

## Introducing Computer Music in Mandarin Language Learning Software for Assisting Intonation to non-Mandarin Speakers

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**Abstract.** Mandarin Chinese is widely spoken in worldwide nowadays due to economic growth in mainland China, Taiwan, Singapore, Hong Kong or Macau. Therefore, it has attracted a large group of non-Mandarin speakers to comprehend the language regardless for business, education, politic and other purposes in the aforementioned countries. Nevertheless, non-Mandarin speakers might face difficulty learning the language particularly to differentiate the identified five different tones in Mandarin Chinese to convey different meanings in speech. In this paper, we are proposed to standardize the starting first tone of music note G, so that the differences between the pitches can be easily determined for the rest of the tonal sounds. Since four of the intonations in Mandarin provide different pitches of sound, the correlated music notes possibly can be mapped with the tones by introducing computer music with singing method to distinguish the tonal language when learning Mandarin Chinese from any Computer-Assisted Language Learning (CALL) available in the market. We have developed a singing method framework with the use of CALL software to assist the non-Chinese speakers or non-Musicians to learn the tonal language in more effective and interactive. It is fun for a person can sing and lean a mandarin at the same time. Based on our observation, the results are appearing to have educational benefit to the non-Chinese speakers. The framework proposed non-Chinese speaker or non-Musicians should learn the music note G (first tone) and the music note c (third tone) first. The fifth tone is also introduced to further strengthen the understanding of the tonal language.

**Keywords:** Computer-Assisted Language Learning, Computer Music, Intonation, Mandarin, Tonal Language.

### 1. Introduction

Chinese language consists of variety dialect including *Cantonese, Hokkien, Hakka, Mandarin, Fuchow, Teochew* and others. As a result, Standard Chinese is preferred as the lingua franca among Chinese speakers and the term is also known as interchangeably with *PutongHua* or *Mandarin*. It is the official language in People's Republic of China and Republic of China (Taiwan) [1]. In addition, it is widely spoken in Singapore and Malaysia and it is known as *HuaYu*. Due to the economic growth in China recently [15], Mandarin is increasingly becoming popular from other countries as to venture business opportunities in the country. As a consequence, communication is important particularly by using Mandarin when initiating business deals with the companies in the country. In general, Mandarin is derived from the northern dialect of China principally *Beijing dialect* that is furthermore popularly spoken in the central and southern China. To convey different meanings in Mandarin, each syllable has typically five different intonations from the tonal language to form different words. Based on Table 1, five different Chinese characters are selected as the example with the same syllable with different tonal sounds [6]. On the other hand, the writing system is standardized among

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different dialects and therefore Chinese characters are considered as logograms but generally it is also can be considered as ideograms [13]. Even though the writing grammars might differ from other Chinese dialects, most of them are able to communicate through writing as the Chinese characters are well standardized under the Qin Dynasty [12].

Table 1: Mandarin five tonal sounds with syllable “ma” as an example.

Chinese Characters	Pinyin	Tonal Sound	Meaning
妈/媽	mā	First highest tone	Mother
麻/麻	má	Second rising tone	Hemp
马/馬	mǎ	Third lowest tone	Stallion
骂/罵	mà	Fourth falling tone	Quarrel
吗/嗎	ma	Fifth neutral tone	Eh

## 2. Facts and Findings

There are two types of Chinese writing system that are currently used that are Simplified Chinese Characters as well as Traditional Chinese Characters. Referring to Table 1 (Chinese Characters), the character 妈 (mā) is the simplified Chinese Character where as 媽 is the Traditional Chinese character with the alternative writing system. Typically, some of the Computer-Assisted Language Learning (CALL) software offers dual writing system such as PowerWord (金山词霸, *jīnshān cíbà*) whereas some CALL software provides Simplified Chinese Characters such as MemChinese (学中文, *Xué zhōngwén*). Hence, CALL is technically is a field to research the computer applications for teaching and learning languages existed around the world [2]. With the existence of CALL, it is possible to enhance learners listening skills, writing skills, reading skills and speaking skills that are not limited to grammar, vocabulary and pronunciation [4]. Since Mandarin has five different pitches of tonal language, it has typically four tonal sounds with one as the neutral tone that can be associated with interjections that provide certain expression in speech or a sentence [6]. In that capacity, music notes do produce variety of pitches and it is possible to be mapped with the tonal language for learning the Mandarin language especially in speaking to differentiate the different tonal sounds in each syllable of the sentences.

