The Design of Music Ear Training System in Building Mental Model with Image Stimulus Fading Strategy

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Abstract. The study provides effective insights into the difficult issues related to get acquainted with the skills of music ear training. The music ear training system with image stimulus fading strategy in this design could move learners beyond basic drill exercises to a competence from vision to hearing in the music ear training process. The abstract aural skills for the novice learners can be built up through the combination of practice and immediate feedback with image stimulus fading strategy. The stimulus fading is usually used as a significant support for the special education. The concept is not new, but it is effective for improving the quality of efforts to educate learners with difficulty in music ear training. The purposes of this article are to describe the context in hearing of music ear training which could be bridged from the assistance in vision. The findings can be utilized in the design of aural skills learning with additional visual features, especially related to human computer interaction and instruction purposes.

Keywords: Music ear training · Stimulus fading strategy · Aural skills

1 Introduction

Music ear training is one of the aural skills to get into the music realm that includes identifying pitch, intervals, chords and rhythm. The inherent abstract complexity of extraction in identification of hearing variations is hard for learners to comprehend and learn. The move to use technology to support learning has become an emerging development in the recent music pedagogy. Many learners in traditional ear training exercises have faced a big burden of getting bored of repetitive or frustrating practice to develop such listening skills. Although there are a lot of ear training programs and websites which provide a related but slightly different approach to music ear taring, learners frequently stumble upon their heads with the tone that is played after they have heard a cadence to establish a key intervals. The music ear training system adopting an image stimulus fading strategy in this study is designed as an easy way for the learners to build the mental model corresponding with exercises connected to the skills of ear training.

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1.1 Difficulty in Music Ear Training

Music ear training is a critical skill from intonation when singing or playing an instrument to playing and transcribing by ear. It is a means for anyone to learn to be immersed into the music area [49, 72, 80]. As the music ear training which is intended for auditory studies major is quite difficult from traditional learning by visual sense. The learners have to alter their learning sense from vision to listening. Therefore music ear training confronts the challenges throughout the auditory system with learners for listening far beyond sight reading in music [33, 34, 44, 63]. Auditory music domain represents a distinct world in which well-trained learners will exhibit better memory for any kinds of sounds than visual stimuli around [15, 61, 62, 71, 84]. It is hard to establish links to previous learning experiences for the novice learners [55, 64, 83]. That is the general difficulty which is encountered by learners in their aural training course. The novice learners who lack of aural skills and some aspects of music theory are not aware of what they are doing, but practice in a mechanical way during the music ear training course. Furthermore, they are also frustrated by not having enough time and confidence to practice correctly the content of the music ear training course. It seems challenging for all novice learners to stride across the barriers of aural skills learning to be part of music realm. Thus there is a need to help them learn the rules and adapt to the new setting.

1.2 Related Strategy for Music Ear Training

The perception during music ear training includes several processing stages in identifying pitch, intervals, chords and rhythm which are the essential elements into successful music world [5, 38, 43, 45, 65]. The mentally abstract structure of auditory perception for the learners has to be marked and distinguished with relationships in temporal and spatial constitution. There are many focuses on the scientific and technological themes in the notes and the imagery of the tones, as well as the role of web sites to help learners develop the ability from intonation when singing or playing an instrument to playing and transcribing by ear.

Drill and practice based on the learning theories is one of the instructional strategies that have been used in music education software design [8, 18, 22, 47, 69, 82]. Drill and practice is the foundation to the music ear training. The accuracy of the aural skills could be achieved through performing some sequence of activities repeatedly in order to acquire or polish a specific skill. The computer assisted technology could facilitate this self-practicing characteristic in the drill and practice strategy by means of self-controlled interaction. Learners therefore could be well motivated and encouraged to learn by themselves [12, 14, 37, 70].

Cascading Strategy. The traditional way to instruct music ear training for the novices is focused on developing the ability to hear music form looking at sheet music before it is played. The strategy used in the related websites or software starts with the basics in simple notes, intervals and scales and then upgrades the difficult or complex level as learner gets better after being identified by oneself or the system assessment. All of these skills move on to navigating a specific criterion fluently [16, 21, 28, 32, 60, 74]. Learners then learn how to get advanced their work on stuff that is either atonal or near

atonal. This procedure which proceeds often like the cascading style is so-called cascading strategy in this paper study. The process in cascading strategy will likely make learners in boringly learning time, and is often something interfering with their learning interests [19].

Melody Strategy. Humming a tune is really a natural way to help learners to develop the ability to overcome the trouble memorizing intervals in music ear training [4, 6, 40, 56, 77]. This melody strategy is implemented in a lot of websites and software design [25, 28, 42, 52, 75]. Once the learners hear the harmonic component of melodic sounds, the interval itself becomes much easier for them to do in isolation. After singing or playing for more than a few times, learners could see the music sheet, mark down the intervals, listen to them again and then remember what the intervals sound like. Therefore learners could tune their intonation from hearing the tonal center of the music and the harmonies.

2 The Music Ear Training System Design

2.1 Stimuli Fading Strategy

Stimulus fading is one technique to develop useful skills for learners [1, 17, 20, 48]. The strategy implemented in stimulus fading comprises gradual changes in stimulus intensity or amplitude (e.g., to "fade out" a prompt), in the shape or form of a controlling stimulus (e.g., morphing), or in the temporal relations between the onsets of prompts and target stimuli (e.g., progressive delayed cue procedures) [26, 30, 54, 66]. It is an effective and efficient way in terms of the behavioral principles that facilitate learning feedback from the skills practice [11, 36, 46, 67]. Strategical stimuli retreat during performing skills by the individual learner is the key successful mechanism for stimuli fading strategy [2, 27, 31, 39, 68].

