

## 3D Guqin: Digital playground to explore music that embodies Chinese culture and philosophy

Eng Tat Khoo

Research & Development Department  
EON Reality Pte Ltd  
Singapore  
engtat@eonreality.com.sg

Roshan Lalintha Peiris

Mixed Reality Lab  
National University of Singapore  
Singapore  
roshan@mixedrealitylab.org

Matthias Rauterberg

Department of Industrial Design  
Eindhoven University of Technology  
Netherlands  
g.w.m.rauterberg@tue.nl

**Abstract**— This media art installation aims to digitally reconstruct a traditional Chinese Guqin string instrument using physical sensing techniques, to invite bodily interpretation of the classical instrument. Guqin has a unique place in the Chinese history, as a symbol of the high culture of the nobles and intellectuals (Junzi, Superior Man). It's also seen as the vessel for pursuing harmony. Guqin is sometimes referred to by the Chinese as "the father of Chinese music" or "the instrument of the sages". This work allows the performer and audience to experience three dimensions of the Chinese culture: sound, movement and emotion. The setup consists of an interactive instrument with "strings" created by laser light, designed to allow meaningful intervention of movements to trigger the sound. The movements of the dancer is analysed using a Kinect camera in the EON Interact software. The performer will also wear bend and pressure sensors at different parts of the body to create layer of sound effects. The emotion of the performer will be sensed by a heartbeat sensor, which in turn translates into the temperature actuation (heating and cooling) at the palm rest of the audience, so that they could feel the additional sensation of the performance.

**Keywords:** digital guqin, interactive performance, culture computing, EON Interact.

### I. INTRODUCTION

Guqin (shown in Figure 1), is perhaps the most revered instrument in China. However, not many people know what it is or seen and heard one being played. Evidently, Guqin music is an important part of Chinese traditional culture. Qin came first among the Four Arts (四藝) of the Chinese Scholar, namely Qin (Guqin), Qi (chess of Go), Shu (calligraphy), and Hua (painting). The great Chinese philosopher, Confucius, had also emphasized on the importance of music education. Confucius said, "To educate somebody, you should start from poems, emphasize on ceremonies, and finish with music."

Traditional Guqin music often has thematic, poetic or philosophical associations, and is often played solo. To play the Guqin is not only to play the instrument but a pursue of harmony with the nature. A famous Qin scholar once said, "Though the Qin player's body be in a gallery or in a hall, his mind should dwell with the forests and streams."

This installation aims to digitally reconstruct a traditional Chinese Guqin string instrument using physical sensing

techniques, to invite bodily interpretation of the classical instrument and it's association with traditional Chinese culture.

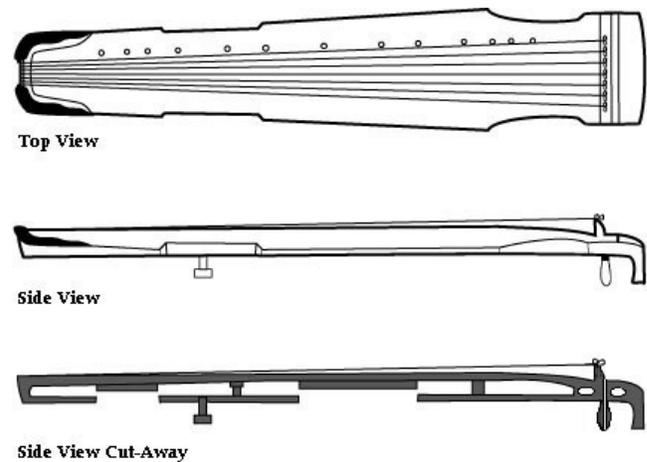


Figure 1. Zhong Ni Shi/Confucian style Guqin

### II. MOTIVATION

Research suggests that there is a strong relationship between music and body movements among the player and the audience. In particular, when listening to Guqin music, the movement of the audience is correlated with other audience, and with the shoulder movements of the Guqin player [2].

Researchers have also carried out detailed study of different gestures in Guqin playing [1]. Interestingly, besides oral transmission of Guqin playing knowledge from the master, there is a rich written information about Guqin tone quality and expression based on gestures, as described in the section *Gesture graphics* in the *Tai Yin Grand Collection* [4]. Figure 2 illustrates a technique called Nian: pinch a string between two fingers and lift the string. The right picture and the captions above and below it indicate which fingers to use, and how to execute this technique. The technical description is accompanied by a poetic evocation on the left, which shows a picture and a poetic description of how the gesture should be applied. The technical description

is to guide the hand to produce the tone, while the poetic aspect is to guide the player to achieve the right character of the tone.



