G-Tunes – Physical Interaction Design of Playing Music

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Abstract. In this paper we present G-tunes, a music player that couples tangible interface with digital music. The design is done based on the research of tangible interface and interaction engineering. We offer an overview of design concept, explain the prototyping and discuss the result. One of the goals of this project is to create rich experiences for people to play music; another goal is to explore how external physical expressions relate to human's inner perception and emotion, and how we can couple this with the design of a tangible music player.

Keywords: Interaction design, Tangible interaction, Sensory perception, Music player, Scale, Weight.

1 Introduction

Human interact with world emotionally. We may slam the door heavily to express our anger, whereas we will carefully close it when seeing a sleeping baby. However, nowadays many products and systems are designed to work automatically, which doesn't provide a contextual environment for people to apply physical actions. Thus people lose the opportunities of expressing themselves by means of rich physical interactions [1].

Nowadays graphical user interfaces (GUIs) are commonly employed to design digital music players such as Windows Media Player and i-Tunes. However using mouse and keyboard limits the richness of interaction people could have with their favorite music. We believe that a tangible interface, which turns everyday objects into physical inputs of a computerized system [2], can expand the dimension and freedom for human machine interactions. Thus, enhancing the experience of listening to music becomes possible through various physical ways of controlling it.

To expand our views of design possibilities, we started exploring experiences of people interacting with everyday products. We took an example of using a professional digital camera as a starting point. Taking a good photo requires the setting of right angle, right explosion time, and the right moment of pressing the shutter. Serial delicate physical interactions such as holding, rotating, bending and coordinating between two hands combining with precise visual perception contribute to the creation of a great artwork. This example shows how sophisticated motor skills possessed by human can be employed to interaction design.

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2 Related Work

For many years, research regarding tangible musical instrument has been conducted aiming at mapping human physical interaction with musical output. As the examples, the Music Cube [3] and Embroidered Music Balls [4] will be discussed later in this session.

By looking at these examples, we found that the process of manipulating and creating music with a musical instrument can be designed more expressively through many innovative tangible interfaces.

2.1 Music Cube

Music Cube is a project that explores ways of adding physical experiences to digital music playing. With a cube interface, users can shake to shuffle music and place cube on its different side to select or stop music. A speaker like button can be rotated to scroll a list of music. Each side of the cube shows a different color to represent certain type of music because it is believed that color can show certain expressions. Music Cube uses many metaphors for designing interactions of playing and selecting music. However, it is noticed that interactions with Music cube are constrained by its physical shape.

2.2 Embroidered Music Balls

Another similar design that applies tangible object to manipulate music expressively is called Embroidered Music Balls. Through simple interactions with the Embroidered Music Balls users can easily compose artistic music. Unlike common musical instruments such as piano and violin that require years of practicing, it allows untrained people (children, novices or professionals) to use simple and natural hand gestures (such as squeezing and stretching) to perform music. Embroidered Music Balls provides more freedom in terms of interaction style. However, although interactions like squeezing and stretching offer more fun, it is rather limited when used to compose professional music.

2.3 Design Insight

Based on the previous research, we tried to explore free, direct and expressive interaction styles that not only offer fun experiences but also combine auditory sensation with physical interactions [5].

3 Concept of G-Tunes

As we know, music can be categorized as classical, jazz, pop, rock-and-roll, etc. Different types of music can create different atmosphere, which may also influence the way people interact with the environment. Interestingly, people call classical music as light music and associate rock-and-roll with heavy. The words “light” and “heavy” reflect that people tend to relate their sensory perception to physical object in a certain extent. The concept of G-tunes employs a metaphor of “musical scale”,

which does not represent a series of music note, but a weight measurement device for music since we assume each song has it's "weight". Furthermore, since gravity of physical objects drives music playing, the concept is called G-tunes.

3.1 Defining Music Weight

One of the essential issues of this design is how to define the “weight” of music, and map the physical interactions properly to music effect. In this paper, we tried to define the weight of music from two different perspectives: acoustic effect and cognitive perception.

