HERITAGE SCIENCE on Air

From the Digitalisation to the Virtual Reconstruction and Sound Simulation of Ancient Musical Instruments: Methods, Results, Perspectives

25th February, 2021
h.9.00-12.30

Organiser *Angela Bellia*

This webinar aims to discuss how digital technologies based on 3D modelling and sound simulation can expand our knowledge of ancient musical instruments. Computational methods for processing the 3D models allow for a more accurate analysis of surfaces, volumes, internal structures, and density of materials. Moreover, being non-invasive, these methods enable the study of the instruments' measurements and morphology, overcoming the limitations posed by their fragility.

Although reconstructions cannot tell us unequivocally how ancient users and audiences perceived the sounds of these instruments, they offer the chance to break through the time barrier by reviving sound emissions. By combining optical metrology with computational analysis, some of the subjective observations on ancient instruments can be substituted by measurable parameters, opening up new perspectives for the study of sounds and the artisan production process of ancient instruments.

As it has emerged from the STESICHOROS project – which has been funded by the European Commission's Marie Skłodowska-Curie Actions programme –, studies on 3D virtual reconstructions and sound simulations can help us in defining novel approaches and methodologies not only for the "active preservation" of musical instruments, but also in enriching our understanding of ancient music and musical cultural heritage.

Moreover, the webinar aims to explore the ancient sonic interactions and the spatial configuration of sanctuaries and theatres in their respective landscapes and environment in order to investigate the use of auralisation technology in the archaeological field, as well as experimental interpretative 3D reconstruction integrating acoustic models.

These topics will be addressed through the contributions of scholars working in various fields, including: archaeology, archaeomusicology, information engineering, interactive museums, musical heritage, physics, and virtual heritage.

09.00-09.15
WELCOME MESSAGE

Costanza Miliani

DIRECTOR OF INSTITUTE OF HERITAGE SCIENCE (ISPC)
NATIONAL RESEARCH COUNCIL OF ITALY (CNR)

Paolo Romano

RESPONSIBLE OF THE CATANIA ISPC HEADQUARTER

MODERATOR *Alfonsina Pagano*

CNR ISPC

9.15-09.35

INTRODUCTION: AN OVERVIEW OF HOW VIRTUAL RECONSTRUCTIONS AND SOUND SIMULATIONS CAN IMPROVE OUR KNOWLEDGE OF ANCIENT MUSICAL INSTRUMENTS

Angela Bellia

CNR ISPC

A https://nationalacademies.academia.edu/AngelaBellia

09.35-09.55

ASSESSING UNKNOWN PARAMETERS OF INSTRUMENT FINDS BY WRITING SOFTWARE

My contribution will focus on the advantages of a personal union between researcher and software engineer, drawing on examples involving the reconstruction of intended pitch sets on wind and string instruments from the early classical period up until late antiquity, and addressing the needs of visualisation, sonification as well as interfacing to data formats that facilitate physical reconstruction.

Stefan Hagel

Austrian Academy of Sciences
Institute for the Study of Ancient Culture

🌐 https://homepage.univie.ac.at/stefan.hagel

09.55-10.15

LINEAR AND NON-LINEAR EMULATION OF CLASSICAL MUSICAL INSTRUMENTS

The emulation of musical instruments represents a valid method for virtually reproducing their sonorities for several purposes: the conservation, the restoration, or even the realisation of replicas could take advantage of this methodology. The talk will present some methods and examples carried out at University of Bologna in this Millennium.

Lamberto Tronchin

University of Bologna

🌐 https://www.unibo.it/sitoweb/lamberto.tronchin

R^G https://www.researchgate.net/profile/Lamberto_Tronchin

10.15-10.35

MNESIAS: AUGMENTATION AND ENRICHMENT OF CULTURAL EXHIBITS VIA DIGITAL INTERACTIVE SOUND RECONSTITUTION OF ANCIENT GREEK MUSICAL INSTRUMENTS

MNESIAS project targets research, development and evaluation of user-friendly digital tools and applications that: a) allow museum scientists to create specific Auditory Virtual Musical Instruments, which accurately reproduce the musical sound of any specific Greek Ancient Musical Instruments (AMI) exhibit, and b) enrich and augment the experience of a museum visitor through accurate digital sound reconstitution and 3D representation of exhibited AMIs, allowing real time user interaction and music creation.

