

ISGMA 2021 – Abstracts

Physical, Iconographic and Symbolic Features of the Plectrum –Some Reflections on Sound Production in Ancient String Instruments

Felipe Aguirre Quintero

In this paper some of the relevant features of the πλῆκτρον within Greco-Latin tradition will be analyzed. Starting from the formal aspects (shape, materials, technical properties) and the archaeological evidence, some of its symbolic implications that emerge in the light of literary and iconographic analysis will be discussed. I shall expose that, in addition to fulfilling a purely physical function within the process of sound production, the πλῆκτρον was the object of a rich imagery that provided it with an allegorical, metaphorical-poetic and even metaphysical dimension.

The Teotihuacan Sound Mapping Project: Exploring the Sonic Sphere of the City of the Gods, Mexico

Arnd Adje Both, University of Huddersfield, UK

The Teotihuacan Sound Mapping Project explores the sonic environment within the architectural setting of a UNESCO World Heritage site (Classic Mesoamerica, Central Mexican Highlands, 150 BCE to 700 CE). So far, the sound tools and musical instruments of Teotihuacan have been reconstructed, according to the measurements and organological particularities of the original finds. The process of producing and testing a series of experimental models per instrument type enabled us to understand the technological and musical/acoustical knowledge inherent in the sound artefacts. Their acoustic characteristics, especially sound intensities, the study of the find contexts and interpretation of music iconographical data helped to identify the uses and meanings of the finds in Teotihuacan. The paper presents a synthesis of the so-far achieved findings and, hopefully, first results on the upcoming field research, in which the instruments are sounded in different architectural settings of the site (geo-referenced sound mapping). This process will lead to the final outcome of the project. With the aid of and multimedia applications, a virtual sound-map of the city and a soundwalk event for the visitors will be created

An unusual Roman brass instrument from Voghenza (Ferrara, Italy)

Daniela Castaldo

In the archaeological site of the Roman village of Voghenza, near the modern city of Ferrara, has been found an unusual Roman wind instrument. It was discovered among objects that came to light in a house (domus), together with a military diploma dating back to AD 100, belonging to the Dalmatian soldier Lucius Bennio Beuza. A bronze trumpet is about 130 cm long and probably contemporaneous with the diploma. The slightly curved shape of this trumpet is unusual and has no parallel among the excavated Roman trumpets, since it is neither straight like a tuba, nor circular like a cornu. Starting from the available documentation related to Roman brass instruments, including realia, texts and images, I will propose some hypotheses on the context of use and the destination of this instrument.

The 12th-Century Organ and Bell Carillon of the Nativity Church in Bethlehem

David Catalunya

The Terra Sancta Museum in Jerusalem preserves the remains of a 12th-century organ and bell carillon discovered during an archaeological excavation at the Nativity Church in Bethlehem. Considered the

oldest and most complete exemplars surviving in Christendom, these archaeological remains shed unique light on a particularly obscure period in the history of these musical instruments. The Institut für Musikforschung of the University of Würzburg has initiated a collaboration with the Terra Sancta Museum in Jerusalem to study and reconstruct the Bethlehem organ and bell carillon. While the project is currently in a preparatory stage, in this presentation I will report the results of my initial exploration of the preserved material. Preliminary analysis has already uncovered many details relevant to the dating, origins and reconstruction of the instruments. I will also reflect on methodological aspects, and finally discuss the implications of these discoveries for our understanding of medieval church culture and its technologies.

The most prestigious Maya instrument. Investigation about rattles in the Maya culture of the Classic Period.

Monika Ciura, Doctoral School of Humanities, University of Warsaw

The Maya rattle -simple, gourd idiophone or the highest valued Maya instrument? During my presentation, I will demonstrate all of the aspects of the rattle based on the iconographic, archaeological, epigraphic, and ethnohistoric sources of the ancient Maya culture. In the Classic Period Maya culture (AD 250-900), events with the participation of musicians were illustrated in the art, often enriched with written narratives and the rattles of different shapes and sizes are the instruments most frequently depicted in the iconography. I propose, that the rattles might have been made not only from a gourd but also from cocoa fruit and that different types correspond with local traditions or the social status of their users. Finally, I present the hypothesis, that the rattle was one of the attributes of Maya royalty, which served not only as the source of the sound but also socio-political power of Maya rulers.

