
Graspable Music and *Vuzik*: Music Learning and Creativity using an Interactive Surface

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Abstract

This paper examines an approach to music education and exploration that we have called “graspable music,” whereby music is represented in a more tangible and permanent form that illustrates certain otherwise abstract musical concepts in a multisensory way. We describe one exploration of this approach in *Vuzik*, an interface we designed and implemented to allow children to compose music by painting using an interactive surface, and we present our findings from a preliminary

design critique of our current prototype.

Keywords

Tangible musical interfaces, music education, children, Surface Interaction, tangible user interfaces, sketch-based interaction.

Introduction

Making music is a valuable activity, and is especially enriching for a child’s cognitive development [1, 8]. However, due to the inherently abstract and often intangible nature of some of the concepts involved, understanding and especially creating meaningful music can be challenging, particularly for those who have not yet had extensive music education. The temporal nature of music is sometimes a barrier to visualizing, analyzing, and learning to compose music even for those who are musically educated. Yet we assert that these barriers must be overcome if we are to encourage children to move beyond being simply consumers of music to becoming creators who can express themselves musically in increasingly complex ways.

We motivate and discuss the design of interfaces that manifest abstract musical concepts in a concrete, multisensory form, allowing music to be explored interactively in a fashion disengaged from music’s temporal nature. We believe that such interfaces will

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allow children valuable exploration, learning, and creativity with music. Towards this end, we have designed and implemented *Vuzik*, an interface for composing music by painting on an interactive surface. Our paper presents *Vuzik* as an example of our pedagogic design philosophy, and discusses the current prototype and our preliminary design critique.

“Graspable Music”

We believe that if one could not only hear music, but also visually see or touch it, and furthermore freeze it in time and hold its representation in stasis for more prolonged contemplation, then one could gain greater understanding of its construction. This process is more accessible to those who have the necessary musical education to read and write music notation. Yet people of all levels of musical knowledge would benefit from understanding the structure of music, especially concert audiences and children seeking to understand and create it.

We argue for the design of musical interfaces that leverage a person’s existing understanding of basic concepts about the physical world. We believe that such interfaces could help build a usable understanding of music’s structure and could encourage more intuitive music exploration and creation, in similar reasoning to that posed as a case for Reality-Based Interaction [4]. The basic concepts of space, height, colour, shape, size, etcetera, learnt through early interactions with the physical world, can be used as a basis of understanding from which to build musical understanding. Mapping features of music to physical properties of objects that can also be experienced through a person’s non-auditory senses like sight and touch, can not only reinforce their concept of basic principles that govern the physical world, but may also make certain abstract aspects of

music more concrete and therefore more intuitive to manipulate. Likewise, relating musical features to certain kinesthetic actions may further embody musical understanding within existing familiar motor skills.

We believe that with the help of digital interfaces that emphasize such mental connections, people can conceptualize music more easily and approach music creation in an intuitive way. By giving music a lasting form that people can explore employing multiple senses, music can become more accessible and tangible, and therefore more intelligible. This forms the basis of a concept we call “Graspable Music,” where making the music more *sensorially* graspable makes it more *mentally* graspable. *Vuzik* is our attempt to explore this concept in practice.

Vuzik Interface

Towards this goal of fostering music understanding and creativity through tangibility, we created the *Vuzik* interface [7]. Named with reference to “viewable” music (and pronounced similarly to *music*), *Vuzik* allows a person to compose digital music graphically by full-scale painting gestures through an intuitive mapping of sound to visuals (see Figures 1,3) that effectively allows people to “see” their music as they hear it, using a vertical interactive surface, paintbrush, and icon palette (Figure 1). Use of an interactive surface provides direct freehand painting input of the sound with a tangible paintbrush (as well as alternate tools or possibly fingers), which additionally nurtures the connection of physical gestures to the resultant sound and visuals.

Vuzik employs an explicit mapping of visual elements to sound elements, such that the sound produced is consistently related to what is painted on the canvas (Figure 3). Our mapping principles are quite simple: the

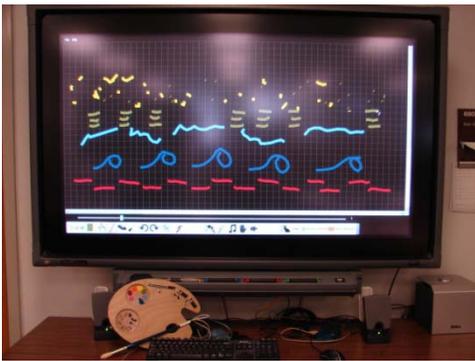


figure 1: *Vuzik* Interface.



figure 2: *Vuzik* icon palette and brush.

y-axis position corresponds to pitch; the x-axis length reflects rhythm on a time continuum running left to right; each colour is paired to a unique instrument timbre; and the thickness of the line reflects the loudness. The mapping underlying *Vuzik*'s design aims to leverage people's understanding of common physical concepts (e.g. height, size, space, length), in an attempt to be easily understood by various people, with specific attention to young learners. Additionally, in order to promote music learning and pave the way for future music education, the mapping choices are also consistent with the basic graphic principles employed in traditional music notation and certain metaphorical phrases commonly used by musicians, such as "tone colour," and "lengths of notes." This capability of *Vuzik* to simply and directly link sound to visuals lets people visualize the music they are creating and thereby more easily understand its construction.

