



HAL
open science

Historical and Contemporary Non-Occidental Long-Neck Lutes: Relationships between Making Strategies and Musical Aesthetic

Henri Boutin, Sandie Le Conte, Farrokh Vahabzadeh, Philippe Bruguère

► **To cite this version:**

Henri Boutin, Sandie Le Conte, Farrokh Vahabzadeh, Philippe Bruguère. Historical and Contemporary Non-Occidental Long-Neck Lutes: Relationships between Making Strategies and Musical Aesthetic. 3rd Annual Conference COST FP1302 WoodMusICK, Sep 2016, Barcelona, France. pp.31-35, 10.3926/wm2016 . hal-03583416

HAL Id: hal-03583416

<https://hal.science/hal-03583416>

Submitted on 21 Feb 2022

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.

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/310452993>

Historical and Contemporary Non-Occidental Long-Neck Lutes: Relationships between Making Strategies and Musical Aesthetic

Conference Paper · September 2016

DOI: 10.3926/wm2016

CITATIONS

2

READS

268

4 authors:



Henri Boutin
Sorbonne Université

35 PUBLICATIONS 139 CITATIONS

[SEE PROFILE](#)



Farrokh Vahabzadeh
Université Côte d'Azur

19 PUBLICATIONS 11 CITATIONS

[SEE PROFILE](#)



Sandie le conte
Institut national du patrimoine

48 PUBLICATIONS 110 CITATIONS

[SEE PROFILE](#)



Philippe Bruguere
Cité de la musique / musée de la musique

15 PUBLICATIONS 9 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Farémi "Faire parler les instruments de musique du patrimoine" [View project](#)



Building a facsimile of an Érard grand piano of 1802 [View project](#)

Making wooden musical instruments

An integration of different forms of knowledge

Proceedings

Editors: Marco A. Pérez & Sandie Le Conte

3rd Annual Conference
COST FP1302 WoodMusICK

Museu de la Música de Barcelona
September 7-9, 2016



3rd Annual Conference
COST FP1302 WoodMusICK

**Making Wooden Musical Instruments - An Integration of Different
Forms of Knowledge**

Museu de la Música de Barcelona
September 7-9, 2016

Proceedings

Editors: Marco A. Pérez & Sandie Le Conte

Organized by:



In Collaboration with:



All rights reserved (including those of translation into other languages). No part of this book may be reproduced in any form -by photoprinting, microfilm, or any other means- nor transmitted or translated into a machine language without written permission from the publishers. Registered names, trademarks, etc. used in this book, even when not specifically marked as such, are not to be considered unprotected by law.

© 2016 FPS COST WoodMusICK

ISBN: 978-84-945603-3-0

DOI: <http://dx.doi.org/10.3926/wm2016>

Printing and Binding: OmniaScience (Omnia Publisher SL) · www.omniascience.com

Cover Design: M.A. Pérez. Antonio Torres guitar fretboard

Printed in Barcelona

COST (European Cooperation in Science and Technology) is a pan-European intergovernmental framework. Its mission is to enable break-through scientific and technological developments leading to new concepts and products and thereby contribute to strengthening Europe's research and innovation capacities. It allows researchers, engineers and scholars to jointly develop their own ideas and take new initiatives across all fields of science and technology, while promoting multi- and interdisciplinary approaches. COST aims at fostering a better integration of less research intensive countries to the knowledge hubs of the European Research Area. The COST Association, an International not-for-profit Association under Belgian Law, integrates all management, governing and administrative functions necessary for the operation of the framework. The COST Association has currently 36 Member Countries.

www.cost.eu



COST is supported by the
EU Framework Programme
Horizon 2020

Historical and Contemporary Non-Occidental Long-Neck Lutes: Relationships between Making Strategies and Musical Aesthetic

Henri Boutin¹, Farrokh Vahabzadeh^{2,3}, Sandie Le Conte³, Philippe Bruguière³

¹ CNRS, USR 3224, Laboratoire du Musée de la Musique, France

² MNHN, Department of Eco-Anthropology and Ethnobiology, France

³ Chair GeAcMus, Sorbonne Universités, France

Abstract

The Musée du Quai Branly in Paris keeps a large collection of non-occidental long-neck lutes, showing a variety of geometry and wood species, due to different making strategies. Some of them have been scarcely documented and present missing parts or pieces. Most of them are not in playing conditions. 14 instruments of this collection have been selected as well as 5 contemporary instruments. Their dimensions and their vibration are compared and analysed. This study reveals that longer instruments have larger soundboards. However, their first resonance frequency, due to the coupling between body and air vibration in the sound box, is not necessarily lower. In addition, specific making techniques may have been adapted to longer lutes, so that they can support higher string tension.