### 2.1. Problem Formulation

There are researches conducted and found out that westerners especially with no musical background are facing difficulties determining the tonal sounds effectively compared to Chinese speakers and Musicians [8]. Since the tonal sounds are vital in Mandarin for each syllable in the sentence to convey the meaning, the westerners or non-Chinese speakers perceive the tonal language as same due to the fact that English sentences does less emphasize the pitch differences in each of the sentences [7]. The only tonal rising sound and falling sound is used in English when to determine only whether it is in a form of questions or answers. Apart from that, each breath is controlled to project different tonal sounds at each syllable when pronouncing in Mandarin. Whereas, the whole breath is used to control the pronunciation for the whole sentences with the pitch differences are less emphasized. Therefore, this is the main reason some of the learners unable to detect the differences.

### 2.2. Governing Equations

Beforehand, numerous researches had been conducted to extract pitch into musical notes from the sound waves denoted from equation (1) [11]. Thus, the music note with the associated pitch (sound) can be mapped with the frequencies (Table 2) based on the music note A 440Hz as the standard. With the emergence of Musical Instrument Digital Interface (MIDI), it is the industry-standard to map the pitches with the application of computers as from equation (2) [14].

$$\lambda = \frac{v}{f} \quad (1)$$

$$p = 69 + 12 \times \log_2 \left( \frac{f}{440 \text{ Hz}} \right) \quad (2)$$

Where  $v$  is phase velocity and  $f$  is frequency.

Table 2: Pitch and the associated frequency (Hz).

Music Note (Pitch)	Frequency (Hz)
A	220Hz
A#/Bb	233Hz
B	247Hz
C	262Hz
C#/Db	277Hz
D	294Hz
D#/Eb	311Hz
E	330Hz
F	349Hz
F#	370Hz
G	392Hz
G#	415Hz

### 2.3. Mapping Mandarin Tonal Language with Music Notes

Since Mandarin language is very melodic [10], it is possible to map the four tonal sounds into musical notes with the standardized pitches. With the exception of fifth sound as the neutral tone, it produces indefinite pitches that is not possible to be mapped into the musical notes. It is proposed to standardize the starting first tone as the music note G as most of the Chinese speaker falls into the range of frequencies although it can be higher or lower. With the proposed standard music note G as the first tone, the differences between the pitches are easily determined for the rest of the tonal sounds. Based on Figure 1, the music score is generated based on the music notes sequenced by Finale 2010, the score-writer software and it is also sequenced by Fruity Loops 9.0, a Digital Audio Workstation and the so called melody produced is similar with the four tonal sound in Mandarin. Referring again to Figure 1, the second tone is mapped with the music note D and glided (*portamento* effect) to the music note F as the rising second tone. While the third tone, it is associated with the music note C that is lower than the music note G and D in an octave. Lastly, it is known as the falling tone as the fourth tonal sound is associated with the music note B higher than the rest of the notes and it is glided down to the music note D.

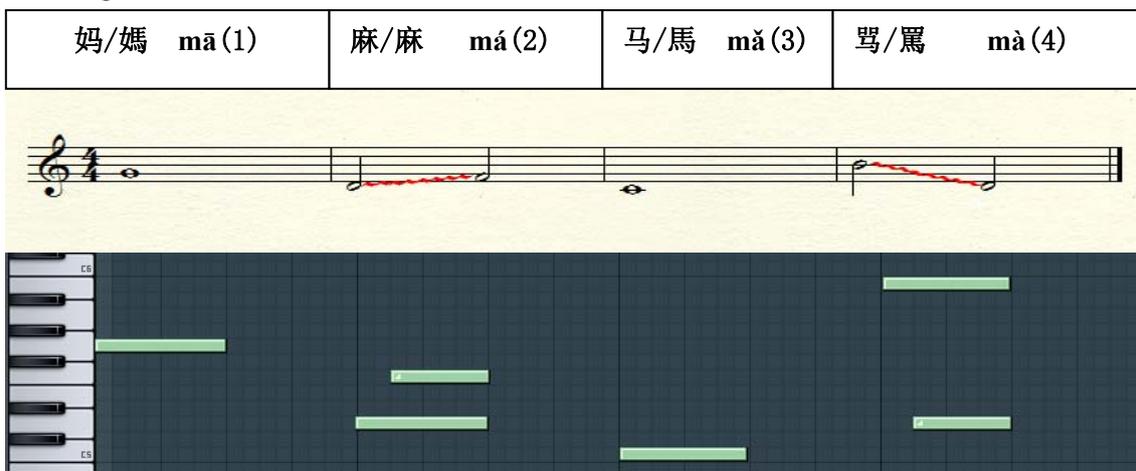


Fig. 1: The first tone can be mapped as the music note G, the second tone as the music note D rising note “*portamento*” to F, the third tone is the music note C and the fourth tone is the falling note “*portamento*” from music to note B to D.

