



HAL
open science

Towards constructing a historically-grounded gesture-timbre space of Guqin playing techniques

Han Han, Cixian Lu

► **To cite this version:**

Han Han, Cixian Lu. Towards constructing a historically-grounded gesture-timbre space of Guqin playing techniques. *Timbre 2023*, 3rd International Conference on Timbre, Thessaloniki, Greece, Jul 2023, Thessalokini, Greece. hal-04460843

HAL Id: hal-04460843

<https://hal.science/hal-04460843>

Submitted on 15 Feb 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

Towards constructing a historically-grounded gesture-timbre space of Guqin playing techniques

Han Han*, Cixian Lu+

*Laboratoire des Sciences du Numérique de Nantes (LS2N) han.han@ls2n.fr

+University of Minnesota, School of Music

Funds and support

Introduction:

Guqin is an ancient (~3000 yo) Chinese zither instrument known for its **timbral variability**. Most of its playing techniques were developed no later than Ming Dynasty (14-16 century). Numerous ancient text dating back to the 900s have provided guidelines for gestures of defined Guqin playing techniques and recommendations on timbre aesthetics.

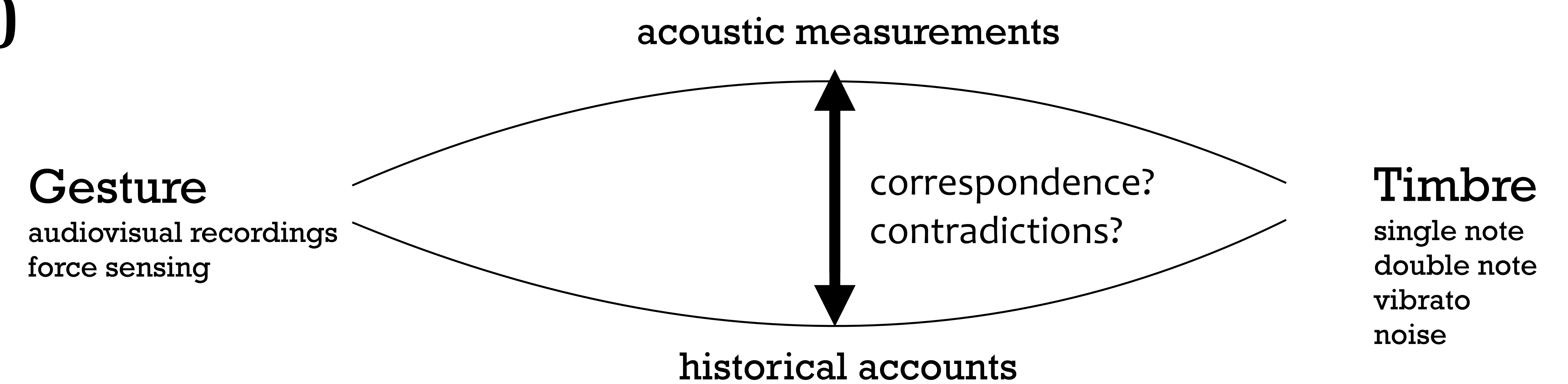
Nevertheless, a large part of Guqin pedagogies is **metaphoric**, mind instead of body-centered, and include **limited justifications** on recommended gestures.

Objective:

This work attempts to **digitize and concretize** the sonic implications in Guqin gesture-timbre writings, and variegate within the vocabulary of playing techniques by designing and recording a **dataset of isolated, short representative Guqin timbres labeled by gestural data**.

The Text: <Tangchenzhuo zhifa> 唐陈拙指法 (est 860~900)

- Chen Zhuo 陈拙 (Late Tang dynasty: mid 9th century)
- Include technical (hand control and tone production) and expressivity (aesthetics of tone) instructions 【诀, 法, 用】, on three fundamental elements of qin playing 【指, 声, 韵】: finger, sound, resonance

