Meaningful Melodies - Personal Sonification of Text Messages for Mobile Devices

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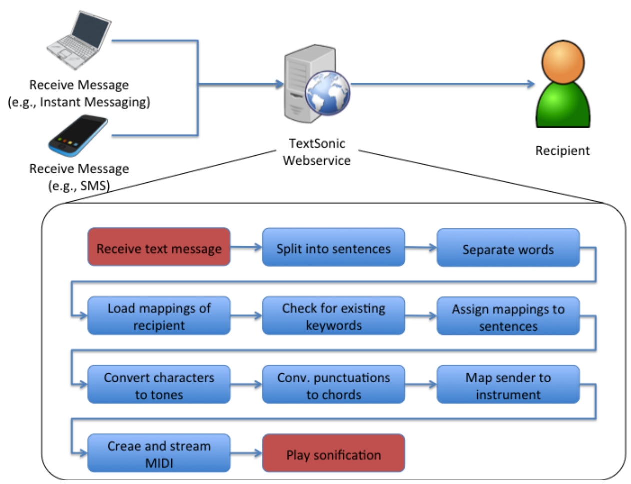

Figure 1: Sonification pipeline to convert text messages. Clip arts are provided under CC0 by openclipart.org.

MobileHCI'12, Sept. 21–24, 2012, San Francisco, CA, USA.
ACM 978-1-4503-1443-5/12/09.

Abstract
Mobile phones offer great potential for personalization. Besides apps and background images, ringtones are the major form of personalization. They are most often used to have a personal sound for incoming texts and calls. Furthermore, ringtones are used to identify the caller or sender of a message. In parts, this function is utilitarian (e.g., caller identification without looking at the phone) but it is also a form of self-expression (e.g., favorite tune as standard ringtone). We investigate how audio can be used to convey richer information. In this demo we show how sonifications of SMS can be used to encode information about the sender's identity as well as the content and intention of a message based on flexible, user-generated mappings. We present a platform that allows arbitrary mappings to be managed and apps to be connected in order to create a sonification of any message. Using a background app on Android, we show the utility of the approach for mobile devices.

Author Keywords
Sonification; text messages; rich audible information.

ACM Classification Keywords
H.5.2 [Information interfaces and presentation]: User Interfaces – Auditory (non-speech) feedback

Introduction

On mobile phones, ringtones have long since become a central feature for personalization. Ringtones are used both as a way of self-expression and to distinguish between different types of communication (e.g., calls, SMS). By assigning different ringtones to contacts, incoming messages can be easily linked to these contacts. Currently, ringtones are based on static audio files, such as sounds, songs, or personal recordings. Their expressiveness is limited and the playback cannot adapt to the context of a message. However, it has been shown that audio can convey richer information, including the exact content of a message. Also, more abstracted information can be communicated, e.g., whether a message contains a question.

In this demo we present an approach which allows client applications that deal with text messages to obtain a sonification for arbitrary text messages in order to convey additional information. Thus, not only expressive ringtones can be created, but users can benefit from that as they do not necessarily need to read the content of an incoming message immediately. To realize this idea, we present an approach which allows transforming a text string into a musical representation based on pre-defined mappings similar to the approach shown in [1]. This is done by encoding information about the message content, the message category, the intention, and the sender.

Interesting use cases for our approach are (1) personal devices such as mobile phones, which users carry with them throughout the day, (2) situations where users are engaged in multiple tasks (e.g., at work) to make them aware of important information in a non-obtrusive, yet understandable way, and (3) for users that want to personalize their devices as a form of self-expression while at the same time benefitting from additional information.

We present a platform which allows different mappings to be created and which enables clients to convert text strings into musical representations. We use the platform and an Android client to showcase the approach.

Related Work

The Morse code was one of the first character encoding systems that allowed information to be communicated in a non-verbal way. Recently, researchers looked into using non-speech audio to convey information, e.g., by sonifying numbers [10], data sets [9], or spatial information [7]. Different projects looked at how sonification could be used for messaging. Prior projects include instant messengers [2, 4, 6] and SMS clients [8].

In addition, so-called earcons in computer interfaces have been explored by Hankinson et al. [5]. Brewster studied the use of earcons and evaluated whether they provide effective means for communicating information [3].

Prior work has shown different ways to sonify data. In contrast, we shift the power to create sonifications to the user. We show, that even with little musical knowledge, sonifcations to convey information in an understandable way can be created. Furthermore, our platform allows arbitrary apps to create and use mappings for text data.