Steppe Harps and Shamans: Archaeological Context, Morphology, and Function

Gabriela Currie, University of Minnesota Twin Cities

The presence of angular horizontal harps in a significant number of tombs from the area of Xinjiang, and from Pazyryk, Bashadar, Olbia, etc. attest to this instrument's rapid geographical spread across Eurasian steppes in the second half of the first millennium BCE. Even as subtle morphological differences point toward regional traditions of instrument manufacture, the presence of *Cannabis sativa* in many of the archeological grave sites suggests a possible link between instrumental music cultures and shamanistic rituals among steppe-dwelling Indo-European populations at the time. Building upon the work of Bo Lawergren, and drawing upon recent archaeological and ethnobotanical scholarship, the present paper will map the distribution and material construction of this instrument through space and time, and explore the emergent symbolic associations engendered by the archeological context.

The rattles from Szadek – acoustic research with the use of numerical sound reconstruction

Ireneusz Czajka -AGH University of Science and Technology Kraków, Katarzyna Tatoń -Warsaw University

Although archaeomusicology use methods of both archaeology and musicology, but sometimes it turns out that methods that comes from as far away as mechanical engineering are useful. Reconstruction of archaeological objects often restores their visual functions, while fundamental functions -sound functions are lost. In such cases, numerical sound reconstruction can help to restore at least some of the basic functions of damaged artifacts. The paper presents research methods allowing for the sound reconstruction of such objects. Using reverse engineering techniques, it is possible to build a model

that will allow to learn at least some of the sound characteristics of the reconstructed objects.
Keywords: x-ray tomography, reverse engineering, sound synthesis, numerical reconstruction

Lost context: Challenges facing experimental reconstruction of the Egyptian angular harp (Louvre Museum N 1441).

Susanna Schulz, Sibylle Emerit, Ricardo Eichmann

The angular harp of the Louvre Museum N 1441 was bought in 1826. Unfortunately, the archaeological context is unknown. The exact investigation of the original artefact was again essential for the reconstruction of this antique harp as a comparison with a similar instrument preserved in the Metropolitan Museum of Art in New York. Some observations could be made concerning the chronology of the single parts of the instruments, parallel to ¹⁴C analysis, confirming those. Also some of the decoration could be imitated therefore, which lend surprisingly the basic aesthetic beauty to the instrument. Later experiments on playability, also with a professional harpist, opened new views on the construction as well on stringing and tuning methods, giving hints to lost parts such as the strings itself, but also to the use of certain measurements. Why was it made this way and not another way? In all, the musical practise opened new interesting questions and search for answers.

The Experimental Restoration and Reconstruction in Music Archaeology

Fang Jianjun

Known as research methodologies, restoration and reconstruction are lab-based experimentation in music archaeology. Restoration tries to recover the original shape of excavated artifacts that have a little damage. Theoretically, restoration involves in musical instruments, pictorial remains, epigraphic texts, and ancient notations. Actually, only musical instruments have been mostly conducted for restoration. Restoration has tangible and intangible ways to carry out. Tangible restoration is visible, for instance, the shape recovery of instruments. Intangible restoration is invisible but sonic and aural, such as tone series and scales of musical bells and chime stones. Borrowed from experimental archaeology, reconstruction primarily focused on unearthed instruments or instruments appeared on images, which included reproductions of playable replica and imitation, or simulative manufacture and model reconstruction by using 3D or VR technology. In this paper, I will discuss the methods and differences of restoration and reconstruction

The Soundscape in Prehistoric China: An Ethnographic Analogy on Musical Instruments Found in Taosi Cemetery

Fang Xueyang

Dating to late Neolithic time, the Taosi cemetery lies within the boundaries of Xiangfen county, Linfen city in Shanxi province. In the cemetery, the growing numbers of different musical instruments were found in five large tombs, especially the chime stones, alligator drums and pottery drums. Moreover, a few ceramic ocarina, bone jew's harp, pottery bell and even one copper bell were found in this site. Four chime stones are representative of the earliest chime stones in prehistoric China, which were all uncovered from large tombs and were found to coexist with alligator skin drums as well as pottery drums in the cemetery. In this paper, I will focus my study on the manufacture, usage and performance of musical instruments unearthed from Taosi site. Gongs as we know, come in many guises from the flat, dark-toned tam tam, through the shimmering wind gongs to the resounding Chinese opera gongs. The percussion instrument such as Mangluo belongs to the gongs category and is widely distributed in ethnic minorities in southwestern China. Having a metal disk, Mangluois made of bronze and is popularized in ethnic groups in Yunnan. Interestingly, it has different sizes and can emit different pitches according to the size of the gong, which is similar to chime stones. The single Mangluo or the

smaller ones can be hand held to play, but the larger one need to be suspended on the stand. Similarly, they used to be hanged by a cord through a hole near its apex and struck at the area above bulge in the middle of the body with a wooden hammer, arranging five to ten gongs suspension in general. They usually match with cymbals and elephant-foot drums in music performance of the Dai ethnic minority.