Another integral part of *Vuzik*'s design is the use of tangibles to control the attributes of the sound. A person is able, without the use of onscreen menus, to control various interaction elements like dynamics and instrument color using only physical and tangible interfaces such as the *Vuzik* paintbrush and palette (Figure 2).

Although other interfaces exist that support composition of music graphically, such as *Hyperscore* [2], *Vuzik* approaches composition differently in terms of its use of freeform painting gestures and physicality, and its focus on the micro elements of music construction, such as timbre, layers of sound, and dynamics. Some aspects of *Vuzik*'s appearance may be mistaken with a sequencer, or with interfaces such as *The Music Animation Machine* [6]. However, *Vuzik* is fundamentally different from a sequencer by its freeform painting-style interaction,

freedom of expression, and greater integration of visual and sound elements, and unlike *The Music Animation Machine*, *Vuzik* is interactive.

Through these interactive elements of combined tangibles and visual-music metaphors, *Vuzik* attempts to offer children and other interested people a range of informative, engaging and fun mechanisms for composing music, hopefully inspiring increased understanding of music and a desire to explore further.

Design Critique

To help inform our design towards creating an enjoyable, meaningful, and creative musical experience for children, we performed a preliminary design critique with the help of four children, three girls and one boy respectively aged 4, 8, 10 and 11. After brief explanations of how *Vuzik* worked, all the children quickly figured out how to interact with the interface, and began exploring and creating in a concentrated, thoughtful manner (Figure 4-5). Although each child's interaction style was unique, all children continued to be engaged in creating for their entire 30-45 minute sessions. All the children explored many or all of the instrument colours, line thicknesses and other features for the impact on the sounds. Some of the children, especially the 4-year old, painted vigorously with the enjoyment of hearing the sounds resulting in real-time from their painting gestures, while others contemplated each stroke. It was particularly rewarding to observe how the children connected their physical gestures to the visuals and sound, such as when the 8-year old stretched up as high as she could to continue painting strokes with pitches that became increasingly higher.

The reference to a painting program initially seemed strong, and sometimes overpowered the sound aspects

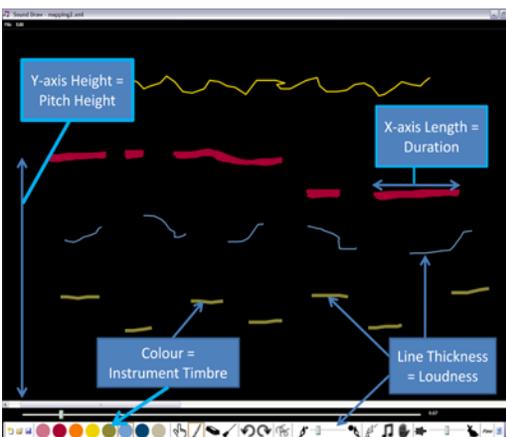


figure 3: *Vuzik* mapping of sound to visuals.

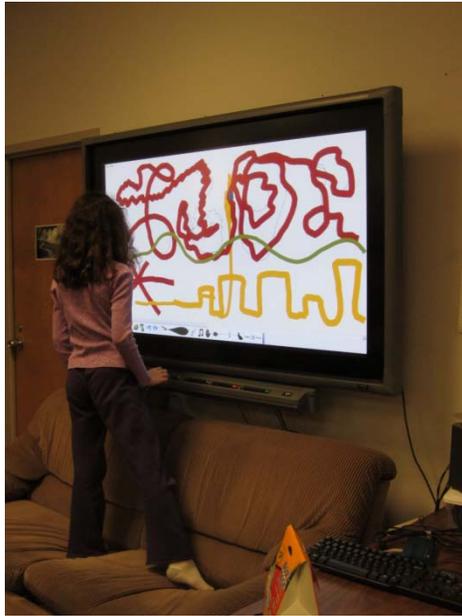


figure 4: Ten-year old interacting with *Vuzik*.



figure 5: Eight-year old interacting with *Vuzik*.

until children were shown the interface capabilities to make music. At minimum, the sound feedback to the children painting created increased enjoyment beyond a silent painting program, and promoted exploration of layers of strokes to experiment with the aural effect. As with other forms of composing, it became clear that the user would need some time to explore the interface and think about what type of sounds and music they would like to create over time before creating a piece of music. Overall, and although this was merely a preliminary evaluation, we felt that *Vuzik* demonstrated promise and strong potential to promote musical play and exploration, and in offering a basic mapping that was easy to figure out.

Future Work

We are planning to continue developing *Vuzik* towards providing more direct control over the expressive features of the music, such as the musical scale, and towards incorporating maximum gestural control of all visual and sound elements. A more formal study in a school classroom, that allows its "surface-trained" young learners more individual time with the interface, would also help us refine our design towards an enriching musical experience for children. In working with students and teachers in this fashion, we envision the value of freeplay sessions for exploratory learning, in addition to curriculum-based lessons designed to teach particular principles of music using *Vuzik* as an illustrative tool.

Conclusion

Music learning, creation, and exploration can be encouraged and strengthened by the use of interfaces that develop a connection, between modalities and abilities that are innate or formed through the use of our senses and gestures, and musical abstractions and concepts. Our approach of "graspable music," where musical

concepts become more mentally "graspable" through being more physically graspable, was explored in our design of the *Vuzik* prototype. Through *Vuzik* we would like to offer children an unencumbered way to create music that promotes greater understanding of the construction of music. Similarly, we hope to see the proliferation of interfaces like *Vuzik* that invite musical play, creativity and exploration through tangibility, thus making the pleasure and benefit of music available to all.

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