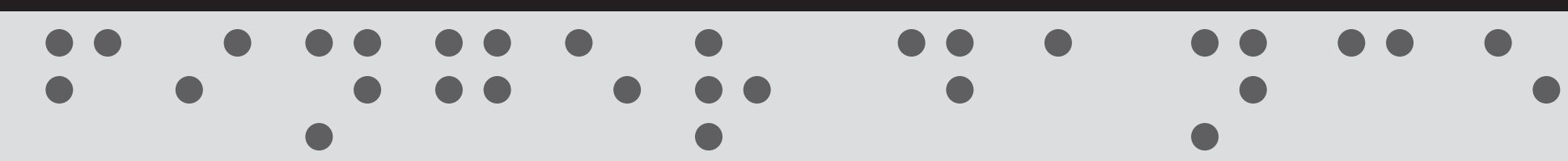


The Finger Dance Project

2007



developing musical games for the visually impaired



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Introduction

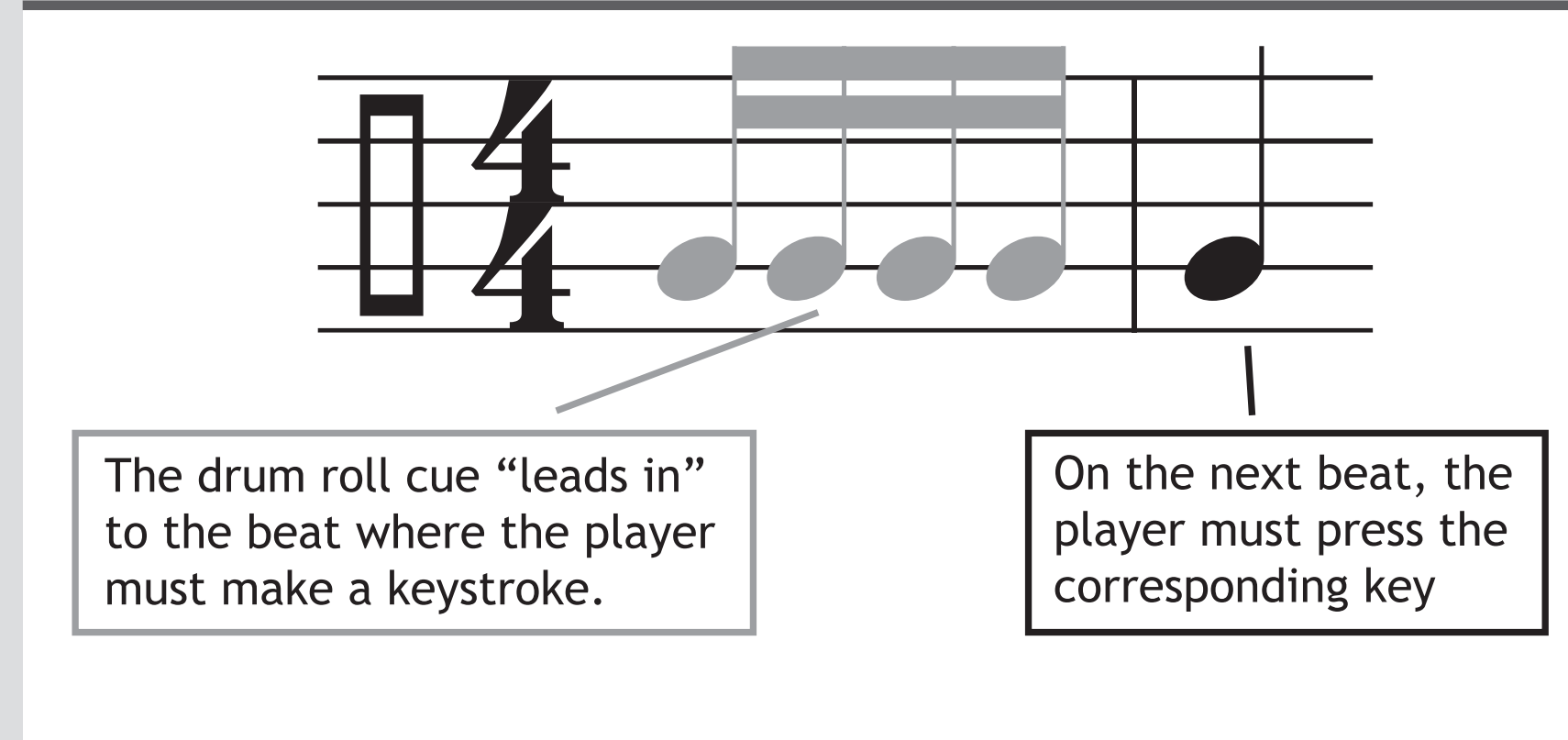
During the past two decades, video games have boomed into a multi-billion dollar industry. This growth has led to the use of new and diverse technologies that allow gamers richer experiences than ever before. However, much of this growth revolves around the use and development of powerful graphical engines that can support three-dimensional worlds and visually immersive games.