Figure 2. Guqin hand gesture illustrations

For this installation, we aim to translate the Guqin hand gesture as described in the classical text to full body gesture, visualized by the dancer's movements. The relationship between gestures/movements and sound will be explored. Our research extends on the Eurythmy [3] concept of visualising language and music in a form of body movement. When performing Eurythmy with music (also called tone Eurythmy), elements of music for example melody, harmony and rhythm, are all expressed.

The movements coupled with sound would provide another dimension of performance to the audience. We would also like to extend the musical and cultural communication between dancer and the audience by letting them feel the emotion of the dancer through temperature actuation, on top of movement and sound.

### III. SYSTEM DESCRIPTION

The installation consists of an interactive instrument with "strings" created by laser light (Figure 3). The movements of the dancer is analysed using a Kinect camera in the EON Interact software. A Guqin VST virtual instrument is used to synthesize the sound, based on the movements of the dancer and the intersection with the laser lines. The performer will also wear bend and pressure sensors at different parts of the body to create different gestures with corresponding layer of Guqin sound expressions. Various arrangements of the laser network and body sensors are experimented to achieve the desired representation of the cultural aspect of this work.

The emotional state of the dancer is measured through the mounted heart rate monitor on her. The emotional states are then mapped to various temperature cues, which are fed as thermal stimuli to the users. We use Peltier elements as the thermal actuators, which are rapidly heated or cooled to the required state. A close loop control system monitors and

controls the temperature to be accurately controlled. To interact with this system the user places her hand into a black box, where the fingers will be rested on the Peltier elements. This multimodal interaction would craft a unique cultural experience to the user as she journeys through the performance.

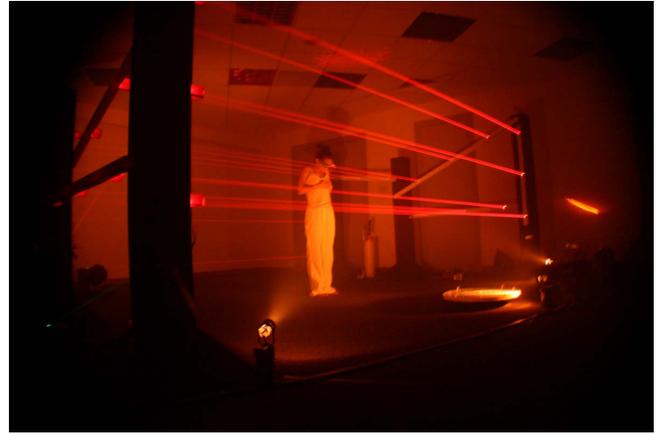


Figure 3. Virtual Guqin "strings" created using laser light.

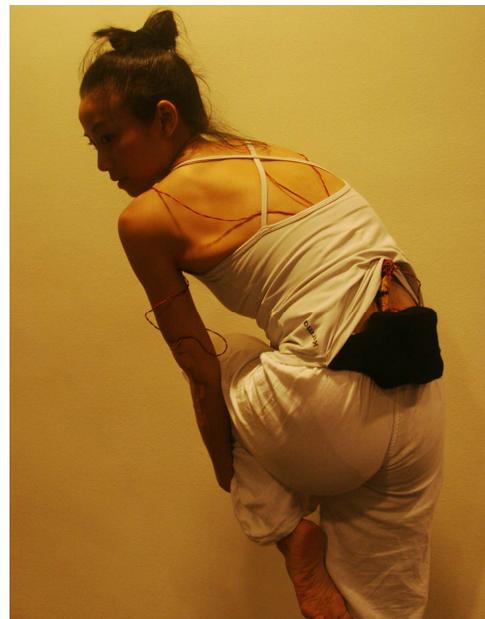


Figure 4. Dancer wears heart rate monitor, bend and pressure sensors.

- [1] Henbing, Li and Leman, Marc(2007) 'A Gesture-based Typology of Sliding-tones in Guqin Music', Journal of New Music Research, 36: 2, 61 - 82
- [2] Marc Leman, Frank Desmet, Frederik Styns, Leon Van Noorden and Dirk Moelants. Sharing Musical Expression Through Embodied Listening: A Case Study Based on Chinese Guqin Music. Music Perception: An Interdisciplinary Journal Vol. 26, No. 3 (February 2009), pp. 263-278
- [3] Steiner, R. 2008. Eurythmy Forms for Tone Eurythmy. Steinerbooks.
- [4] Yuan, Junzhe (Ed.) (before 1413). Tai Yin Grand Collection. Version printed in 1521 - 1567. See in Corpus of qin repertoires, published by Zhong Hua Books Co. (1981).