From the acoustic effect perspective, volume of the music can be a criterion of music weight measurement. The louder the music is, the longer the distance it can be spread. We can also imagine that the more space it occupies, the heavier the music should be. Besides volume, frequency of the music is also one of the key factors for “weighing” music. Within the audible range of human beings, low frequency sound evokes “oppressive” & “intensive” feelings to people. It is also an indispensable part of heavy music like rock-and-roll; meanwhile, high frequency sound brings “euphoric” & “releasing” feeling to people, one example is classical music.

Regard to the cognitive perception, as we already discussed, people relate different types of music to physical objects by adding “light” or “heavy” into the music name. In fact, frequency is the reason why people have this kind of feeling. Each different instrument produces a certain range of frequency. Typical instruments for playing classical music are string instruments. Although its’ frequency range is very broad, they are often used to generate high frequency pitch. However in rock-and-roll music, percussion instruments, which play important role to the band, can only locate at low frequency range [6]. Besides, some rock-and-roll music apply digital technology, such as a equalizer, to enhance the sound effect by adjusting frequency, which makes the music sounds heavier as well.

Viewing from these two perspectives, in this paper we define classical music as the lightest and rock-and-roll music as the heaviest. Jazz and pop songs are in between. These four types of music were used for prototyping.

3.2 Interaction with G-Tunes

Interaction with G-tunes can be described as selecting different styles of music by putting different weights on a scale. The metaphor is illustrated in Figure 1.

G-tunes provides two modes of playing music for people to experience. One is to change the weight of a selected music; the other is to switch among different type of music. In the first mode, depending on the weight people put to the scale, sound effects within different frequency ranges of that music will be enhanced or weakened accordingly, so that it sounds lighter or heavier. In another mode, putting different weight on G-tunes can result in the selection of different types of music. For instance, classical music is lighter than rock music, putting enough weights to G-tunes will switch the music being played from classical to rock music.

Moreover, any everyday objects can activate G-tunes as long as they can be put onto the scale. Throwing or gently placing weight to G-tunes will result in different effect of music.

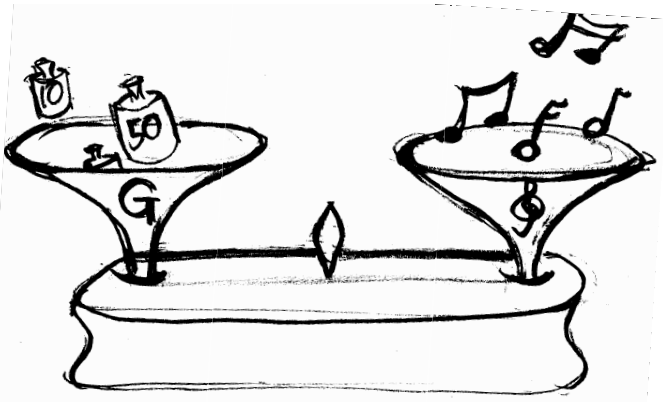

Fig. 1. Concept of weighing music

4 Prototyping

A working prototype was developed as shown in Figure2. A standard mechanical scale was taken apart, and used as the core mechanical components of the prototype. A slider is used as scale to measure weight. These two parts are assembled on a base made of foam. A basket is connected with the slider and used as the weight container. Phiget tool kits [7] were used for hardware implementation. RFID tags were used as "music disks". Each of the tag is linked with one type of music which can be switched according to the weight put into the container. The slider is used together