Georgios Th. Kouroupetroglou   https://speech.di.uoa.gr/koupe/koupe.html

National and Kapodistrian University of Athens
Department of Informatics and Telecommunications

Spyros Polychronopoulos

https://www.linkedin.com/in/spyros-polychronopoulos-27bb583b/?originalSubdomain=uk

Konstantinos Bakogiannis

https://www.researchgate.net/profile/Konstantinos_Bakogiannis2

10.35-10.55

3D VIRTUAL RECONSTRUCTION AND SOUND SIMULATION OF AN ANCIENT ROMAN BRASS MUSICAL INSTRUMENT

Digital 3D models are always more used to obtain hypothetical reconstructions of archaeological remains. This presentation addresses the case study of an ancient brass instrument from the Roman Empire period. The pieces composing the instrument were first digitized by means

of a structured light system, then virtually restored applying an on-purpose developed algorithm. Finally, some sounds coherent with the geometry of the reconstructed model were simulated using a physically-based approach.

Antonio Rodà

University of Padua - *speaker*

🌐 www.dei.unipd.it/~roda

Giovanni De Poli
University of Padua

in https://www.linkedin.com/in/giovanni-de-poli-b1404753

10.55-11.15

VIRTUAL RECONSTRUCTIONS AND ANALYSIS OF PRE-COLUMBIAN MUSICAL INSTRUMENTS

Over the last couple of years, more and more studies including the virtual reconstruction and analysis of pre-columbian musical instruments of Mesoamerica are carried out. In this presentation we present the approach and preliminary results of two joint projects, one on the organology, acoustics and psycho-acoustics of Aztec noise whistles (University Zürich/University Huddersfield), the other one on the virtual modelling and organological analysis of Classic period quadruple flutes (Denver Art Museum/University Huddersfield).

Arnd Adje Both

🌐 https://pure.hud.ac.uk/en/persons/arnd-adje-both

University of Huddersfield - *speaker*

Sascha Frühholz University of Zürich
🌐 www.psychology.uzh.ch/en/areas/nec/kaneuro/team/sfr%C3%BChholz.htm

Jared Katz Denver Art Museum
in https://www.linkedin.com/in/jared-katz-8b11ba45/

Pablo Rodriguez University of Zürich
in https://www.linkedin.com/in/pablo-rodriguez-zurich/

11.15-11.35

ANCIENT SONIC EXPERIENCE IN PRESENT-DAY LANDSCAPES – FIELD EXPERIMENTS ON MT. LYKAION, GREECE

Ancient sonic interactions can be recognized only by understanding their existing physical context. This talk will present ongoing acoustic research at the ancient Greek sanctuary to Zeus on Mount Lykaion. Moments of sonic connectivity and isolation in this mountainous site align with past building outlines and prominent sightlines, suggesting that the sanctuary landscape played a key role in ritual experiences, which can still be experienced—and measured—today.

Pamela Jordan 🌐 https://www.uva.nl/en/profile/j/o/p.f.jordan/p.f.jordan.html

Amsterdam Center for Ancient Studies and Archaeology
University of Amsterdam

11.35-11.55

VIRTUAL ACOUSTIC RECONSTRUCTION TO HELP ARCHAEOLOGICAL INTERPRETATIONS: THE CASE OF THE ROMAN THEATRES

The material culture speaks to archaeologists but, sometimes, what we find and what we know is not enough to propose valuable hypotheses. Virtual acoustics analysis and auralisation enhance the array of available instruments useful to discover various aspects of past societies. In particular, the study of some acoustics parameters and the listening of a sound in a 3D reconstructed environment provide precious information to verify the hypothetical architecture of ancient theatres.

Cristina Manzetti 🌐 https://romantheatres.ims.forth.gr/

Foundation for Research and Technology **A** https://forth.academia.edu/CristinaManzetti
Hellas, Institute for Mediterranean Studies

11.55-12.30
CONCLUSIONS