Apart from gongs, other idiophones such as wooden drums, copper drums and Jew's harps have also been played and distributed in ethnic minorities of southwestern China. Here comes several questions, are there any connection between Neolithic chime stones and today's gongs? Do they have the similar way of performance? How about other ancient instruments when comparing with instruments used in ethnic groups? We know little about musical instruments in antiquity, however, take the unearthed musical instruments in Taosi as an example, by using the method of ethnographic analogy to compare and analyze, will estimate their possible manner of use and function. The aim is to explore similarities and differences of musical instruments in different eras, encompassing on manufacture, performance, ensemble and their social and political meaning in different cultural context

Decoration on Lute Plectrum Guards in Pre-Modern China and Japan: A Comparative Analysis

Ingrid Furniss

East Asian lutes were regularly played using plectrums, large triangular ones for the *pipa* and smaller ones for the round-bodied lute, known as *ruanxian*. The tendency of the plectrum to scratch the wooden instrument face led to the application of plectrum guards, usually made of leather, which were placed under the strings. As I will show in my presentation, plectrum guards are decorated with two primary themes: (1) those linked with traditional Chinese iconography associated with elite Han culture, and (2) those that are whimsical imaginings of Central Asian and Steppe cultures.

Acoustic space

Anna Gruszinszka

There are three important limits to human hearing. Two of these, which delimit infrasound and ultrasound, are well known. However, there is a third one, at high frequencies but still below the ultrasound boundary: the frequency of 5 kHz. Above that, it is no longer possible to identify the pitch of the sound and the sequence of tones is not perceived as an audible melody. In the archaeological material from the Polish terrain there are several instruments and sound tools used for acoustic actions above these two upper limits. And these are not effects created by chance: the mentioned acoustic objects are numerous from different regions and epochs of the past, of good workmanship and remarkable aesthetic qualities. We also know that the societies of the past recognised and classified the other part of the sound spectrum: the infrasounds. Thus, recent research indicates that this complex outer space -beyond the perception of the human ear -was the object of interest and "sonorous" actions of our ancestors.

Reconstructing Roman Soundscapes: Music and Sound(s) in Urban Spaces

Jutta Günther / Florian Leitmeir

Die hohe Präsenz von Musik und Klängen in der römischen Welt zeigt sich im Widerhall von archäologischen, ikonographischen und literarischen Zeugnissen. Die Quellen zur Musik sind somit das Ergebnis eines bemerkenswerten medialen Transformationsprozesses vom realen Klang zum Bild, dessen Betrachtung neue Perspektiven auf die Bedeutung von Lauten und Klängen in der römischen Antike ermöglicht.

In unserem Beitrag werden wir bei einem virtuellen Spaziergang zentrale Orte der antiken Stadt aufsuchen und auf Basis der Zusammenschau unterschiedlicher Quellengattungen die dortigen Klangräume rekonstruieren. Über das im Mittelpunkt stehende Konzept des Klangraums entsteht somit ein komplexes Bild der kulturhistorischen Zusammenhänge antiker römischer Klangwelten.

New Discovery in Gaul: A gallo-roman Trumpet (tuba) found on the Antique forum of Bavay

Patrice Herbin / Christophe Vendries

In april 2021, new excavations in the roman forum of Bagacum (Gallia Belgica) revealed the presence of a very large trumpet (2,40 m). By chance, the bronze instrument is complete, from the mouthpiece to the bell. All the pieces have been disassembled and placed in a hiding place: the pit has been deliberately closed by a large stone (probably around the end à the 3rd c. AD or at the beginning of the 4th c. BC)

The similarity between this trumpet and the other models previously discovered in Gaul (Neuvy-en-Sullias, Saint-Just-sur-Dive) is striking : one can observe the same manufacturing technique (in several sections), the same type of decoration and the same kind of mouthpiece. Up to now, it is the sole trumpet found in a well-documented archeological context. This raises the issue of its religious or civic use in a public square as the Roman forum of Bavay.

