

# Using Music Technology to Motivate Foreign Language Learning

Douglas Turnbull<sup>1</sup>

<sup>1</sup>*Department of Computer Science,  
Ithaca College, Ithaca, NY, USA  
dturnbull@ithaca.edu*

Chित्रalekha Gupta<sup>2,3</sup>, Dania Murad<sup>2</sup>, Michael Barone<sup>2</sup>, Ye Wang<sup>2</sup>

<sup>2</sup>*Department of Computer Science,  
<sup>3</sup>NUS Graduate School for Integrative Sciences and Engineering,  
National University of Singapore, Singapore  
wangye@comp.nus.edu.sg*

**Abstract**—Music is a fun and engaging form of entertainment and is often used by teachers to help students learn languages. In this paper, we describe how recent advances in music technology can be used to develop language learning applications that might help children, young adults, and adult learners grow their vocabularies, improve their pronunciation, and increase their cultural appreciation. We describe two apps that are under development: a karaoke app and a personalized radio app. Our goal is to provide teachers and students with new tools that are engaging, promote joyful learning, improve foreign language learning and mother tongue retention.

**Keywords**—Educational Technology; Mobile Applications; Music Information Retrieval; Language Learning

## I. INTRODUCTION

Music is a popular form of entertainment; many of us listen to music everyday and some of us enjoy singing or playing music on a regular basis. But music is more than a source of entertainment. For example, nursery rhymes are used with young children in order to help them *learn* their first language. Additionally, language teachers use music to help students improve their pronunciation and increase their vocabulary when learning a foreign language [1].

Music technologies are rapidly changing how we consume and engage with music. In particular, music streaming services such as Spotify<sup>1</sup> and YouTube<sup>2</sup> provide instant on-demand access to millions of music tracks to over a billion people from all around the world. Popular Karaoke apps like Smule's Sing!<sup>3</sup> and Tencents Quanmin K Ge,<sup>4</sup> provide a platform where millions of individuals can record and share their voices with others. Our work focuses on leveraging the popularity of these music technologies for foreign language learning. That is, we are interested in creating apps that help people learn a foreign language using two forms of music consumption to enhance acquisition and retention, *active singing* and *passive listening*.

In this paper, we describe a project called SLIONS (Singing and Listening to Improve Our Natural Speaking), consisting of two apps which are currently under development. The first app, *SLIONS Karaoke*, is a multi-language karaoke app in which one learns how to sing songs in foreign languages. The catalogue includes nursery

rhymes for children, popular songs for young adults, and classic hits for adult learners. Learning is enhanced by providing personalized feedback on singing pronunciation and giving the learner opportunities to practice and master difficult parts of the song. Our second app, *SLIONS Radio*, is a personalized internet radio player. The app lets users create customizable stations from favourite artists or genres, and then recommends foreign language songs that are acoustically or socially (i.e., based on social tags, collaborative filtering) similar. While listening, the visual interface shows both the lyrics, translation, and definitions of key words to help with vocabulary and comprehension. By listening to pleasurable music in a foreign language with translated lyrics, the user is exposed to the sounds, structure, vocabulary, and syntax.

Our hypothesis is that whether a user is *actively singing* or *passively listening* to foreign language music, the increased exposure to the language will help with pronunciation, vocabulary acquisition, retention, fluency, and cultural appreciation. We intend for these two apps to be used as tools to augment traditional classroom-oriented forms of foreign language education. We hope to make foreign language learning fun and engaging by leveraging the highly entertaining value of music. In the next section, we review the academic literature on the use of music for foreign language learning. We then describe our SLIONS apps, both in terms of the user experience and music technologies that we have been developing for this project. This includes measuring lyrical complexity [2], song intelligibility [3], singing-to-text transcription, and singer pronunciation [4]. We conclude with a description of our experimental design plans to test whether our SLIONS apps are able to improve foreign language learning as well as mother tongue retention.

## II. MUSIC AND FOREIGN LANGUAGE LEARNING

Research has shown that singing in a foreign language has clear benefits to foreign language learning [1], [5]. However, traditional classroom teachers are hard pressed to find the necessary time to listen and provide feedback to each student. This provides an opportunity for us to use novel singing-to-speech technology to automatically provide individualized feedback to students.

