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# Vuzik: Music Visualization and Creation on an Interactive Surface

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## Abstract

*Vuzik* is an interface for creating computer music using painting gestures and graphical music representation on an interactive surface. We present the design and implementation of the current prototype of *Vuzik*, discuss the current ongoing user evaluation, and propose applications of the system in music education

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settings and computer music creation. We aspire for *Vuzik* to offer the creator and audience an alternative insight into music's construction, help make the composition of music more accessible to children and novices, and open up new ways to create and express musical ideas.

## Keywords

Graphic Music Composition, Music Creation, Music Comprehension, Music Education, Surface Interaction, Children, Tangible User interfaces, Sketch-Based Interaction.

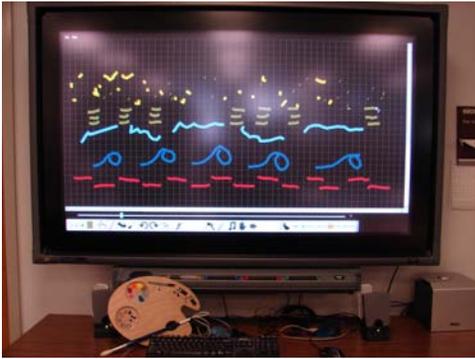
## ACM Classification Keywords

H.5.2 [**Information Interfaces and Presentation**]: User Interfaces – *Interaction Styles*.

H.5.5 [**Information Interfaces and Presentation**]: Sound and Music Computing – *Systems*.

J.5 [**Computer Applications**]: Arts and Humanities – *Music*.

K.3.1 [**Computers and Education**] Computer Uses in Education - *Computer Assisted Instruction (CAI)*.



**figure 1:** *Vuzik* Interface with palette and brush.

## Introduction

Throughout history, music's intelligibility has benefitted from the tangibility offered by multimodal renderings perceivable by sight and other senses beyond hearing. Visual representations of music such as traditional music notation, graphical scores [5], or musical inspired artwork [4] give this ephemeral medium a more permanent form through which to study, preserve, and recreate it [1]. Towards a goal of fostering music understanding and creativity through multisensory tangibility, we created the *Vuzik* interface (Figure 1) which is inspired by these past classic visualization efforts. *Vuzik* is an interface designed to empower people to make computer music using painting gestures and visual representations of music on a vertical interactive surface [8]. We designed *Vuzik* to be simple and playful enough for a child to use, yet also to have capabilities to afford meaningful, complex musical experiences for more experienced musicians. We hope that the *Vuzik* composing interface could open up new creative possibilities for composers and artists that would be engaging for the audience as well. This paper outlines our implementation efforts and describes the current prototype. We also present our ongoing evaluation of *Vuzik*, and outline our coming future efforts.

## Tangibility in Music

Making sense of the complexities of music can be elusive to 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. We believe that if one could not only visually see or touch music, but also freeze it in time and hold its representation in stasis for more prolonged

examination and contemplation, then one could gain greater understanding of its structure. The design of musical interfaces that leverage a person's existing understanding of basic concepts about the physical world would 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 [3]. 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 may 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. By giving music a lasting form that people can explore with multiple senses, music can become more accessible and tangible, and therefore more intelligible. *Vuzik* is our attempt to - explore this concept in practice.

## *Vuzik* Interface

Named with reference to "viewable" music (and pronounced similarly to *music*), *Vuzik* allows a person to compose computer music graphically by full-scale painting gestures through an mapping of sound to visuals (see Figure 3) that effectively allows people to "see" their music as they hear it, using a vertical interactive surface, paintbrush, and icon palette (Figure 2). 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. The brushstroke is the performance and creation



**figure 2:** *Vuzik* icon palette and brush.

gesture that is both seen (as an action and in creating a visual representation) and heard.

*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). In supporting freeform painting, each brushstroke is played back in the stroke direction in which it was created. Otherwise, our mapping principles are quite simple: the y-axis position corresponds to pitch; horizontal length corresponds to the time duration of the stroke; each colour is paired to a unique instrument timbre; and the thickness of the line reflects the loudness. A special remark should be made about time continuum: while the x-axis length of the brushstroke running from left to right represents its duration in time, the stroke plays back in the direction in which it was created, designed intentionally to capture some of the user's intention. Thus, a stroke is free to be vertical, overlapping or retrograde, but the playback duration of the entire stroke corresponds to the length of the stroke on the x-axis. In general, the mapping underlying *Vuzik's* design aims to leverage people's understanding of common physical concepts while maintaining consistency with most of the basic graphic principles employed in traditional music notation and certain metaphorical phrases commonly used by musicians, such as "tone colour." This capability of *Vuzik* to directly link sound to visuals lets people visualize the music they are creating.