This trend has made it very difficult for video game developers to find accessible solutions to their products for gamers with visual disabilities. In fact, while a few developers are finding incentives to include accessibility features in their games, the extreme competition and market demand they face during their development cycle causes most to believe that these features would be too costly. This leaves visually impaired gamers with little to satisfy their appetite for social, recreational or educational computer games.

The usual approach to developing games for visually impaired people is sensory substitution. Elements of the visual display are replaced with auditory and/or haptic displays.

Our approach differs. The purpose of the Finger Dance project is to research and develop accessible solutions to games that are inherently audio-based: musical rhythm-action games. We believe that these types of games can provide a rich source of enjoyment to persons otherwise excluded from video gaming.

Figure 1



The Game

In Finger Dance, players listen to music, and match the rhythm with keystroke patterns in response to unexpected auditory cues. We also developed an audio-based menu, a scoring system, and a testing environment to study different types of auditory cues.

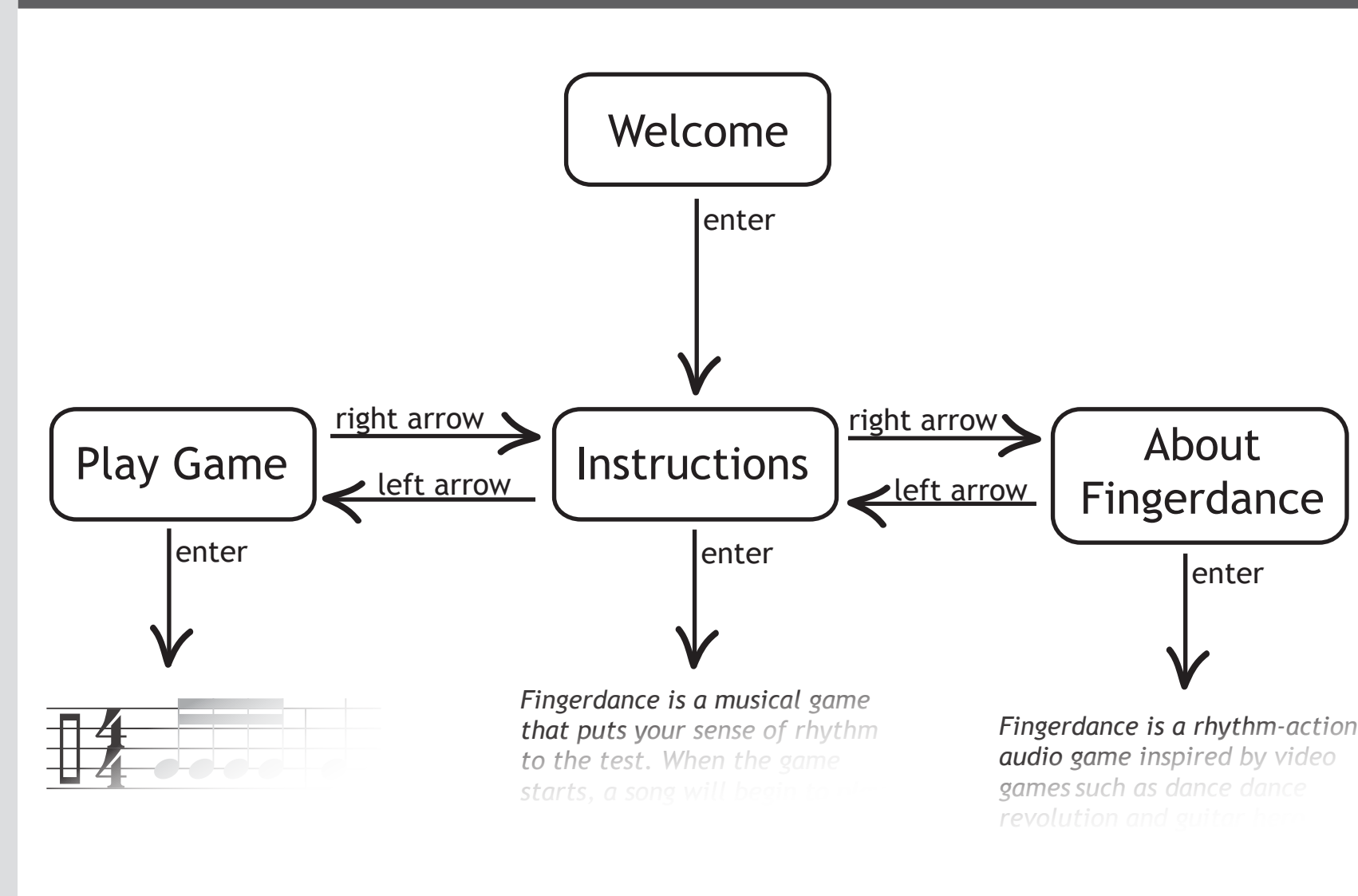
Drum rolls using MIDI percussive sounds define the cues. These drum rolls start playing one beat, half a beat, or a quarter of a beat before the player must make the keystroke. The drum roll will stop on the beat in which the player must make the keystroke.