What is less clear from the research literature is whether passively listening to foreign language music is also beneficial. Intuitively, it seems natural that additional exposure to a foreign language would be beneficial especially if the

<sup>1</sup>[www.spotify.com](http://www.spotify.com)

<sup>2</sup>[www.youtube.com](http://www.youtube.com)

<sup>3</sup><https://www.smule.com/listen/sing-karaoke/8>

<sup>4</sup><http://kg.qq.com/>

student has easy access to learning resources such as lyric translations and word definitions. This open question is something we wish to address with this work.

#### A. Active Singing

Educators recommend singing as a fun and effective language learning aid. It has been observed that the use of songs and karaoke is helpful in teaching and improving pronunciation in adult second language (L2) classes [6]. Studies have shown that singing often leads to better imitation of phrases in the foreign language [7]. More recently, evidence from experimental psychology suggests that learning a new language through song helps improve vocabulary gain, memory recall, and pronunciation [5].

Given the potential of singing in pronunciation training, it is of interest to research automatic pronunciation evaluation for sung lyrics similar to work in computer-aided pronunciation training (CAPT) for speech [8]. Despite the differences between speech and singing, there is little work on mispronunciation detection for sung lyrics. Jha et al. attempted to build a system for evaluating vowels in singing [9]. However, they did not account for possible pronunciation error patterns in singing, and further, their work did not extend to consonants. Some subjective comparisons of pronunciation in singing versus speech show that the most frequent pronunciation errors by non-native singers singing English songs occur in the consonants [10].

In previous work, we studied the typical error patterns in singing pronunciation and incorporated these patterns into the state-of-the-art speech recognition systems to detect mispronunciations in singing [4]. We intend to integrate this technology with our SLIONS Karaoke app. Our previous work focused on the error patterns seen in South-East Asian accents such as Singapore, Malaysia, and Indonesia where the importance of speaking standard English has been recognized [11].

#### B. Passive Listening

Compared to the literature investigating active singing for foreign language acquisition, even less work has focused on the role that passive listening can play as a tool for learning. Passive consumption of other forms of media, such as watching television, has received relatively more attention and appears to improve foreign language acquisition; six-month olds watching educational television programs have increased vocabulary and expressive language skills over a 24-month period [12] than controls. More related to passive listening, watching same-language Bollywood music videos with subtitles improves reading and decoding skills in Indian adults [13]. Although tangentially related, research demonstrating language improvement from passively viewing of television programs with subtitling suggests that using media may be an effective supplement for learning and reinforcing language in traditional classrooms.

Passively listening to music may be appropriately simplistic for language learning exercises; a natural language processing analysis of English songs in the *Music and Media's* top-50 songs found that word rates tend to be around

half the speed of spoken utterances, contain high degree of repetition, and were at a fourth grade reading level [14]. Perhaps most relevant to SLIONS Radio, Beasley and Chuang [15], developed a browser-based online music listening experiment to determine if and how listening to music in another language improves acquisition and retention. Taiwanese ESL students were split into four listening conditions: song-only, song with lyrics, song with lyrics and definitions, and songs with lyrics, definitions, and explanations. They found significant vocabulary and literacy improvements in the songs with lyrics, and songs with lyrics and definitions groups. The authors suggest that passive listening requires some contextual information, but too much may overload a learner. Based on these findings, a passive listening music application appears to have positive effects on acquisition and learning, suggesting that it may be a useful motivator to supplement traditional language classes.

### III. MUSIC APPS FOR FOREIGN LANGUAGE LEARNING

In this section, we focus on our first app, SLIONS Karaoke, as well as briefly describe our second app, SLIONS Radio.

#### A. Active Learning with Karaoke

We are currently developing a karaoke app (see Figure 1) that is similar to popular commercial karaoke apps (e.g., Smule Sing!) but that is designed to help teach a foreign language. In particular, like many other engaging language learning apps (e.g., Duolingo<sup>5</sup>, Ed-Wonderland<sup>6</sup>), we make use of gamification to motivate students to practice and improve their foreign language singing skills.