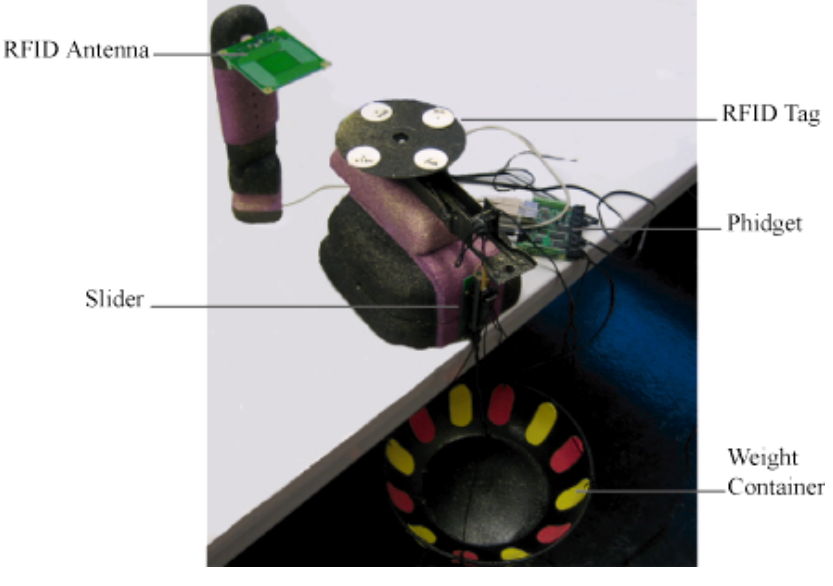

Fig. 2. G-tunes prototype

with a rubber band as a scale. Continuous changes in music can be experienced when the scale increases or decreases. MAX/MSP [8] was used for software implementation and processing music effects. Volume control and frequency control are the core parts of the code. The basic principle is to filter the frequency of music to change the effect between "heavy" and "light".

5 Discussion and Application

5.1 Feedback of G-Tunes

The concept of G-tunes was discussed in an internal demonstration at our design institute. We presented the concept and prototype to twenty audiences and four of them experienced playing music by G-tunes after the presentation.

The general feedback from audience is that G-tunes is an innovative way of playing music and gives lots of fun. Experiences of playing with G-tunes are very expressive and fun, especially when the tune changes synchronously while putting different amount of weight into the container.

Another important feedback is that people perceive the "weight" of music in different ways. This was revealed when the "weight" of a selected song was changed. Some people need to put more weight to perceive the changes of volume and frequency, some people can perceive the changes by a slighter adjustment. In general, it is easier to perceive the music going to be "heavier" than "lighter". One reason lies in the limitation of the prototype. The sensitivity of the slider needs to be improved for weight measurement. Another reason is that, unlike physical entity, it is impossible to give one standard sensory measurement of human beings since people own various cognitive perceptions.

Besides the feedback above, when putting weight to switch the songs, some people did not fully agree with the weight definition of the four songs that were chosen for demonstration. It is obvious to identify the weight of classic music and heavy metal music, but it sounds ambiguous when defining the weight between Jazz and Pop music.

Therefore, one of the suggestions from audiences was to further research how different people perceive and define the "weight" of music. An online survey within a large user group could be considered to obtain insights on the acceptable associations between weight and types of music.

5.2 Additional Application

By demonstrating and discussing G-tunes with audience, we believe the concept can be extended to use in other areas and contexts.

5.2.1 Information Visualization

G-tunes proposed a new method to categorize digital information by "weight". In this term, the definition of information "weight" can represent the size of a digital file and file folders. For example, the more and bigger files the folder contains, the heavier it is. Accordingly, the icon of the folder can look slightly different from each other. For example, heavy folders look more metal and bigger, while the texture of light folders can look more plastic. This could offer a more intuitive and direct way for people to

check how much disc space the folder occupies than to find it out from the property menu of the folder.

5.2.2 Music Education of Children

A game could be designed based on the platform of G-tunes for education of music frequency and composition. We can create a simple music sample consists of several ranges of frequency, such as bass, treble or middle range frequency sound, which are produced by different instruments. With G-tunes, music can be decomposed into pieces that associate with different frequency sound, and each piece can be represented by a certain physical object such as a toy. By manipulating and rearranging physical objects, children can compose the same sample music or create their own music. In this way of playing they can learn about music frequency and composition. Moreover, as an advantage of using tangible interface, G-tunes provides a platform for social interactions as well [9]. Children can play together and learn from each other collaboratively.

6 Conclusion and Future Work

By presenting G-tunes concept, we proposed a new approach of playing music that adds physicality and fun for people when interacting with digital information. In the next step, a more delicate algorithm of how to compute weight of music needs to be developed. Thus, the issue of how to define the weight of music has to be more clear and concrete. The mapping between the weight of physical object and music requires not only interaction design techniques but also professional acoustic domain knowledge. In the end, extended applications can be further experimented and realized if feasible.

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