Pre-Columbian Maya Trumpets

Mark Howell

There are some 54 representations of non-conch shell pre-Columbian trumpets known, but only one extant ceramic version survives. The others are known from paintings, engravings, and sculptures. Of these there appear to be two primary types: long-widening tube trumpets and wrapped trumpets. For my presentation I will discuss the evidence for these instruments, their materials and means of manufacture, and their uses. I will also demonstrate sonic signatures on replications of the ceramic trumpet and long-widening tube trumpet.

Celtiberian Clay Trumpets (2nd-1st Centuries BC): An Approach to Second Iron Age Archaeomusicological Heritage

Raquel Jiménez Pasalodos

This paper will present a summary of the systematic study of 65 fragments of Celtiberian ceramic aerophones, corresponding to a minimum of 50 trumpets, dated to the 2nd and 1st Centuries BC, from a specific theoretical perspective and with methodological tools derived from archaeology, music archaeology, acoustics and ethnomusicology, as an example of the application of a transdisciplinary approach to archaeological musical instruments. It comprises three main parts: The first focuses on the history of the findings on the early 20th Century. The second section comprises the study and documentation of the materials, the analysis of the chaîne opératoire, the experimental reconstruction of the instruments and their acoustic characterization. The third section aims at the interpretation of these aerophones through the study of iconographies, classical and medieval written sources and comparisons with other ancient brass instruments from the Iberian Peninsula, the Mediterranean and Atlantic and Northern Europe.

Palaeolithic strings? Experimental approaches

Gjermund Kolltveit

What is the definition of a musical bow? The background for the question is an artefact in Landesmuseum Württemberg interpreted by the museum as a mouth bow. It comes from the Aurignacien layers of the cave Geissenklösterle in the Schwabian Alps. The problem with this antler object is its small and fragile size, with a length of only 13,1 centimetres. Experiments with replicas and different type models is a method of evaluating the musical capacities of this particular artifact, and also a way of elucidating the probability that a few motives in Late Palaeolithic art depicts mouth bows. Apart from size and length, these experiments employ several variables, such as bow material, chord material and playing technique. Furthermore, the experiments lead to reflection on musical intentions in a remote time and unknown culture.

Norwegian ringing stones, website

Dr. Gjermund Kolltveit

This is a documentation project which will collect and record ringing stones in Norway. The results will be published online at a special designed website with photo, video, sound and text. The website will be bilingual, Norwegian and English. The project is a two-year collaboration (2020–2022) between Magma Geopark, based in Egersund, and music archaeologist Gjermund Kolltveit, Nesodden. It is supported by Arts Council Norway and Norwegian Centre for Traditional Music and Dance. Magma Geopark is part of the UNESCO Global Geopark network, situated in a geographic area in SE Norway with geology of major international importance. This documentation project aims to combine geological and cultural heritage.

The very earliest music in ancient Egypt from the 5th millennium to the middle of the 3rd millennium BC

Heidi Köpp-Junk

Although music was a significant factor in Ancient Egypt, the beginnings of music in Neolithic, Predynastic times and the Early Dynastic period, and the beginning of the Old Kingdom (5th-3rd millennium BC) have hardly been taken into account. In his study "Altägyptische Musik" from 1970 Hickmann assumed a certain "Urbestand" or "original stock" of earliest instruments. The lecture presents the results of the research project, following this up, reflecting on his research in the light of today's knowledge and compiling and examining all the new instruments that have been added in the meantime. The study shows that the original stock in Egypt is significantly different than in other places in the world and than the state of research in 1970 would have suggested.

Playing a Musical Instrument in Classical Athens. Representations on Red-Figure Vases

Angeliki Liveri

This paper presents depictions of musicians playing a musical instrument on Attic red-figure vases, focusing on the instruments' form and playing technique. Selected examples include practical activities and exercises from the beginning to the end of a musical performance. We will show different moments of the musical process regarding the most important and popular wind and string instruments, which were used in various occasions of public and private life in classical Athens: such as aulos, lyre, kithara, barbitos and harp. The instrument's preparation, strings' tuning, the music performance and its end will be represented. The appearance of the musician, his clothing, the way the musical instrument is held, his attitude/position, movements and expressions and the participation of the genders (men-women) to city's musical life will also be taken into account. The paper aims to

demonstrate whether the vase-representations are realistic or imaginary, combining images, literary sources and findings and comparing with analogous representations in other art forms. We wonder whether vase-paintings incorporate important details for the instrument's form, construction and playing by the musician and, therefore, how such images could contribute a) to the understanding of the aforementioned features, b) to a modern reconstruction of an ancient Greek instrument; and c) to a modern interpretation of its performance.