Figure 1 shows two partial musical measures in 4/4 time. The player is required to make one keystroke on the first beat of the measure, after being given a lead-in of four sixteenth notes starting on the fourth beat of the previous measure. The grey notes represent the drum roll that acts as the cue for the player. In this example, the drum roll starts playing one beat before the time when the user must make a keystroke.

Menu System

The player uses the left and right arrow keys to browse menu options and the enter key for selection. A diagram of the menu system is given in figure 2. The menu were created to be fast to use and easy to understand. The design of the navigation scheme is based on other popular audio games, a guidelines document for accessible game development, and the ideas of several papers regarding accessible game development. To convey information to the user, the menu options are described using a synthesized voice developed by Cepstral LLC.

Figure 2



User Studies

Usability tests were conducted on a prototype of the software. Three sighted participants were videotaped using the menu system and playing the game. These tests showed the game's learning curve similar to other rhythm-action video games. Overall, participants found the game fun to play and challenging enough for repeated use.

We built a second prototype with better presentation of cues and an improved synthesized voice. We made the cue length constant rather than variable. Figures 3 and 4 illustrate the differences between the variable- and constant-length cue times.

We made both downloadable prototypes available from our web site, and announced availability on forum.audiogames.net. We requested that anyone playing the game answer seven questions about ease of learning and usability of instructions, menu and game, and whether they thought the game was fun. Finally, we asked about improvements.

We have received responses from three blind gamers. They all really liked the games and the concept. They found the menu navigation and instructions very easy. As we expected, they preferred the sounds on the first prototype, but found it much harder to play. They found the second prototype too easy. They have also made many helpful suggestions about the types of sound cues and how to make other versions of this type of game.

The Sounds

The games are designed similarly to other rhythm-action audio games such as Dance Dance Revolution and Guitar Hero. Players must listen to the music, and match keystroke patterns in rhythm with the song based on certain auditory cues.

In the first version (figure 3), the cues are defined by drum rolls, using midi percussive sounds. These drum rolls start playing one beat, half a beat, or a quarter of a beat before the player must make a keystroke. The drum roll will stop on the beat in which the player must make the keystroke. There are four different cue sounds, each with an associated key:

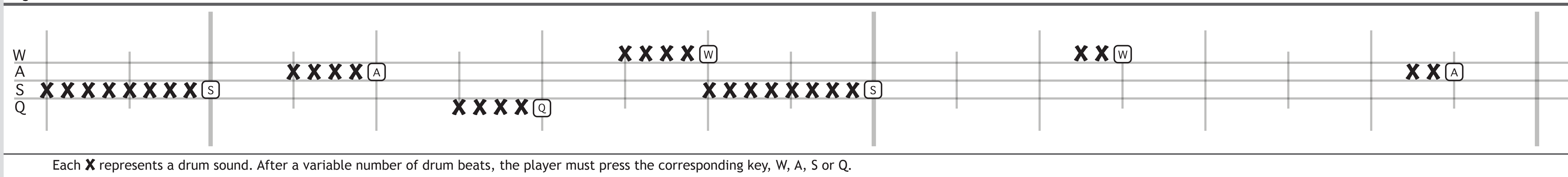
- Q: High pitched, left speaker
- A: Low pitched, left speaker
- W: High pitched, right speaker
- S: Low pitched, right speaker

In the second version (figure 4), the cues are represented by synthesized pitch-sliding sounds. These sounds start playing exactly one beat before the player must make a keystroke. There are four different cue sounds:

- Q: Left speaker, low to high slide
- A: Left speaker, high to low slide
- W: Right speaker, low to high slide
- S: Right speaker, high to low slide

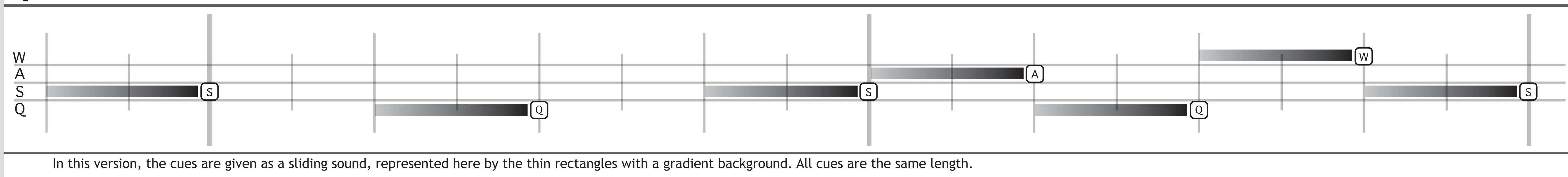
A correctly timed keystroke triggers a "clap" sound, while an incorrectly timed keystroke triggers an error sound.

Figure 3



Each X represents a drum sound. After a variable number of drum beats, the player must press the corresponding key, W, A, S or Q.

Figure 4



In this version, the cues are given as a sliding sound, represented here by the thin rectangles with a gradient background. All cues are the same length.

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