Key Idea and Concept

The aim of our idea is to increase the expressiveness of text messages (e.g., SMS, IM, and e-mails) by creating a sonification for each message. These sonifications are designed such that end users can extract information from a message without having to read it. This information includes the sender and the intention and mood/content of each sentence. In order to adapt the system to each user's needs, we enable user-defined configurations.

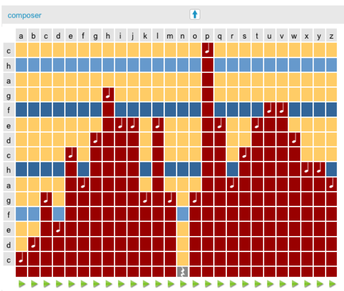

Figure 2: A composing tool allows to map tones to characters.

The sonification pipeline depicted in Figure 1 shows the process. To encode a message with a specific mapping, each single character is mapped to a note. In order to do this, the message is divided into sentences. For each sentence, the system tries to extract the mood/content of the sentence to select the sonification for this sentence. Punctuation within a message is used to encode its intention as chords. Instruments are used to encode the sender.

We opted to build our platform as a web service due to the following advantages: (1) The service can be integrated into different clients (e.g., SMS / e-mail / IM readers) with little effort. (2) Sonification configurations can be shared among different clients and users. (3) Composers and artists get the possibility to create and share (or sell) sound objects and sonification themes.

Tools and Platform

A web-based prototype makes the functionality easily available to a multitude of systems. The platform consists of a database which stores both mappings and user preferences, the program logic for creating sonifications, and an API for external access to sonifications. Additionally, the platform offers a composer for creating the mappings, and a web interface to manage user preferences and to choose sonifications. As a web service, this platform enables to share the same sonifications among all personal devices such as smart phones and PCs.

Composer: Creation of mappings

A composer, similar to [8], was used to create sonifications by mapping characters to notes. Figure 2 shows the interface: each column represents one character. The character can be assigned to one of the notes shown in the rows on the left representing a C major diatonic scale. By dragging the mouse, the assignment between characters and tones can be created. Besides this main task, a title, time, and a default instrument need to be defined. The system uses keyword spotting to identify the content/mood of a sentence. The first keyword found determines the mapping used for a sentence. Therefore, the author of a mapping can freely assign activation keywords.

Web Client for Personalization of the User Mapping

The web client serves to *manage the mappings*. In a first step, the user can select mappings for his account from all available mappings. In a later version, these mappings could, e.g., be bought for a fee. In a second step, the user defines the mappings he wants to activate. These mappings are then used to sonify an incoming message. One mapping serves as a so-called default mapping in cases where no keyword is found in a sentence. The user can also *assign instruments* to the mappings. This allows the sender to be encoded into the sonification. Currently, the user can select from a list of pre-defined instruments.

Sonification API

The platform provides a very simple API that can be used from any web-enabled device to encode messages. The requesting client sends an HTTP request which passes four parameters: username, password, message to be encoded, and the preferred response type. The platform instantly returns a MIDI file or a link to the midi file.

Mobile App

An Android background app has been developed to sonifiy incoming SMS. On receiving a new message, a Broadcast-Receiver extracts the incoming SMS and employs the web service to retrieve the server-generated sonification. Then the personalized, content-dependent sonification is played back on the phone.

Limitations
First, popular tunes are typical choices for ringtones. They are used to identify callers but at the same time are a statement of self-expression. With the use of mappings instead of pre-recorded songs the recognition effect of a song is lost. Second, the approach is limited to single character-to-tone mappings. For future versions we could support more complex forms of sonification. We deliberately used simple keyword spotting to detect the intention of a sentence as a proof of concept. There is a body of work that looks into text mining and text understanding – however this was not the center of our research but it should be considered for a real-world installation. Third, our current server-based generation of sonifications was implemented to facilitate sonifications for a multitude of systems. A future release might allow to generate local sonifications to preserve the users' privacy as no data needs to be sent to a server.

Conclusion
In this demo we showcase how senders and content of messages can be sonfied in an understandable way. The idea was implemented as a web based platform. To show the utility of the platform we implemented an Android app that runs in the background and provides sonification for incoming SMS. Thus, we hope to trigger a discussion on user uptake and identify further application domains.

Acknowledgements
This project is partly funded from the German Research Foundation within the Cluster of Excellence in Simulation Technology (EXC 310/1) at the University of Stuttgart.

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