1. Introduction

The different musical traditions in Asia, especially those concerning long-neck lute family in Iran and Central Asia differentiate themselves by their repertoire, playing techniques, musical systematics, but also and very strongly by the choice that they make in manufacturing of instruments. The article presents the results of an interdisciplinary collaboration between acousticians on the one hand and ethnomusicologists on the other hand. This study focuses on the organology of this family of instruments and its relation with a traditional aesthetics. While investigating simultaneously historical and contemporary instruments, this study provides both a diachronic perspective and a synchronic perspective, which are complementary.

The corpus of musical instruments shows a large variety of dimensions as shown in Fig.1. In order to establish relationships between their making characteristics and their vibration, two sets of measurements are introduced: one concerns the dimensions of the body, the other focuses on the instruments vibrations.

2. Materials and methods

This experimental study concerns a corpus of 19 non-occidental long-neck lutes originating from an area that extends from Turkey in the West, Uzbekistan in the North to Kashmir and Jammu in the East. The 14 instruments, that are part of the collection of Musée du Quai Branly in Paris, date back from the last century, and are called "historical instruments". They are all provided with metal strings, except two made of

silk and gut. Most of these lutes are not in playing conditions because the bridge is missing, the soundboard, the sound box or the neck is cracked.

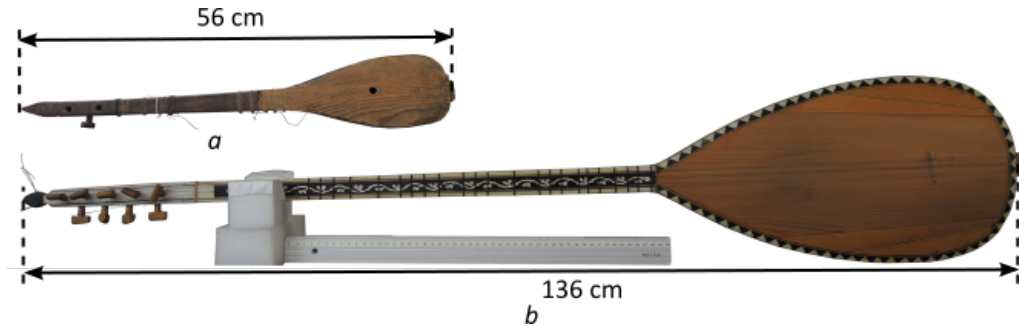


Figure 1: Shortest and longest lutes of the corpus, from collection of Musée du Quai Branly: a- non documented (ref. 71.1937.0.417) b-Turkish Saz (ref. 71.1975.104).

Among the five contemporary instruments, four have two strings, made of metal (one dotār from East Khorāssān and one Turkmen tamdera), silk (one Tajik-Uzbek dotār) and nylon (one Tajik dombra). The last one is a setār from Iran, with four metal strings. They are all regularly played. In order to group the lutes into categories, their dimensions and vibrations are investigated.

For each instrument, the distance from nut to bridge, equal to the maximum string vibrating length and called L_{vib} , is measured, as well as the length l_{sb} , width w_{sb} of the soundboard and depth of the body: d_{sb} .

In order to investigate the vibration of the instruments, three impacts are applied to the back of the sound box, at the furthest point from the soundboard using an impact hammer (Dytran, CA, USA) and their force is recorded via an acquisition card. A sensor located near the treble foot of the bridge measures the acceleration normal to the soundboard. For each impact, the ratio between the acceleration and force Fourier transforms, subsequently called inertance spectrum, is calculated with a frequency resolution of 0.6 Hz. Then, for each instrument, the three inertance spectra, corresponding to the three impacts, are averaged. In addition, the sound radiated from the instrument body is recorded by a microphone, placed 3 cm away from the bridge, perpendicularly to the soundboard plan. Figure 2 shows the average inertance and sound spectra recorded on an Azerbaijani lute from collection of Musée du Quai Branly (ref. 70.2008.28.2).