(New) Materialism and the music of Roman Britain

James Lloyd

This paper examines the merits of four approaches to the study of music archaeology, focusing on musical instruments from Roman Britain studied at the Museum of London: Object agency Instruments as objects of art; Object biography, and the 'life' of an object Chaîne opératoire and use-wear analysis. These four approaches are largely interconnected. They focus on the materiality of an object as a way to explore its meanings, influences, and agency during the times and places it existed in, as well as those of the materials, people, and exchanges needed to create and use it. Conventionally, the differences in the musical cultures of Roman Britain are seen as differences between customs and instruments. By applying the above methods, we gain a better understanding of the structural differences and similarities of the methods of musical production between Britain and Rome.

Ethnoarchaeological evidence of cracked pots reused as sound enhancers in Cypriot 20th century churches

Gloria London / Andreas Georgiades

Ethnoarchaeological research in Cyprus demonstrates the use of damaged jugs to enhance the resonance of the human voice in church settings. Recent refurbishment of an early 20th century church in Kornos village led to the discovery of jugs (35cm tall) in niches placed high in the walls immediately below the roof. Instead of new jugs, people recycled pots that had chipped rims and/or broken handles. Elsewhere, jugs with holes carved into their bottoms were in church ceilings. Unlike other reused pots recorded since 1986, the church niches preserve very old pots made in the village, where potters have worked for 300 years. Kornos is one of four locations where women shape local red clays into jugs, jars, cookware, incense burners, etc. for use by Cypriots. Jugs were used as sound enhancers elsewhere in Europe and explain why archaeologists might find pots a century older than others in sacred spaces. Key words: ethnoarchaeology, Cyprus, jugs, sound enhancers, recycled pottery

The *talempong batu* Lithophone of Talang Anau (West Sumatra): Sound and tuning

Christoph Louven

Back in 1995 my ethnomusical colleague Uwe Pätzold asked me to acoustically analyze some recordings of a presumably ancient lithophone that he recorded in Talang-Anau, West-Sumatra. The *talempong batu* consists of six large stones of unknown, grey to beige material. The stones look quite rough and natural and are approximately 100 to 150 cm long, 30 to 40 cm wide and 15 to 25 cm thick. Nine sounds from each stone were analysed to minimize measurement errors. All six stones show a complex spectrum with inharmonic overtones that is typical to vibrating 3D objects. However, no residual or combination tones can be heard so the perceived tone each corresponds to the lowest partial. The analysis of the tuning system of the instrument showed quite unexpected results. Four of the stones establish a complex system of intervals that perfectly fits to intervals that in European tuning tradition are known as perfect Major Third (5/4, 386.31 Cent), Pythagorean Ditonus (81/64, 407.82 Cent) and Syntonic Comma (81/80, 21.51 Cent). These theoretic intervals are realized with an astonishing accuracy: the maximum deviation is just 3 Cent (between the Major Third and the interval

between stones V and VI). This is less than the just notable difference between two tones in this frequency range. Due to the perfect conceptual symmetry and accuracy of the system it's barely conceivable that this simply resulted from chance. This leads to some important conclusions. First, the complex concept of the tuning implies some kind of theoretical, proportional, mathematical thinking of the creators of the lithophone. Second, the tuning system of the lithophone is hardly imaginable without the existence of string or at least wind instruments in the culture, as means of theoretical thinking as well as of tuning realization. However it remains a mystery how this tuning concept could evolve in a megalith culture, how it was practically realized and how it remained unchanged for presumably thousands of years.

About buzz discs and buzz bones – an ethno-musicarchaeological study of buzzers

Cajsa S. Lund

The buzz disc is a small, flat, usually rounded disc, traditionally made of bone or wood, but also of metal, pierced with two holes in its center. The buzz bone is made of a pig's metapodial and pierced with one hole (sometimes two) in its balance point. Both types are timeless and globally distributed. They will sound by being swung around in the air with a string. A question in focus will be about archaeological finds of buzz bones. Are they all sound tools? Some finds do not function technically because the pierced hole is not correctly placed on the bone, but there are traces in the hole indicating they have been used—but for what? This problem will be discussed from a present-day instrument maker's experience during mass production of buzz bones. That buzzers have a multigenerational role, and this in several ways, will also be addressed.