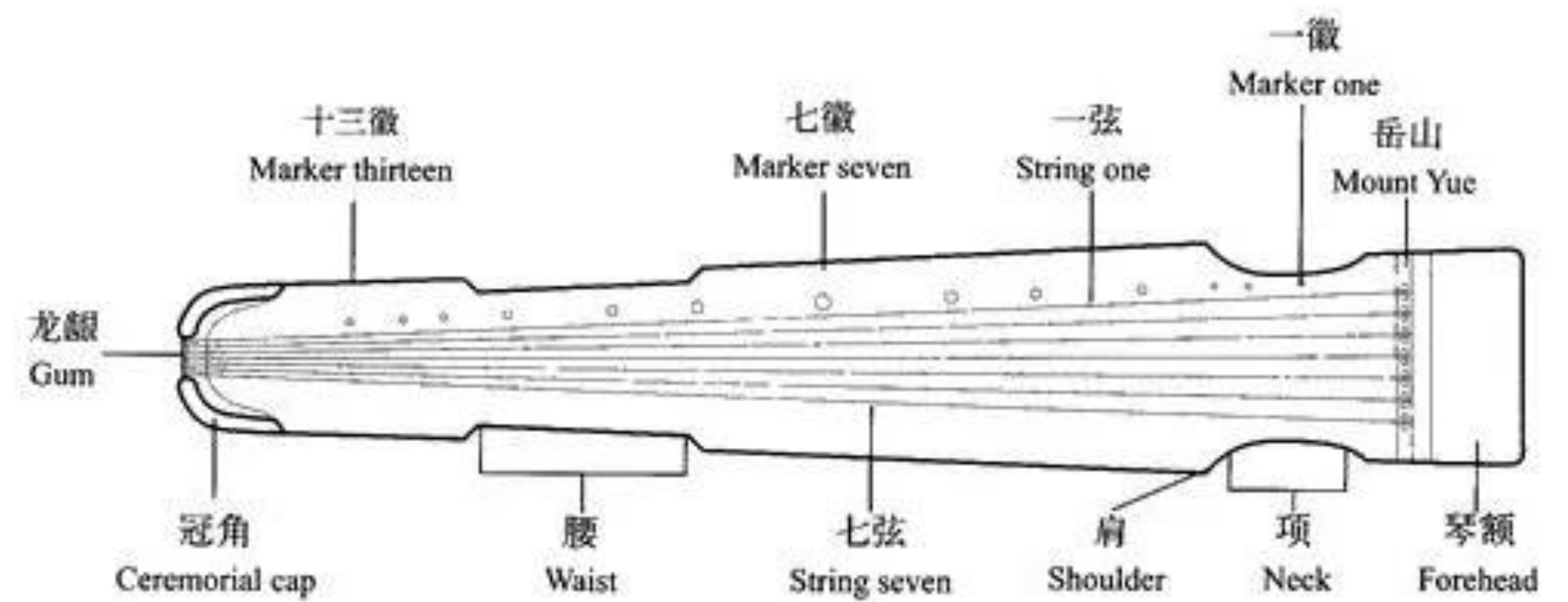


Case Studies:

How do the gestural degrees of freedom identified for each case affect the resulting timbres?

Acoustics-oriented techniques:

- **Single note open string**
 - 指分远近轻重徐急: "For short sounds the finger is positioned on the surface, passing lightly over the string, the attack light and sudden; For long sounds, the finger slowly approaches from far away, goes deep into the string and attacks violently"
 - 声分刚柔: "The outward plucking corresponds to firm sounds - clear and far-reaching; the inward plucking corresponds to soft sounds - harmonious and unctuous"
- **Single note harmonics**
 - 徽正则鸣, 徽差则塞: "Sound rings only if finger strikes at precisely the markings, otherwise it will be dampen and stuffy."
- **Double note**
 - How do the two notes fuse under different modes of attacks?



Context-dependent techniques:

- **Vibrato and portamento**
 - **Resonance:** how do force and timing of lefthand movement affect the modification of resonance
 - **Noise:**
 - noise from nails (right hand attack)
 - noise from flesh (left hand portamento/vibrato)

Feature extraction:

- **Gestural:** fingers, attack positions, direction, inferred force, left/right hand timing coordination
- **Timbral:**
 - **Partials distribution moments:** centroid, skewness, kurtosis
 - **Spectrotemporal modulations:** Joint time-frequency scattering Transform (JTFS)
 - **Noise:** Noise-to-harmonics ratio
 - **Deep embeddings:** openl3

Gesture-Timbre Space:

- **Multidimensionality scaling:** Isomap, TSNE, PCA
- Future: gesture-conditioned timbre synthesis

\ Gestural DoF	Right hand				Left hand					
	position	finger	direction	excitation mode	position	point of contact	amplitude	frequency	force	timing
single note	1. ~9cm from Mountain Yue 2. marker 1 3. marker 2-3 4. marker 4 5. marker 5-6	1. thumb 2. index 3. middle 4. ring	1. inward 2. outward	1. basic pluck 2. flick 掣 3. slap 提 4. knock 敲						
single note harmonics										
double note					selected chords (octave, fifth, tritone, second)	1. open 2. pressed 3. harmonics 4. open+harmonics 5. open + pressed 6. pressed + harmonics				
vibrato / portamento					selected start and end positions	1. between flesh and nail 2. finger belly 3. knuckle				

References:

- YOU, L.-Y. (2017). *Facture et jeu de la cithare chinoise qin sous la dynastie des Tang*. Université Paris Sorbonne.
- Penttinen, H., Pakarinen, J., Välimäki, V., Laurson, M., Li, H.B. & Leman, M. (2006). Model-based sound synthesis of the guqin. *The Journal of the Acoustical Society of America*.
- Jiang, K., & Yao, B. (2009). *Tang Dai Chen Zhuo Lun Guqin Zhi Fa* 唐代陈拙论古琴指法
- Henbing, L., & Leman, M. (2007). A Gesture-based Typology of Sliding-tones in Guqin Music. *Journal of New Music Research*, 36(2), 61-82.