



# Collaborative Music Application for Visually Impaired People with Tangible Objects on Table

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## ABSTRACT

The collaborative work of visually impaired people and sighted people on equal ground plays a significant role for visually impaired people's social advance in society. We developed a collaborative application of music composition to achieve the goal mentioned above. This application has a beautiful tangible interface that would attract the attention of both visually impaired and sighted people, and multiple functions that are likely to induce collaborative communication among users. We demonstrated the experiment with six visually impaired people and six sighted people. In the experiment, the visually impaired people could lead the collaborative work without hesitating even in front of the sighted people whom they did not know very well. Then we focused our attention on the moment in which the visually impaired were having fun, and discussed the factor of the excitement.

## Categories and Subject Descriptors

H.5.2[User Interfaces]: *Interaction styles*.

## General Terms

Human Factors

## Keywords

Visually impaired people, Collaborative, Music application, AR Marker, Kinect.

## 1. INTRODUCTION

Collaborative work with other people in the fields of arts and sports may make the better result, a sense of accomplishment and a new relationship with other people. It is also applicable universally for visually impaired people. There is the collaborative work such as "ball goal" and blind soccer, but visually impaired people can't stand the equal ground with sighted people in the work. So we try to design an application which visually impaired people can use without hesitation. We focused on the communication tool, "music" that has sound feedback, and developed music composition application by arranging some tangible objects on the table like Reactable[1]. This paper introduces the overview of our application and the evaluation with visually impaired and sighted people.

## 2. DESIGN OF THE APPLICATION

In this section, firstly, we will explain about music composing interface that we invented for visually impaired people, secondly, give a full account of the design of the collaborative music composing application with which the interface is used.

We started our research by conducting an interview with a professor who has been working on the education to support

visually impaired students. In this interview, he referred to some factors that prevent those visually impaired people from enjoying music: the difficulty to memorize phrases and read music score with braille. Therefore we have aimed to develop an application, which is able to not only play already-existing music, but also compose the new one. Compared to playing the existing music, we considered this musical composition very creative and effective to promote communication among users. In previous research [2], we confirmed the effectiveness of our music composition interface shown in Fig. 1. We paid our attention to the touch sense which those visually impaired people possess exceptionally, so we employed the interface which users lay out tangible objects on the table. It has some tangible objects with AR Markers and Kinect as a vision sensor. The vision sensor detects the positions of the objects, and the detection results are directly changed into musical score. Users could get sound feedback in real time. We connect the all objects to one another with chain-like objects that lead the visually impaired people to reach each object. Thus they can intuitively understand the whole image of the tune.

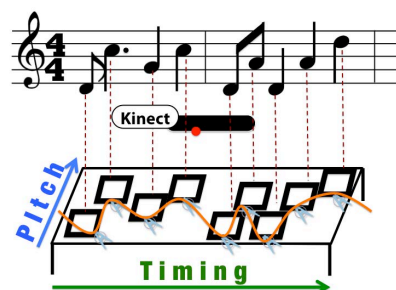


Fig. 1 Overview of our interface

Using the interface, we developed a collaborative music application shown in Fig. 2. This collaboration does not only mean helping activities with each other. More importantly, it means communicating with others, and working on projects more effectively, so as to achieve the shared goal. Under the shared workspace, the sighted people would help visually impaired people. So, we made the workspace independent for each user as the design of the application so as to promote oral communication, as shown in the drawing below; in A of Fig. 2. Two users sit on both ends of a table, create their own melodies individually, and compose those two melodies to make a new music. Additionally, in B, C of Fig. 2, functions that are created on the purpose to extend the range of the entertainment for the users. Basic method of composing a melody is similar with the already-mentioned interface as shown in A of Fig. 2. The dice-like shape box with six AR Markers shown in B of Fig. 2 has a function to change sounds of musical instrument of the melody users composed. The six AR Markers indicate high-pitched piano, low-pitched piano, guitar, drum kit, trumpet and violin respectively,

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and two users can select each instrument by rolling each box. Seven AR Markers called “Base marker” for base sounds are set on the center on the table showed in C of Fig. 2. Seven sounds are the loop of percussion, drum, dance beat, pop beat, dance base, pop base and shaker. At first, all base markers are laid upside down. Users can add the base sounds to their music by turning over Base markers. Combination of base sounds enables the users to make the favor of their music.