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

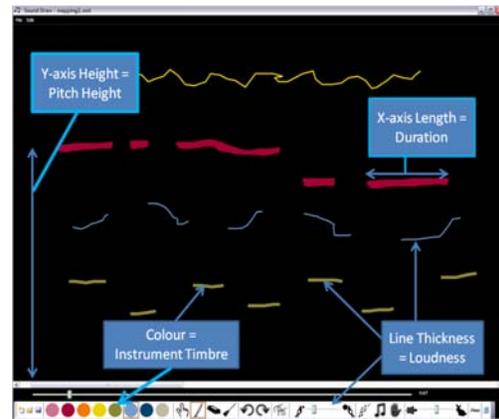
interfaces such as the *Vuzik* paintbrush and palette (Figure 2).

Although other interfaces exist that support composition of music graphically, such as the Making Music software [10] or 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 [7]. However, *Vuzik* is fundamentally different from a sequencer by its freeform painting-style interaction, importance of stroke direction, 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 people a range of informative, engaging and fun mechanisms for composing music, hopefully inspiring increased understanding of music and a desire to explore further.

### Proposed Applications

*Vuzik* was originally envisioned as a tool for children to explore music and sound, while still offering the capability for more advanced music composition. We propose that *Vuzik's* audio-visual integration and gestural input style invites child interaction and promotes understanding of some more abstract aspects of music. We also foresee the *Vuzik* system affording use as an illustrative tool for music educators in support of their curriculums.



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

Additionally, *Vuzik* can provide an alternative way to create and perform computer music for more experienced musicians. The creation of a dual-modality artwork of sound and visuals, and the gestural interaction style, could be engaging for both audiences and the creator in unique ways. Many possibilities exist for use of *Vuzik* in real-time composing in performance, collaboration with other instruments, or as a standalone system for presenting complete music compositions.

### Evaluation

We are currently undergoing a user evaluation with 16 or more school children of grades 4-6 for investigating *Vuzik's* ability to facilitate music composition for children (See figure 4). The evaluation incorporates a between-subjects comparison of *Vuzik* and *Hyperscore* with the goal of understanding the strengths and weaknesses of the former and how it compares or contrasts to similarly motivated interfaces. Over two sessions, subjects will learn the interface, explore example compositions, complete a composition which has beginning and ending provided, receive brief training in composition on the interface, complete a composition by adding melody to a provided accompaniment, and finally compose their own music.

In tandem, the authors with musical backgrounds are creating musical works with the *Vuzik* interface for insight into how it shapes or facilitates the composition process. More extensive exploration of how *Vuzik* affords music composition for musicians is ongoing.

### Future Work

In augmentation of the current ongoing user evaluation with children, we will endeavor to further inform our design of an effective music education tool by

consulting elementary school music teachers about the unique challenges and processes in their music classrooms and how *Vuzik* could support them. Such discussions could contribute towards the design of curriculum that incorporates *Vuzik*. In addition to further development and understanding of *Vuzik* as a music education tool, we intend to further validate *Vuzik* as a composition tool for musicians by creating and performing musical works with it. Such exploration will aim at discovering what type of composing and musical style is possible and idiomatic for the interface, how the interface could be used in performance either for real-time composition or as an instrument, and how its use could be collaborative or incorporate more than one musician or artist. In summary, our ongoing work will aim to determine the interface's unique capabilities, shortcomings, and strengths as applied to music education and composition.

### Conclusion

We have introduced *Vuzik* as an interface that combines music visualization with a painting interaction paradigm for exploring sound and creating music on an interactive surface. The marriage of visuals, sound, and gesture offers new expressive potential in music education and computer music composition. Our work in progress strives to determine the interface's affordances for these purposes and demonstrate the creative musical potential it promises.

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**figure 4:** *Vuzik* user evaluation in progress.

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