TapBeats: Accessible and Mobile Casual Gaming

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ABSTRACT
Conventional video games today rely on visual cues to drive user interaction, and as a result, there are few games for blind and low-vision people. To address this gap, we created an accessible and mobile casual game for Android called TapBeats, a musical rhythm game based on audio cues. In addition, we developed a gesture system that utilizes text-to-speech and haptic feedback to allow blind and low-vision users to interact with the game's menu screens using a mobile phone touchscreen. A graphical user interface is also included to encourage sighted users to play as well. Through this game, we aimed to explore how both blind and sighted users can share a common game experience.

Categories and Subject Descriptors
H.5.2 [**Information Interfaces and Presentation**]: User Interfaces – *input devices and strategies, voice I/O.*
K.8.0 [**Personal Computing**]: General – *games.*

General Terms
Design, Human Factors

Keywords
Accessibility, blind, low-vision, audio games, mobile games, haptics and gestures, user interfaces, user centered design

1. INTRODUCTION
With the video game market placing an increased emphasis on graphics, the visual aspects of games are becoming more and more important. As a result, blind and low-vision people are often excluded from video game play [3]. In order to address this gap, we applied user centered design to create an accessible and mobile casual game for Android called TapBeats[1].

Tapbeats is based on audio cues so that blind and low-vision people can be included in game play. A gameplay screen with four buttons placed in each corner of the touchscreen is employed in different ways to provide various types of gameplay. Each of these buttons emits a different instrument sound when pressed. Blind and low-vision users are also able to navigate through the game menus through the use of text-to-speech and haptic feedback. TapBeats also includes a graphical interface to encourage play by sighted users as well.

There have been several attempts to design and build video games that are accessible to blind users, such as Blind Hero [4] and AudiOdyssey [1]. Like these games, we aim to enable blind and low-vision people and sighted people to enjoy the same level and quality of gameplay, though by making TapBeats for a mobile device, players will be able to carry the game with them and play it whenever they want.

2. TAPBEATS

2.1 Menu Navigation and Accessibility
To give blind users the ability to interact with TapBeats via a mobile phone touchscreen, we developed a gesture system based on Slide Rule [2]. To explore menus and figure out the available options, the user can slide their finger around on the screen (Figure 1). As the user's finger touches a menu item, the phone will speak out the menu item name and generate a small vibration. Once the user hears the desired item, they can select it by double tapping anywhere on the screen. To return to a previous menu screen, the user can swipe with two fingers anywhere on the screen. The user can also use this gesture during gameplay to pause. Finally, if the user wants the game to speak out what menu screen they are currently on, they can double tap with two fingers.
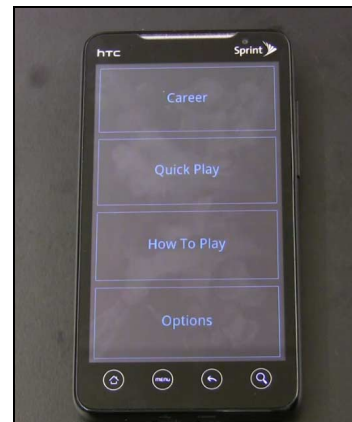

Figure 1. The TapBeats Main Menu

2.2 Gameplay
2.2.1 The Gameplay Screen
TapBeats contains various types of gameplay based on this same gameplay screen (Figure 2). Each button on the screen makes a different percussion instrument sound and correlates to one of the corners of the phone so that it is easily findable by touch.

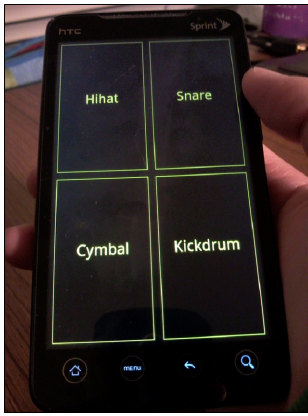---

[1] http://mobileaccessibility.cs.washington.edu/tapbeats/

Figure 1. The gameplay screen.

2.2.2 Quick Play

In Quick Play mode, the player can pick directly between the four different types of gameplay TapBeats offers: Free Play, Memory Mode, Concert Mode, and Studio Mode.

Based on a preliminary review of our application by a blind colleague, we found that it was important for blind users to be able to explore and develop a feel for how the gameplay worked. Therefore, we added Free Play, where users can press the instrument buttons without the added stress of being recorded or having to correctly mimic patterns given by the game.

In Memory Mode, the user plays a game of Simon. Over several rounds, the phone plays a growing pattern of drum sounds the user has to copy. The game continues until the player makes a mistake.

Concert Mode is like Memory Mode, except that the phone and the user play drum sounds to the beat of a background song the user can choose. The game will play a pattern of drum sounds along with the rhythm for one measure, and in the following measure, the player is to mimic that pattern; this continues until the song finishes and the player receives a score. Concert Mode includes audio feedback to help the user figure out how well they are doing.

In Studio Mode, the player can choose a song to "freestyle" to, without having to mimic any patterns given by the game. As the music plays, the game records the player-created song by turning on the phone's microphone, which listens to the phone's speaker. The player can add more to their song by singing or playing other instruments into the microphone. Once the recording is completed, the user can choose to save the recording to later playback.

2.2.3 Career Mode

In Career Mode, the player follows the story of a drummer whose dream is to become a rock star. Career mode integrates the various modes of Quick Play into stages in which the player must complete objectives. For example, the objective for a stage may be to hit a certain number of correct notes while playing a song in Concert Mode. The story progresses as the player completes more stages.

3. USER FEEDBACK

We informally presented a previous version of TapBeats to blind and low-vision students at the Washington State School for the Blind in order to receive feedback on how fun and easy to use they found the game. The following is a concise list of features that were included in the version of TapBeats presented in this work as a result of their feedback:

- Including a Career Mode to act as a tutorial

- Changing the "error" sound from a cowbell noise to something more synthetic

- Using a two-finger swipe as a back gesture rather than a single finger swipe (which could accidentally happen if the user was exploring the menu)

- Adding the two-finger double tap as a "Where Am I?" gesture

Overall, however, students seemed to enjoy the idea of TapBeats and were able to figure out how to play with some guidance.

4. FUTURE WORK

There are several future features planned for TapBeats. We wish to allow user-created content, such as custom songs playable in Concert Mode or custom instrument sets to replace the default drum set. We also plan to add several multiplayer aspects to the game, including a mode where several players can use different instruments to play as a band. Lastly, we plan to run a formal user study in which we evaluate the gameplay learning curve, the enjoyment level of players, and the usability of the TapBeats interface and gesture system. With feedback from blind users, we hope to make TapBeats truly accessible and fun.

TapBeats is not only spontaneous and easy to play due to its mobility, but is also a casual game that both blind and sighted people can play. Through this application, we aim to create a game that allows players to share the same game experience.

5. ACKNOWLEDGMENTS

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