### 3. Proposed Method/Framework

As most of the CALL software principally in Mandarin language learning, it focus more on writing, pronunciation, vocabulary and reading the ideograms without emphasizing the importance of tonal language in Mandarin the conveys different meanings in a sentence. Given that Mandarin is Melodious [10], introducing a singing method in any of the CALL software will definitely be advantages for non-Chinese speakers or Musicians to assist them differentiate the tonal language effectively and interactively [9]. Based on Figure 2, the proposed framework also suggests that with the speech recognition feature would be advantages to correct the pronunciation as well as the intonation from a singing passage from users [3]. Subsequently, the proposed standardized mapping of the tonal language is introduced and it is used as base to compose interactive songs to implement the singing method to assist the users to learn the Mandarin language.

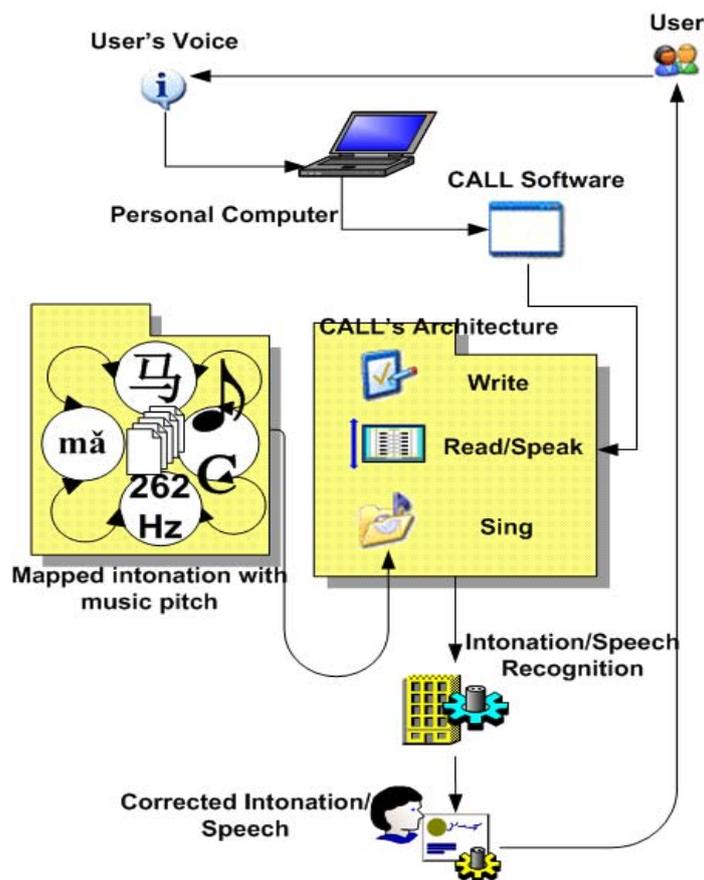


Fig. 2: Proposed framework to any generic mandarin CALL with the introduction of singing method.

#### 4. Discussion and Conclusion

Seeing that Mandarin is Melodious, it is an innovative method as an alternative to assist non-Chinese speakers or musicians to learn the Mandarin effectively. While pronounce each words in Mandarin, a wrong tonal pitch will result other listener unable to comprehend the sentences or might even worst if it is perceived as negative or vulgar sentences. Therefore, any CALL software should emphasize the learner to master the tonal language prior to read and pronounce the Mandarin words effectively. With the proposition of the standard music note G for the first tonal in Mandarin is not absolute as it is very subjective as each of us possess different voice quality. However, it understood based on our observation and as the Mandarin speakers is that the first tone in Mandarin resemble closely to the music note G (*So*). As for this, it is recommended as well to learn the music note G (first tone) and the music note C (third tone) first as it does not have the gliding sound between the notes such as rising second tone and falling fourth tone of the language. Since the fifth tone is the indefinite pitch with neutral tone, English interjections (Ah, Eh, Oh, Uh and etc.) can be introduced in the songs for the singing learning method to further strengthen the understanding of the tonal language to westerners or non-Chinese speakers and to non-Musicians.

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