3. Results

3.1 Geometry analysis

For each instrument, the dimensions of the sound box are compared to the maximum string vibrating length. Because the shapes of instruments' bodies have complex geometries, as shown in Fig.1, the sound box volume is not readily calculated. For reasons of simplification, it is estimated by an effective volume, subsequently called V_{eff} , equal to the product $l_{sb} \times w_{sb} \times d_{sb}$, cf. Fig.3.

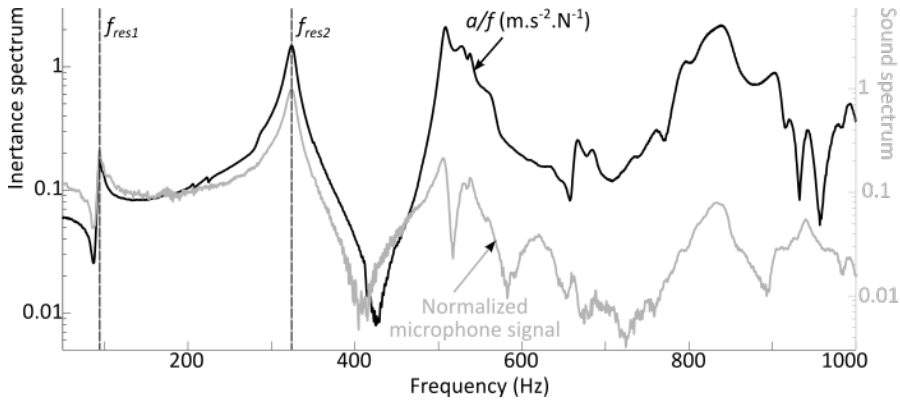


Figure 2: Inertance spectrum (black) and sound spectrum (grey) measured on an Azerbaijani Lute from collection of Musée du Quai Branly. The vertical dashed lines show that the frequencies of the first two peaks in the sound spectrum coincide with peak frequencies in the inertance spectrum.

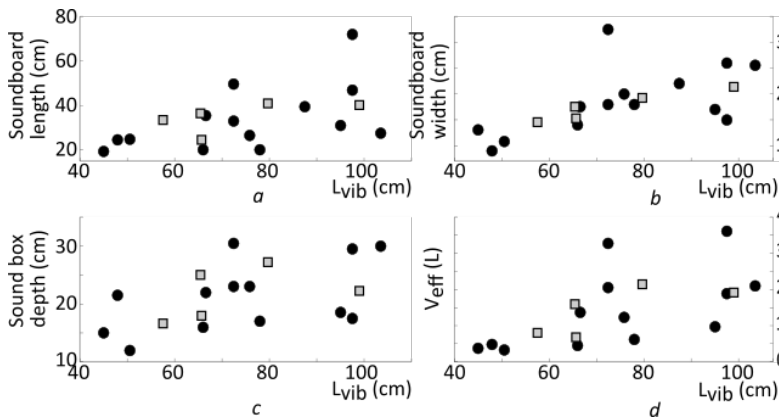


Figure 3: Soundboard length (a), width (b) and depth (c), and effective volume of the sound box (d) versus maximum vibrating length of the strings. The black circles correspond to the historical instruments and the grey squares show the five contemporary instruments.

First, Fig.3 shows that the dimensions of the contemporary instruments, identified with grey symbols, are compatible with those of historical instruments. In addition, Fig.3d reveals that the effective volume of the instruments ranges over a wide interval of values, from 3.2 L to 36.1 L.

As shown in Figs. 3a and 3b, the soundboard width and length increase with the vibrating length L_{vib} , and consequently the total length of the instruments. This trend is less obvious in Fig.3c, between the sound box depth and L_{vib} .

3.2 Vibration analysis

In string instruments, some body resonances, resulting from the coupling between structure and air vibration in the sound box, amplify the radiated sound. Indeed, in the measurement shown in Fig. 2, the frequencies of the two largest inertance peaks match those of the sound spectrum.