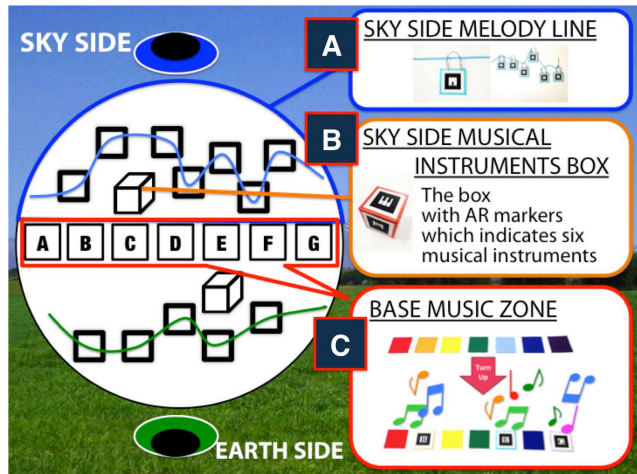


Fig. 2 Outline of the application

### 3. EVALUATION

Six visually impaired and six sighted people participated in the evaluation. Fig. 3 shows the appearance in the experiment. The experiment consists of three parts: (exp.1) composing music by a visually impaired person (about 10 min), (exp.2) composing music by a visually impaired and a sighted people person (about 20 min), and (exp.3) composing music by two visually impaired people (about 20 min). In experiments, the pair of visually impaired people and sighted people met each other for the first time, and the pair of two visually impaired people is close friends with each other. In exp.1, visually impaired people composed the music with checking relationship between their operations and sound feedback silently. In exp.2, although individuals varied from one another, users had a lot of conversations, in spite of the fact that they met for the first time. Additionally, there were many scenes in which a visually impaired person led collaborative music composition, for example, by giving advise such as “You should use trumpet”, “Put on more markers!” In exp.3, as in exp.2, many conversations were carried on between two visually impaired people.

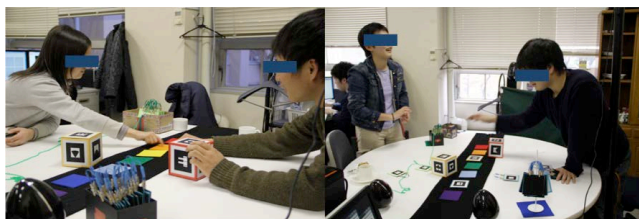


Fig. 3 Appearance of the experiment

Participants commented their positive opinion to the application such as “we can’t write and robe off musical notes on paper since We can’t see, but using this application, we can try and select sounds by moving objects on table”, “Thinking about the how to

select music instruments and combine our sounds was very fun”, and “We can compose a cool music by only some base music, so even the beginner can enjoy this application easily.” There was a visually impaired person who said, “I would like to actually join and contribute to the process of the application’s improvement.” In interview, it became clear that all participants were satisfied with the music they composed, and all visually impaired participants enjoyed collaborative music composition more than the solo music composition. As the reason, five out of six visually impaired people commented a similar opinion, such as “I couldn’t know what was going to happen, but it is exciting.” And “It was beyond my imaginings.” Compared to the music composed in the collaboration, solo composing music is too simple and plain. We believe that collaborative work effected well in terms of the enjoyment of composing music and the quality of composed music. Fig. 4 is the scene in which the visually impaired participant was enjoying composing music with the full of excitements. She was amazed at the harmony of the sound she composed on her own and the sound that her partner composed. Separating their work on music composition leads them to understand the relation between their own sounds and other’s sounds and enjoy it fully.

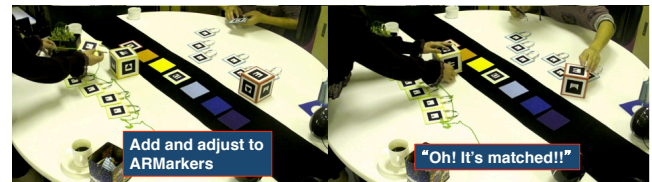


Fig. 4 The moment of exciting

### 4. CONCLUSION

This paper introduced our collaborative application that enables the visually impaired people to enjoy composing music with the sighted people. In the experiment of collaborative music composition with the application, visually impaired people had a lot of conversations with sighted people. Moreover there are even some scenes in which visually impaired people advised sighted people about what to do in collaborative work. As a future work, we will implement our application that run with even inexpensive web camera, and want to release it.

### 5. ACKNOWLEDGMENTS

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