2.2 Color Theory and Learning

Color is a ubiquitous perceptual stimulus which can enhance the user interaction mechanisms to be more intuitive and cognitive, and the user's involvement in the design of digital environment. It could attract user's attention to be involved in the application [3, 35, 57, 59]. Color itself is beyond the aesthetics, it also brings meaning for the human beings [23, 24, 51, 76, 81]. Learners' responses and emotions could be aroused as they are exposed to an environment with color [7, 10, 13, 41, 78]. Especially color red is associated with failure and evokes avoidance motivation in achievement situations. It has an exciting and stimulating hue effect [10, 41, 50, 53, 58, 73]. The color related researches show the effective potential for designing computer assisted tool in the learning environment to influence learner responses.

2.3 Architecture of Music Ear Training System

The music ear training system in this study, integrating the Microsoft Agent with Chinese Text-to-Speech Engine as a verbal tutor, is composed of piano drill engine

(Fig. 1) and ear training engine. The piano drill engine facilitates the learners in do-it-yourself to get acquainted with the sounds before advancing to ear training practice. The ear training engine provides single note and musical intervals practices which supports piano keyboards image fading in four phrases shown as Fig. 2. By applying the external stimulus fading strategy to the ear training engine, a picture of piano keyboards is presented separately in space from the practicing item, and the picture of piano keyboards is systematically and gradually faded out. Learners could thus build their own mental model from the piano keyboards fading process as the test sounds are played. Practicing listening skills in such a visual way can be useful, as it simplifies the challenge in recognizing the abstract sounds of pair notes or single note.

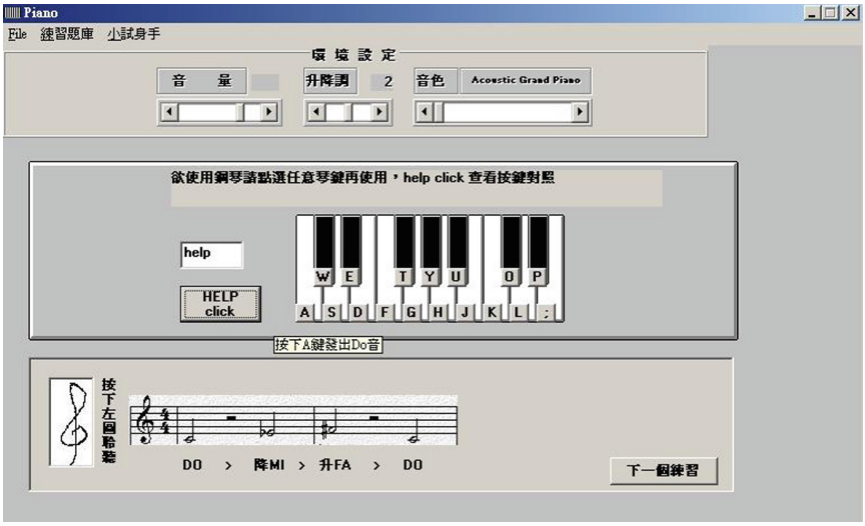

Fig. 1. Piano drill engine

3 Evaluation of Music Ear-Training System

The participants in the study consisted of 25 volunteers of senior high school students who have limited music background. The experiment involved the use of music ear training system integrated into the 8 weeks music interval instruction program. Participants were given pre and post-tests. The attitudes towards music were explored through online questionnaires.

A paired t-test was conducted to investigate the effects of ear training system with image stimulus fading strategy on interval recognition practices. The results showed a significant increase in scores from the pre to post-test ($t\ (24) = 2.831$, $p = .013$), indicating that the ear training system with image stimulus fading strategy could effectively achieve the learning goal of ear training. The questionnaires also showed that the learners agreed that the piano keyboards could help connect their mental model building after practicing with the piano drill engine.

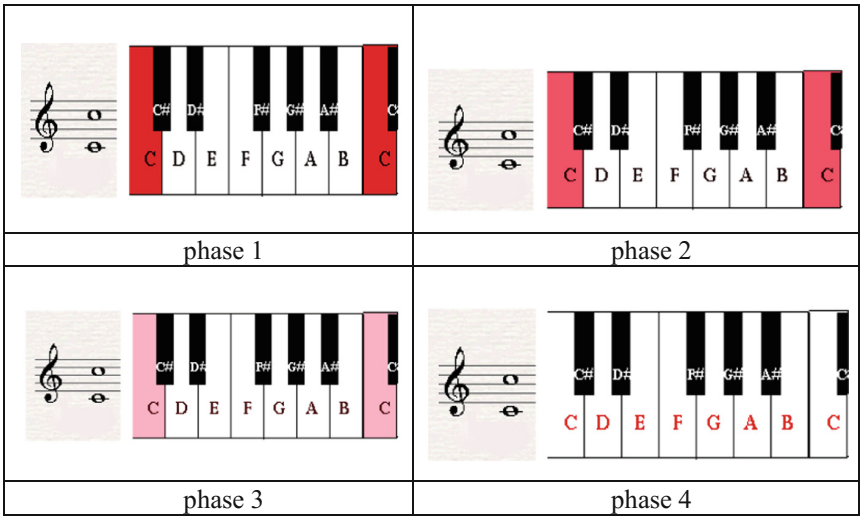

Fig. 2. Example of external stimulus fading

4 Conclusions

Ear training is a continual process of teaching your brain and ears to recognize elements in music. This does take time, and will require some persistence. The music ear training system with image stimulus fading strategy in this study could move learners beyond basic drill exercises to a competence from vision to hearing in the ear-training process. As much as this design intends that there is a way to get incredible ears to all.

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