Thus, in order to investigate the acoustics of the lutes, the lowest resonance frequency, called Helmholtz frequency, was measured on the historical instruments as well as the contemporary dotār from East Khorāssān and the setār from Iran, available for the experiment. It corresponds to the lowest frequency where both inertance and sound spectra reach a maximum value. Fig. 4 shows this frequency in function of the vibrating length L_{vib} .

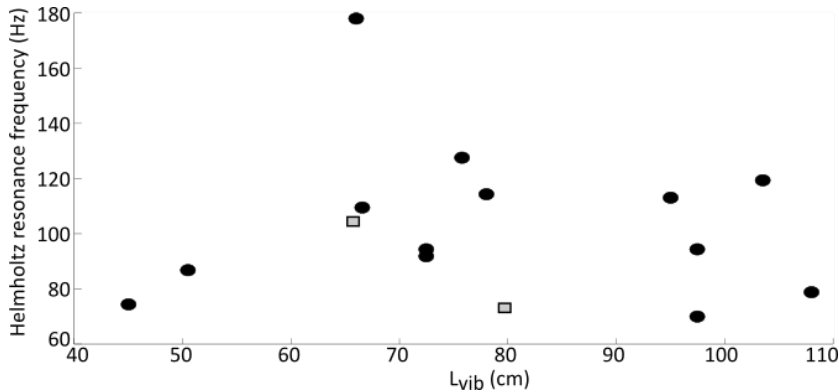


Figure 4: Helmholtz frequency of the instruments in function of the vibrating length L_{vib} . Black and grey symbols correspond to historical and contemporary instruments respectively.

As a result, Fig. 4 shows no clear relationship between the Helmholtz frequency and the maximum string vibrating length, in contrast with other families of string instruments, like violins and guitars [1]. Such diversity in the Helmholtz frequencies can be due to a large variability in the sound holes area from one instrument to another.

4. Discussion

The study of the instrument geometry shows that the soundboard dimensions increase as the instrument length grows, in contrast to the sound box depth. This feature tends to enhance the acoustic radiation of larger instruments, without necessarily changing the sound box volume. Such an adjustment may be sought by makers in order to control both the acoustic power of the instrument and the Helmholtz frequency, due to coupled vibrations of the body and air in the sound box.

Further, vibrating analysis shows that the Helmholtz frequency, is not tuned on a fixed frequency and does not decrease for lutes with larger sound box volume. This result raises the question whether makers adjust the Helmholtz resonance, while modifying the surface area of the sound holes, in order to give a specific timbre to the instrument.

Although strings of large instruments are longer, their musical register (range of notes that can be played) is similar to that of smaller instruments [2-3]. In consequence, the string tension must be higher on bigger instruments, in order to compensate for the increased vibrating length. For this reason, makers may have developed techniques to reinforce the body.

In particular, among the 11 longer lutes, only four have a back made of ribs joined with glue. For one of them, from Turkey (ref. 71.1973.77.662), some ribs are cracked and

disassembled, as shown in Fig. 5. The sound box of the other long instruments is made of one or two pieces of wood. The latter technique may allow the instrument to support a larger string tension. For purposes of comparison, among the six shorter instruments, three have a back made of ribs.



Figure 5: Sound box of a long-neck lute from Turkey made of glued ribs. Some of them are cracked and disassembled.

The tension applied to the instrument bodies also depends on the string linear density. Thus, for longer lutes, the string material may be chosen such that the tension is lower. Further investigations on historical and contemporary instruments will aim at identifying other making characteristics specific to musical traditions.

Acknowledgement

This research is supported by the Chaire thématique “GeAcMus” through the “Idex Sorbonne Universités”.

References

- [1] JANSSON, E., *Acoustics for violin and guitar makers, chapters 6-8*, Kungl. Tekniska högskolan, Department of Speech, Music and Hearing, Stockholm, 2002
- [2] VAHABZADEH, F., *Le dotâr et sa musique dans le Khorâssân et en Asie Cen-trale*, Ph.D. dissertation, EHESS, Paris, 2010
- [3] DARVISHI, M.R., *Encyclopaedia of the musical instruments of Iran (Vol.1), Chordophones in regional music*, Mahoor Institute of Culture and Art, Tehran, 2004.

