TempoString: A Tangible Tool for Children's Music Creation

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ABSTRACT
In this paper, we introduce the design and implementation of TempoString, an easy-to-use tool which assists children with music creation. It provides such a fun and novel platform by allowing children to "draw" music on a canvas and then edit it using a rope. The main contribution of our work is the novel access which allows children to "paint" music on a canvas and then edit using a rope.

Author Keywords   music creation; rope interaction; tangible interface; children; visual and audio feedback

ACM Classification Keywords   H.5.2 [Information Interfaces and Presentation]: User Interfaces (D.2.2, H.1.2, I.3.6) – auditory (none-speech) feedback, haptic I/O, input devices and strategies, interaction styles, prototyping.

General Terms   Design, Human Factors, Performance

INTRODUCTION
Music is an effective form of expression. For children, creating music is not only a joy, but the process also helps with their cognitive development. However, according to some professional kindergarten music teachers whom we have interviewed, mastering and performing music well with instruments require a vast amount of knowledge and years of repetitious training. This usually bores children and gradually, their interest declines. For children facing the above mentioned problems, they normally don't have chances to create their own music. We hope they could have an easy access, yet a new form of creating music and thus in a way express themselves.

We present TempoString, a novel tool which allows children to create their own music by simply pointing on a canvas with their fingers and editing music using a rope. This way, we transit music creation into painting, a metaphor which is much easier to manipulate. This tool addresses its ease of use and natural interaction, which may help cultivate children's interest in music.

The key feature of our tool is editing music with a rope. With force feedback, music is endowed with tangibility and thus users can feel it with their hands. Such feedback in turn makes it better for children to edit music and thus contributes to the development of cognition.

RELATED WORK
Recent years novel ways of creating music are emerging.

Researchers are focusing on utilizing interactive multitouch table for music creation, such as Scrapple [2] and reacTable [4]. Theses are mainly based on the combination of visual (drawing) and audio feedback. But it does have drawbacks: a) Multitouch tables are more sophisticated and customized devices; b) Limited space is available for operation. Apart from multitouch tables, motion-capture came up as a natural way of input [1]. However it's difficult to control. People have also made attempts to create music through painting like Singing Fingers [5] and Twinkle [6]. Our TempoString inherits ideas from them, but it is inexpensive and can expand the operation space as well.

As an everyday tool, rope has some unique features. In Rope Revolution, a gaming system which was presented by MIT, rope was used as an interactive input. It can be extended because its elasticity, and with forces it can be twisted and shaped. With the above mentioned features we see the potential of rope and therefore it can be utilized to create music with tangibility.

DESIGN AND IMPLEMENTATION
Our goal for design and implementation are as follows: a) Music can be created with simple input for the children's convenience; b) In order to help children understand basic editing operation, natural and direct input which comply with children's cognition are adopted. c) For the better implementation of children's music creation, rich music resources should be provided.

Hardware
Hardware includes the following components: a) A wooden palette with a RFID reader and a button built on Arduino platform. RFID reader is used to identify tags which represent different musical instruments, and the button is for switching between modes. b) An easel and a projected canvas as visual feedback; c) A Microsoft Kinect for hand tracking; d) And a projector behind the canvas.

Figure 1. Hardware Configuration.

Software

Software runs two modes: Creation Mode and Edit Mode. Before creation, a palette is used to select from six timbres: piano, guitar, bass, timpani, Kalimba, and Taiko Drum.

In Creation Mode, user points at the projected canvas with a finger. A bubble with random color emerges and enlarges at the tip of the finger. The longer the finger holds, the bigger the bubble becomes. Each bubble which represents a sound has a certain scale, and accordingly music is created in a time sequence. During the whole process, the music is recorded for replaying and editing.

In Edit Mode, the created music can be edited with a rope using its elastic deformation feature. User grabs the rope to select a bubble. By pulling the rope forward and backward, the music volume goes up and down. By heightening and lowering the rope, the music scale ascends and descends. While the music is playing, user can change any bubble by adjusting the position of the rope.

Scenario

User stands in front of TempoString and hold a palette with pieces of tags on it. Each tag represents a musical instrument. By putting the selected tag on a specific area of the palette, user can switch between instruments, and thus choose a timbre. Having selected the desired instrument, user then points his finger on the canvas. Every time he points, a bubble with random color emerges and continues to get bigger accompanied with a lasting sound. The existence of sound and the growth of bubble stop until finger leaving the canvas. In this way user continues his attempt and make multiple bubbles. This is the process of creating music.

After the creation, user presses the button on the palette to play the music. As a unique feature of our tool, user can manipulate the horizontal rope attached to the middle of the canvas to hear the changes of volume and scale timely.
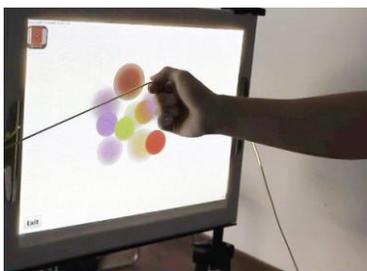

Figure 2. Rope Manipulation.

CONCLUSION AND DISCUSSION

We designed and implemented a novel tool which assists children to create music. At current stage, the tool TempoString is merely a prototype. A formal user study will be conducted in the near future. Through observation and data feedback, we will evaluate what musical features are best supported by each approach - pointing and rope. Simultaneously we will explore the possibility of implementing our system in other contexts and domains. Finally we will improve the system based on our findings. Currently, the system we developed permit single-user operation only. To share the joy of the whole creating process, co-location collaboration and remote collaboration could also be one of our future works.

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