Singing Fingers: Fingerpainting with Sound

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ABSTRACT

Singing Fingers is a new system that allows children to fingerpaint with sound. You paint by touching a screen with a finger, but color only emerges if you make a sound at the same time. By touching the painting again, you can play back the sound. This creates a new level of accessibility for recording, playback and remixing of sound. We describe several ways in which Singing Fingers can be used, including music making, exploration of sound, and interactive storytelling.

Categories and Subject Descriptors

H.5.5 Sound and Music Computing (J.5), Systems

General Terms

Human Factors

Keywords

Audio, music, remix, touchscreen, multitouch, fingerpaint

INTRODUCTION

The art of scratching a record on a turntable brought a new, tactile way to directly manipulate sound to a whole generation of artists. Our current culture of digital remixing draws on turntablism for inspiration. New technologies like tape recorders and digital audio recorders also enable a larger group of people than ever before to record their own audio. What if both recording and remixing were made so simple they become accessible even to children? What if they were brought right to the tip of your finger?

Singing Fingers allows children to fingerpaint with sound. You paint by touching a screen with a finger, but color only emerges if you make a sound at the same time. By touching the painting again, you can play back the sound.

The color and texture of the digital paint are determined by properties of the sound: louder sounds make thicker lines, different pitches create different hues, and "brighter" sounds create lighter, less saturated colors.

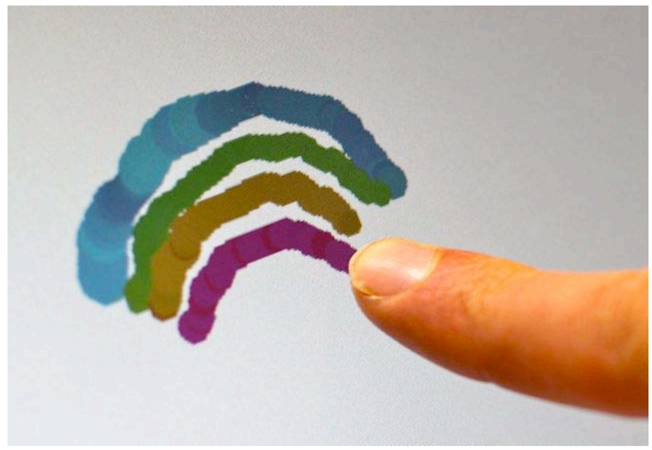

Figure 1. Playing a song by touching the rainbow

For example, you could whistle a steady note and draw a spiral with your finger, which might come out bright blue. By touching the blue spiral again, you can play the whistle back. Or you could sing "Somewhere over the rainbow" while drawing a rainbow, and then move your finger over the rainbow to hear the song again. By moving your finger backwards over the rainbow, you can listen to it in reverse.

Our goal in designing Singing Fingers is to create an interface that is both generative and simple. By generative we mean able to produce a wide variety of expressive outcomes. By simple we mean easy to learn and having a small number of elements. These properties are often in conflict in the design of software interfaces, with generativity coming at the cost of increased complexity, or simplicity coming at the cost of reduced generativity. Singing Fingers occupies a sweet spot of simplicity and generativity. The interface can be so simple because it draws on intuitive knowledge: people know how to fingerpaint, and they know how to make sounds. Fingerpainting and sound making are generative by themselves, so combining them is naturally generative.

A research goal for the Singing Fingers project is to explore the space of synaesthetic transformations. Synaesthetic transformations are mappings from one sensory modality to another (for example, the mapping in Singing Fingers from sound to color). By exploring these transformations, we hope that people will gain a new level of attention to and curiosity about these sensory modalities, exploring sound and color more deeply than before.

RELATED WORK

The I/O Brush project [1] is one of the main inspirations for Singing Fingers. It consists of a brush with a camera that allows you to pick up the colors and textures of objects in the world, and paint with them on a digital screen. Jabberstamp [2] is another direct inspiration. It allows you to embed sounds in hand-drawn pictures using a special stamp that can then play back a sound from that location. Golan Levin's Audiovisual Environment Suite [3] is also closely related. It is a set of painterly interfaces for creating animations and synthesized sound. For example, Warbo allows you to create animated compositions of glowing blobs, and then move a cursor over them to play synthesized musical sounds.

Singing Fingers combines some features of these related works. Like I/O Brush, it's about playing with properties of the world as a kind of palette, but Singing Fingers picks up sounds rather than visual textures. Like Jabberstamp, it embeds sounds in drawings, but it does so continuously rather than discretely, creating a direct link between the act of drawing and the recording of sound. Like Warbo, it allows you to paint and then play back your painting as sound, but in Singing Fingers the paint properties are controlled by audio input, and playing the painting uses the original audio.

TECHNOLOGY

Singing Fingers is currently implemented using the Processing programming language [4]. Signal processing algorithms estimate the sound's pitch, "brightness" and loudness. Pitch is roughly estimated using the peak bin of a frequency spectrum. "Brightness" is an estimate of the high frequency noise content in the sound, made by counting the number of times the signal crosses zero in a given window. Loudness is estimated using the scaled amplitude of the sound. Pitch, brightness and loudness are converted to hue, saturation and size of the line, respectively, as you draw it. The sound is played back using a granular synthesis algorithm, allowing smooth audio as you scrub over the sound at different speeds. A touch-screen computer allows singing fingers to be used with one finger; future versions will take advantage of multi-touch.

EXAMPLES

Music

Draw a musical instrument

By singing different pitches while drawing a set of shapes, you can draw a musical instrument of your own invention, and perform music on it. You could draw a piano with color-coded keys, a trombone with a working slide, or a drum set with different vocal percussion sounds.

Play chords

In the multi-touch version of singing fingers, you will be able to paint three or more separate notes and then play them back simultaneously as a chord.

Remix melodies

You can sing a melody while you draw a shape and then play it back in a different way by touching the notes in a new order. In this way you can transform the melody into a new one.

Figure 2. Playing the sound effects embedded in a scene.

Exploration and Sound Science

Explore properties of sounds

As you paint with different sounds, you see the properties of the paint change. This allows you to explore the relationship between the sound and the paint, testing out different vocal sounds, sounds from objects and sounds in the environment to see what type of paint they make.

Environmental exploration

You can experiment with environmental sounds, recording them and comparing them, and playing them at different speeds, backwards and forwards. This type of experimentation will be especially interesting on future mobile versions of Singing Fingers.

Stories

Embed sound effects in an image

A picture showing a garden could have sound effects embedded in it, so that when you touch the bee it buzzes, when you pet the cat it meows, and when you tickle the flowers they sneeze.

Embed narrative in a scene

You can draw a story using the words of the story themselves. You might draw three frames of a story about a caterpillar who transforms into a butterfly. As you draw each frame, you speak the words of the story, so that someone tracing the lines again will hear it being told. The pitch changes and pauses in speech will create colors and textures that affect the visual properties of the drawing in a unique way.

FUTURE WORK

In the future we hope to create a multi-touch version of Singing Fingers, so that you will be able to play multiple sounds at once. We are also hoping to implement Singing Fingers on one or more mobile platforms, so that it can go out in the world. We also hope to create a version that allows people to save and share their Singing Fingers compositions on the web. Further out, we may explore a full body version of the system.

We hope to perform studies of Singing Fingers with children of different ages in order to evaluate our design goals of generativity and simplicity. We also hope to interview and observe children in order to evaluate our research goal of helping them to explore their own perceptions.

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