleasantly. According to the preliminary observations, it seemed to be important that the instruments resembled real instruments, guitar and bass, so that its affordances were easy to perceive [2]. For the music therapist, it was important that there were many alternatives to choose from the sound library, relating to music genres, instruments, sounds and tones. The most significant finding was the fact that performing to an audience seemed to be important for this user group. Generally, the threshold to perform and try out new things seemed to be quite low.

## 4.3 Interaction Analysis Lab

The music therapist used much effort in trying to provide a creative atmosphere, so that the therapy situation would not be just about pressing buttons and learning rhythm. For example, he accompanied the players by playing traditional instruments and encouraged the players to communicate with him through musical expressions such as tempo variations and pauses. In addition, he made occasional polyrhythmic textures in order to increase the complexity level of playing. Many times his efforts disturbed the participants, as finding the rhythm took all their attention. Otherwise, the playing situation was quite static; it appeared that there was not much improvisation or experimental playing during the practise. An incentive to support creativity with the 'DIYSE Music Creation Tool' was the promised performance for an audience.

The observations indicated that the appearances, the shape and sound of the instrument, were important and that the instruments must support the player's identity. For example, one of the players mentioned that because his brother played the guitar in a band, he liked to play it too. However, the guitar-like shape also provided challenges: it was difficult to detect the colour buttons and it was challenging to decide how to hold the instrument, as it seemed to be uncomfortable to hold it 'like a guitar'. Some participants even did not have enough motor coordination to play the instrument like a guitar. This was an important observation, because the way to hold the instrument influences the way feedback is received. Preferably, the interaction with the instrument should be as intuitive as possible. Observations indicated also, that it seems to be more important for the players to press the right button at the right time, than to have a subjective playing experience and feel comfortable in the role of an improviser.

The music therapist himself learnt to prepare the system on the third observation day; connecting the guitars and the computer, uploading the sounds and creating personalized mapping strategies for the players. The most significant observed difficulty of the learning experience was related to learning the rhythm. If the players could not find the rhythm, it became difficult to perceive a mental map of the overall situation, and the users were disappointed and frustrated. In general, the players of this user group needed a lot of support from the therapist i.e. the level of independency was low. The music therapist guided the participants e.g. by instructing the colour keys of the instrument: "red-green-yellow" (see figure 3). On the third observation day, there was a new player attending the music therapy sessions. He practiced playing the instruments only once and was therefore an excellent subject to study. At first, he played the bass and was able to learn the first three notes of the rhythm pattern, but learning the whole rhythm structure seemed to be quite demanding for him too. Yet when he finally had learned the rhythm, it seemed to be extremely rewarding.



**Figure 3. Practicing to operate the instruments: music therapist giving instructions – red, green, yellow...**

During the observations, there were specific moments when players seemed to be quite frustrated. For example, in the second observation day one of the players was notably disturbed. His playing of the bass was already fluent and therefore his gaze wondered towards other interests. One of the players stated to be tired of the chosen piece of music, and he wanted to play something else. Frustration was apparent especially when the participant's ability to learn was not properly taken into account. There seemed to be a delicate balance between patronising the player and providing too much information and encouragement for independent playing.

## 5. DISCUSSION

The 'DIYSE Music Creation Tool' was intended to be a design tool for the music therapist. During the design process, the therapist utilized the system for planning the sessions for his customers, and the end-users utilized the system for playing music and performing. By co-designing the system and using it in a real therapy situation, it was possible to create and develop new music playing experiences for music therapy clients in situ. Creativity was chosen to be a critical issue of the study. Based on the theoretical background and the results attained through the user evaluations, it was perceived that the Guitar Hero controller is not an ideal controller for playing music. The controller's interface elements mainly support point and click

interaction style, which is suitable for playing rhythm games as indicated by Machover [5]. Supporting only the rhythm is not nearly enough; rhythm, timbre, pitch and time should all be considered equally important when designing interactive music instruments. In the light of Petersen et al [6], the Guitar Hero controller can be mainly seen from the mechanistic tool perspective, thus having distance to dialogue, media and aesthetic views of interaction. In search of the aesthetic experience, we emphasize experimental aspects of the four music elements presented above. Therefore interaction design of the instrument should encourage the player to explore and playfully appropriate the musical dimensions through the instrument. However, it must be acknowledged that the point and click interaction is one considerable alternative when designing music instruments for persons with learning disabilities. A significant finding of the research was that it is important to minimize the possibilities to fail (or the feeling of failure) by keeping the control of the instrument simple. On the other hand, it is important that the playing situation challenge the player in the five learning phases that Resnic [7] presents: imaging, creating, playing, sharing and reflecting.

In future research, we intend to develop instruments that enable explorative human-computer interaction. This allows the players to concentrate on the creative process of music making and creating in a performance space. Performing on stage and training for the performance were stated to be very important. Some of the challenges for future design phases include providing support for two or more players and for the co-playing concept as a whole. Social media could support in developing the music performance space by offering a tool for publishing music and providing a place for recording music or performing. In an ideal situation, digital and physical tools help users to enhance their everyday life; to think, to design and create art, experiment with new technology and technological gadgets and become stakeholders in public projects.

## 6. ACKNOWLEDGMENTS

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### Links:

- [9] Max MSP, Web site (read April 26, 2011): <http://www.cycling74.com>
- [10] Nintendo Wii Remote, Web site (read April 26, 2011): <http://www.nintendo.com/wii/console/controllers>

### Video

<http://www.youtube.com/HTIforWelbeing>