Military and Processional music in Ancient EgyptReconstructionsof (The Egyptian Metal Barrel Drum –Tutankhamun Trumpet)

Mohamed Maged / Reem Shakweer / Abdalbasset Hatab

Ancient Egyptians were familiar with military and processional music, they used multiple shapes of Drum to mark the rhythm in combats and processions; also Horns was used to giving out tones for certain purposes. These instruments were usually used by Army Bands for organizing the soldiers steps, encouraging warning and notifying them with victory. Barrel Drum and Trumpet was also used in religious festivals and popular feasts. Numerous military and processional music scenes are documented in tombs and temples showing that Barrel Drum and Trumpet were among the prominent instruments and it was frequently used in military music. Unfortunately there are limited number of original instruments in museums, that's why reconstructing this few surviving pieces is a doorway to knowledge and comprehension. This research will tackle the following points: 1. Following the stages of military and processional music in Ancient Egypt. 2. Reconstructing a model of barrel drum like the original one in the Egyptian museum in Cairo. Using the same measurements, materials, and following the original ancient process of manufacture. 3. Reconstructing one of Tutankhamun trumpets, copying the original one in the Egyptian museum in Cairo. 4. Electronic simulation for ancient Egyptian music, "musical performance with barrel Drum and trumpet".

Ancient Assyrian Vocal Technique in Ethno-Archaeological Perspective

Sam Mirelman

A relief of the Assyrian king Ashurbanipal (7th c. BC) illustrates an Elamite orchestra. This orchestra includes a female singer, who holds her hand to her neck. It has been suggested that this represents a traditional vocal technique known from the contemporary Middle East, namely ululation. Alternatively, it has been suggested that this action functioned as a means of creating pressure on the larynx, thus resulting in a specific vocal sound. This contribution will examine vocal techniques from

the Middle East and the wider world, in order to determine which vocal technique is most likely to apply in this case. The terms for vocal techniques in cuneiform texts will also be briefly discussed, in order to determine whether the Assyrian term for such a technique can be identified.

Current Research on the Forty-Thousand Years Old Palaeolithic Wind Instruments of the Swabian Jura (SW-Germany)

Susanne C. Münzel / Gabriele Dalferth / Wulf Hein / Barbara Spreer / Hannes Wiedmann / Anna Friederike Potengowski

The incompleteness of the Palaeolithic musical instruments from the Swabian Jura led to everlasting questions: which frequencies, which intervals and what kind of tonality might have been played 40-thousand years ago. Consequently, our work followed those questions by systematic comparative studies of tonal results on different reconstructions.

First musical analyses of experimental reconstructions were conducted by Wulf Hein and Fritz Seeberger (†) in the 1990s. On this basis Anna Friederike Potengowski continued the musical analyses including four different wind instruments presented at the ISGMA 2014 in Berlin.

In our presentation we would like to give an overview of our current research concerning the Palaeolithic wind instruments from the Swabian Jura, which will also be the topic of our workshop.

After a short introduction about the archaeological background and find history of all instruments from the Swabian Jura, we will focus on the mammoth ivory instrument (GK3) from Geißenklösterle cave.

The Palaeolithic manufacturing of the mammoth ivory instrument was on a very high technological level. This was not only confirmed by revisiting the instrument in the Urgeschichtliche Museum of Blaubeuren (Hannes Wiedmann), but also by experiences made while producing numerous reconstructions (Wulf Hein, Frank Trommer, Hannes Wiedmann).

The playability of ivory instruments is another challenge. This was tested with different raw materials (mammoth versus African elephant ivory), with different glues and also in different lengths of the tube.

Four templates of the mammoth ivory instrument were manufactured of bird bones (swan ulnae) in the same size and volume with four different mouth pieces representing a nay, a quena, a clarinet and an oboe (Barbara Spreer).

We also considered basic aspects and parameters causing pitch variability in reconstructions (Gabriele Dalferth).

Dancing Image System of Ancient Asian Bronze Drums

Peng Xiaoxi

Bronze drums were once popular in China, Vietnam, Laos, Thailand, Cambodia, Malaysia and other Asian countries, forming a bronze drum cultural circle. At present, there are thousands of bronze drums left in Asia. The bronze drum is not only a symbol of power and wealth, but also an accompaniment instrument and ritual object of dance. On the bronze drums, there are a large number of dance images in various forms. And in southwest China, there are still many ethnic minorities who beat bronze drums and dance. This article adopts the method of combining ethnology and dance iconography to study the meaning system formed by the dance images carved on the bronze drum, and the function of these image systems in the society at that time. Furthermore, this article attempts to find the connection and variation between the dance images on the bronze drums and the bronze drum dances left by various ethnic groups in Asia today.

