Designing More Playful Music Experiences

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Abstract
We present the creation of a mobile music player accompanied with synchronised haptic feedback to create a novel method of audio playback on a mobile device. Our results show that users enjoyed the combination of audio and haptic feedback, mentioning that is was particularly novel and something they would like incorporated into their own mobile devices.

Keywords
Audio playback, Haptics, Mobile Interaction.

ACM Classification Keywords
H.5.2. [User Interfaces]: Haptic I/O.

General Terms
Design, Human Factors.

Introduction
Mobile devices equipped with haptic feedback have been around for a number of years now and provide specific alerts such as incoming calls and messages through a number of basic on/off vibration patterns. However, in recent years, developments in technology have allowed the creation and playback of more complex haptic feedback, making it possible to convey greater meaning through the tactile modality as well as making interactions more playful. Systems such as Immersion's VibeSystem and TouchSense SDK [5, 6] software make it possible to create a vast array of

different haptic effects that can be used for a variety of applications. For instance, they can be used to improve separation between alerts and notifications to make them more unique; provide a more immersive experience while navigating a user interface; and in enhance gaming and music applications by providing immersion through multiple modalities.

The increase in storage capabilities on mobile devices, allows users to carry their whole music collection with them wherever they go. There is some very interesting research into the use of haptics to enhance our connectedness to applications we are interacting with. This research has focused on the benefits that haptics can provide regarding usability [3] and as a method of eyes-free control [1, 4].

We hypothesized that if we built a music player that enabled users to select the next music track they wish to listen to using an eyes-free haptic method this would be a more enjoyable player to use than the native devices music player. We created a demo music application that would allow users to preview three different genres of music on a mobile phone. Each preview was accompanied by its own specially produced haptic feedback track that contained key musical elements such as rhythm, melody and tempo [7].

Design and Implementation

The phone used for development was the Samsung Behold II, running the TouchSense 3000 system on Android 1.5.

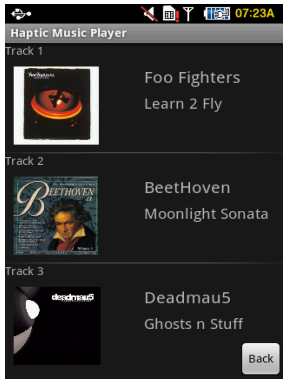

figure 1. Haptic Music Player

The haptic for each track was designed so as to highlight and signify various musical elements. We realised that it was important for each audio track to be from significantly different musical genres so that the haptic feedback could mimic particular elements more effectively. As a result, we selected one classical piece, modern rock piece and electronic dance piece being:

1. *Beethoven – Moonlight Sonata*
2. *The Foo Fighters – Learn to Fly*
3. *Deadmau5 – Ghosts n' Stuff*

The rhythm of piece 1, the melody of piece 2 and the tempo of piece 3 could each be converted to separate haptic feedback effects. These music choices also had varying dynamic ranges and audio intensities and allowed each haptic feedback to be tailored further to accompany the music.

Haptic Feedback During Audio Playback

Each of the music tracks were converted in 128kbps MP3 files cut to 30 seconds in length. In order to ensure the feedback for each audio track was as effective as possible, the intensity, period and ADSR

(Attack, Decay, Sustain, Release) values of each waveform were attentively manipulated. Typically, audio synthesizers utilise ADSR envelopes are used to control how a particular waveform develops over time once triggered. For instance, a slow attack would mean the haptic feedback would gradually fade in until reaching its peak amplitude. A short decay would mean the waveform would end abruptly. The TouchSense SDK uses a similar system for manipulation of haptic waveforms.

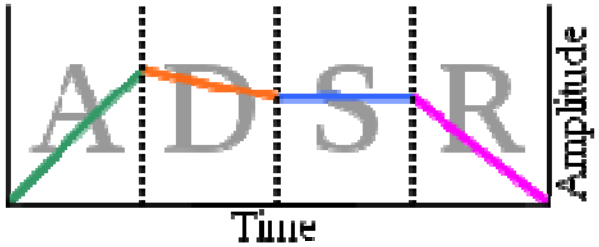

figure 2. A typical ADSR envelope for an audio waveform.

We undertook some pilot tests of the application with 3 users to determine whether the haptic feedback created was suitable and that it was representative haptically of the music it was accompanying. Some changes needed to be undertaken after these tests such as adjusting the position of some individual effects and altering their intensity.

Evaluation

We had three phases to our evaluation. Stage one of the evaluation featured a number of background questions that included personal information such as age, education level and a question asking users whether they had any previous experience of haptics on their mobile phones. A short introduction to the evaluation and a demo of a simple haptic effect was provided in order to ensure they understood what haptic feedback felt like. A task set in the form of a scenario was completed by each participant. The user could repeat the scenario as often as they liked. We used a counterbalanced within-subject design in which one set of users were asked to use the haptic preview player first and the other the devices native music player first. Once the scenario was complete users were asked to answer a number of short questions regarding their experience.

RESULTS

Overall 15 participants between the ages of 18 to 56 (average 26), completed the evaluation. During the testing a large number of users expressed a look of surprise when they first felt the haptic feedback. After the testing users were quick to state how much they enjoyed feeling the music as well as hearing it. This is also clear from a number of positive comments made about the music player app:

"Music player haptic effects are the best of them all. It's really awesome to feel the music in your hand". (User 14, Testing TUI, Sept 2010)

"Song playing with haptic was quite amazing". (User 3, Testing TUI, Sept 2010)

These responses show that an application with the ability to allow haptic accompaniment to audio could be beneficial to the users' experience of their music.

Mobile Devices Native Music Player Vs Haptic Music Player

We used the System usability scale (Brooke [2]) do assess the usability of our haptic player compared to the devices native music player. On all of the questions from 1-10 there was no statistically significant

differences between the players, for example question 7 asks the participant if they think that most people would learn to use the player quickly.

Q7. I would imagine that most people would learn to use this player very quickly.

It is an unsurprising result that most of the participants agreed or strongly agreed with this statement for both players. As the main focus for us was on enjoyment we added two additional questions to the standard scale:

Q11. I enjoyed the time I spent using the player.

Q12. I would recommend this player to my friends.

The result regarding enjoyment (Q11) produced a statistically significant result (p value of <0.001) this showed that a significant majority (e.g. 70%) of the users enjoyed using the haptic music player. Q12 asks about recommendation and again there was a statistically significant (p <0.005) result with only one user stating that they would not recommend the haptic music player to their friends. These results demonstrate that the users preferred the music player that had haptics compared to the devices own native music player.

Conclusion

In conclusion we created a method of interaction that allowed users to feel the music in order to help them select the music they wished to play. It is clear from the results that users who took part in our evaluation would appreciate the benefits that a music player with a haptic preview facility could provide.

An important caveat of this work is that the effects that were used during the project were done using the TouchSense 3000 system available at the time. There is now a newer Immersion touch sense 5000 tactile feedback system that uses Piezo Actuators. We believe that with the development of these types of systems the level of accuracy of haptic feedback could be increased considerably. Thus the findings in this paper lay some important ground work for further research into the effectiveness of haptics and musical cognition particularly for an enhanced user experience.

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