The target age group for our app is young adults aged 13-25 years old who are currently enrolled in a foreign language course. In addition, our multi-language music corpus covers a number of genres (e.g. Tween, Pop, Rock, Hip-Hop) in order to appeal to a broad group of individuals with differing music tastes. Finally, our initial prototype is targeted to the population of Singapore, where the majority of individuals speak one of the four official languages: English, Mandarin, Malay and Tamil. Our app allows users to select any one of these languages as the native (L1) language and another as the foreign (L2) language. After selecting the languages, a user selects a genre and a difficulty level (e.g. easy, medium, hard). Our recent research on both lyrics complexity [2] and song intelligibility [3] helps us automatically categorize songs into difficulty levels. For example, a song containing many common and frequently repeated words would be rated as an easy song. The user then selects a specific track that he or she is interested in singing.

The user then listens to a short verse or chorus sung by a professional singer with a backing track. The user is able to see the current and the next lyric of the song, along with the translated version of each lyric in the native language.

<sup>5</sup><https://www.duolingo.com/>

<sup>6</sup><https://madewith.unity.com/profiles/alice-education-studio>

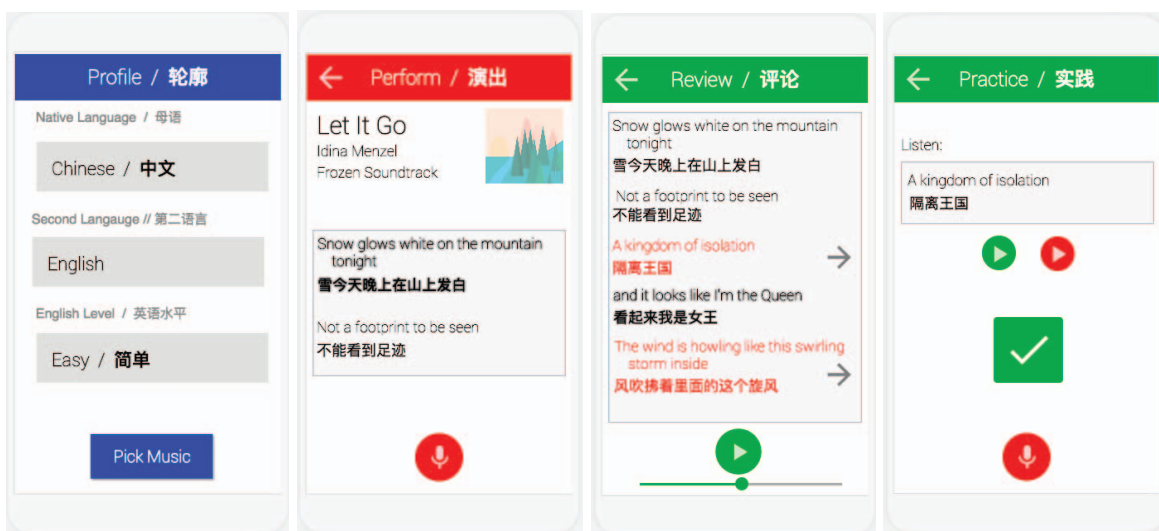


Figure 1: SLIONS Karaoke app: The user starts by selecting a native language, a foreign language, and a difficulty level (far left). After selecting the song (not shown), a user then learns and **performs** the song (middle left). The user receives a score based on the singing-to-text translation (not shown) and can **review** mistakes (middle right). The user can **practice** each difficult line until he or she has mastered it (far left).

The current lyric is highlighted to help them follow along. The user can play/pause the song as well as scan forward and backward in the song to learn it at his or her own pace. We also allow the user to click on individual words to see a definition. This is intended to help the user better understand the meaning of the lyrics as well as increase his or her vocabulary.

Once a user has learned the part of the song, he or she then records a karaoke performance. The app scrolls through the lyrics as the user sings. Our singing-to-text technology evaluates the user's voice line-by-line from a time-aligned lyrics file, and detects the words that were pronounced correctly or incorrectly by the user. After the recording is completed, the automated assessment is shown to the user on a feedback page where points are awarded (e.g., a three-star system) and the word accuracy percentage is displayed.