Archeo-Musicology in South America: Goals, Resonance And Future

José Perez de Arce

This paper tries to show some regional tendencies in archeo-musicology in the Andes and south América as perceived by me and some colleagues from Perú, Bolivia, Argentina, Chile and Ecuador. Some of these tendencies has to do with methodological approaches of organology as a main tool for our research. We have been expanding the taxonomic role of organology, very important when dealing with objects that lacks any contextual data. New dimensions of the concepts of “sound objects” is needed when dealing with instruments that need to be played by two or more performers (as with the Indonesian anklung). Here organology merge with orchestral problems, as happens with south Andean flute orchestras. The movement, not only as a basic compound of sound objects (without movement there is not sound), but as dance, performance, including changes in space and listening perspectivism, all of which influence our study object in many ways. In some cases timbre reaches a main dimension –over rhythmic or melodic ones, and has a close relation to modifications in conscious states, a difficult area of study, that deals with the cultural use of the instrument. Finally, there are dimensions that places organology not in service to music and musical parameters at its primal function, but on social ones, as complex socializing technologies, whose purpose is to bring social bonds of a very specific kind. Also, archeo-musicology is intertwined with the new social regional tendencies, that reverses colonial paradigms, as part of the so called “emergencia indígena” (Indian emergence). This is a complex social process taking part in many regions, with many expressions. The consequences of this inversion on our field of archeo-musicology are far to be clear, but the concept of “pre-Columbian music” (whatever this can be interpreted) gives voice to this emergence in many ways, and our duty is to have some position in relation to it.

The organization of instrument making workshops in ancient Greece: written sources and archaeological data

Sylvain Perrot

In comparison to performers, the ancient Greek sources on music instrument makers are lacunar. Apart from the remains, which can be studied from organological, technical (e.g. traces of handcraft) and economic (materials as evidence for commercial channels) perspectives, there is scant evidence on the artisans and workshops. One may at least provide some micro-historical analyses, based on a few study cases considered in their political and socio-economic context. One aspect is commercial networks as exemplified by the shipwreck of Giglio (ca. 590 BCE). Among other goods, achieved auloi were found as well as unfinished samples: the question arises whether an aulos maker was on board, unless this should be interpreted in terms of trade and technical transfers. Another aspect is the spatial and social organization of classical Athenian workshops (I will suggest that one could have been hosted on the agora) and Hellenistic Delian workshops, which should be studied within the urban tissue.

Metallic Idiophones between 800 BC and 800 AD in Central Europe –Their function and acoustic influence in daily life (first results)

Beate Maria Pomberger

Metal sound objects have fascinated men for already more than four thousand years. The materiality of idiophones as such are rarely examined scientifically; nor are the sounds produced by them. In our project “Metallic Idiophones between 800 BC and 800 AD” we investigate metal idiophones –bells, pellet bells and sound producing costume jewellery – in terms of their functional use, their sounds and psychoacoustic parameters, their acoustic influence on daily life and sonic environment of living beings, their materials and manufacture processes. The interdisciplinary project, which started in January 2020 and will last until December 2022, includes idiophones from Switzerland, Austria, Slovakia, the Czech Republic and Hungary, found in funeral contexts and settlements from the Hallstatt

Culture, the Roman Period and the Early Middle Ages (Avars). In my contribution I will present the first results based on idiophones from the Byci skala cave (CZ), the cemetery of Hallstatt-Hochtal (AT) and the Avar cemeteries of Komárno (SK).

Medieval key for tuning string instruments from Ostrowite in Eastern Pomerania (Poland)

Dorota Popławska / Jerzy Sikora

The subject matter of this study is a key made of an alloy of copper, which was most probably used for tuning the strings of musical instruments. It was excavated thanks to the use of metal detectors in Ostrowite in eastern Pomerania (commune and district Chojnice) as an accidental find. The key is dated indirectly by defining the chronology of the site between about the middle of the 11th century and the 1330s. Similar artefacts were excavated e.g. in England. Medieval iconography, including the Polish one, sometimes shows tuning keys next to harps and liras. Beyond any doubt the key settles the issue of a form of a peg grip. Based on the finds of pegs it will be possible to establish whether the form was common. In the study we pose different questions, i.e. whether the key from Ostrowite was used for tuning harp or whether it could also be used for tuning other types of string instruments.