On the review page, the user can listen to the recording along with the lyrics, where correctly pronounced lines are highlighted in green and incorrect ones are highlighted in red. The user can select an incorrect line to practice and re-record. Each time they improve an incorrect pronunciation, the word accuracy score increases and the user is awarded with more performance stars. A user can also take mini vocabulary quizzes after a completed song to gain more points and stars. Once a user has successfully received enough stars, he or she unlocks additional songs and difficulty levels as is typical in many casual games (e.g., Angry Birds.<sup>7</sup>)

In addition to the student-facing karaoke app, we plan to design a dashboard for language teachers who might use this app in a classroom setting. This would allow a

teacher to monitor student progress as well as find songs that are popular with the students and as such, may be a good song for a classroom sing along.

#### B. Passive Learning with Personalized Radio

Based on the research, one might argue that active singing is more likely to improve foreign language learning than passive listening. However, there are many use cases when a user may not wish to or be able to sing out loud: a young adult during a commute via public transportation; a student studying in a library; an individual who simply does not enjoy singing. For these users we have also begun to develop a personalized radio app [16] that relies on passive listening and lyric translation. A user starts picking a seed artist or genre, a native language, and a foreign language. Our music recommendation algorithm then picks foreign language songs that are similar to the seed artists or match the preferred genre of the music. While the details of our cross-language music recommendation system are beyond the scope of this paper, our approach involves combining information from a variety of complementary sources of music information [17]. This includes metadata, social tags, preference information (i.e., collaborative filtering), and audio content analysis.

As with the SLIONS karaoke app, the user can read the foreign language lyrics, a translation of the lyrics into the user's native language, and definitions of individual words upon request. By listening to music, we expect that increased exposure to sounds and structure will help with foreign language phonetics and syntax. Similarly, through reading translations of the lyrics and word definitions, we expect a user to grow his or her knowledge of semantics and pragmatics [15]. Finally, discovering music that is (acoustically) similar to music that is already familiar to

<sup>7</sup><https://www.angrybirds.com/>

the user may provide a more welcoming introduction to the foreign music tradition.

#### IV. DISCUSSION

Our goal is to design apps that help students learn a foreign language. This includes addressing the problem of mother tongue retention, which is an important cultural issue in Singapore<sup>8</sup>. Furthermore, Singapore is an ideal test-bed for this application because it is a polyglot nation with four official languages.

To determine whether there is sufficient interest for these applications for this target audience, a preliminary survey of 55 students was conducted at a local junior college in Singapore. Results indicate that 27% of students are enrolled in mother tongue classes and 63% are interested in learning mother tongue languages. Unfortunately, 52% students found that the curriculum was monotonous or disengaging and 43% of students suggested that lack of vocabulary was the greatest difficulty they faced. The SLIONS Karaoke and Radio apps are specifically designed to alleviate these problems by providing engaging learning experiences with mother tongue music. In particular, the apps focus on expanding vocabulary and improving pronunciation through lyrics and singing.

Our next step is to test the efficacy of the SLIONS Karaoke and Radio apps with students in Singapore. We have a design and testing protocol that we plan to run in the coming months. Teachers will instruct their classes to supplement their language learning by using SLIONS Karaoke, SLIONS Radio, both, or neither. To determine whether the interventions significantly impact learning, language tests will be conducted at the beginning, middle, and end of semester. We expect that these apps may influence learning in different ways; to account for this, tests will include assessments of vocabulary, fluency, and functional application. Additional metrics extracted from the apps such as average time using the applications and consumption histories will also be utilized in analysis. We hypothesize that students using both applications should have the largest improvements in language learning when compared to the control group. We also expect that students who spend the most time using our applications will improve the most over the course of the semester.

Our future work will include working with teachers and students to improve our SLIONS apps. For example, we plan to design an assessment dashboard for teachers to monitor student progress. We also plan to refine our apps to make them more entertaining for a general audience. This includes better gamification, growing the music corpus, incorporating user generated content, and social network integration. Ultimately, we would like our apps to provide engaging language learning experiences for students regardless of expertise or background.

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<sup>8</sup>See: <http://www.bilingualism.sg/>

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