Reconstructions of Palaeolithic Melodic Wind Instruments - Variability of Shape, Sound and Performing Practice

Anna Friederike Potengowski / Gabriele Dalferth / Wulf Hein / Barbara Spreer / Susanne C. Münzel

This is a comparative study of morphological possibility in bird-bone melodic-wind instruments designed to test four embouchure techniques in instruments of the same shape, length and finger-hole design. The four blowing/voicing methods examined are those associated with playing the nay, the quena, the clarinet and the oboe, respectively. The blowing end of each instrument has been modified accordingly. Acoustic vocabulary is dependent on design details like distances between finger holes, size of finger holes, diameter of the tube, temperature of the air column, and so on. Our question concerns the extent to which the acoustic vocabulary changes when we modify the blowing/end of the instrument and embouchure respectively. Results from our experiments demonstrate a relative constancy in the range of playable frequencies across morphologies of embouchure.

Prehistoric pendants as instigators of sound and body movements: Atraceological case study from Northeast Europe, circa 8200cal.BP

Riitta Rainio / Kristiina Mannermaa

In the Mesolithic graves of Yuzhniy Oleniy Ostrov, Russia, large amounts of Eurasian elk incisors have been found. These teeth, for the most part fashioned into portable pendants, seem to have formed decorative sets for the garments of the deceased. This paper examines both the technologies associated with these artefacts and their uses, as well as reflecting on the sensorial experiences generated by them. Osteological analysis of a sample of 100 specimens indicates that all types of incisors were used for making the pendants. Traceological analysis indicates that the teeth were modified by scraping, grooving and grinding. Traces of wear consist of general wear and distinctive pits or pecks on the perimeters of the crowns. These traces indicate that the pendants were worn before their deposition in the graves, in such a way that they were in contact with both soft and solid materials. The pattern of pits or pecks has until now been unreported in the traceological literature. In experiments, a similar pattern emerged when pendants of fresh elk incisors were hung in rows and bunches and struck against one another. These strokes created a rattling sound. Thus, the elk incisors of Yuzhniy Oleniy Ostrov appear to provide insight into previously unattainable sonic experiences and activities of Mesolithic hunter-gatherers, as well as the early history of the instrument category of rattles.

Practical experiment: Exploring the differences of sounds with different bottoms on Beycesultan-type clay-drums

Andre Schlauch

What difference would different types of drum-bottoms make in the sound of the drums. We will explore that with three variations of a Beycesultan-type drum. One has a closed bottom like the original, the second has an open bottom and the third has a fur-covered bottom.

Casting bronze lurs - new considerations on an old problem

Joachim Schween / Thorsten Helmerking

The lure is a mystical wind instrument from the Bronze Age, the manufacturing technique of which, together with the secrets of the foundry art of the period, seems to have been lost in the depths of time. New aspects of its production process will be presented from an experimental archaeology perspective.

An Egyptian Singlepipe with Two Thumb Holes Found in the Ruins of Panopolis in 1888 and Studied by Victor Loret

Marco Sciascia / Barnaby Brown

Two almost identical musical instruments were found in 1888 near Akhmim. Both came to France with reeds in superlative condition: one pipe was sent to Maspero, the other to Bouriant. Loret published detailed observations, drawings, measurements, and photographs within months of their arrival, respectively in 1889 and 1893. My contribution is the knowledge gained through practical experiment, making and playing a reproduction of Bouriant's pipe, based on Loret's publications. I compare its musical behaviour with two other nineteenth-century finds that lack archaeological context but ended up in Egyptian collections: a singlepipe in Turin (Museo Egizio cat. 6258/2) and a doublepipe in the Louvre (E10962). The collective voice of these four instruments is astonishingly concordant, to a degree that either raises questions over their dating, or indicates that the same tonal framework and pitch standard persisted between the New Kingdom and the Christian era.

Role of sistrum instruments in ancient Egypt Hathor's sistrum / Reconstructing of Metal Sistrum –Egyptian Museum

Rasha Shehata / Eman Elbably

Sistrum Instruments were used in religious events inside the temple to accompany songs, hymns and prayers. Ancient Egyptians believed that the resonance of sistrum instruments kept away the evil spirits. Sistrum instruments were often used in groups of three or more female players. The priests taught the youth the art of playing sistrum instruments and such lessons commonly took place in the temple corridors. Hathor's Sistrum Perhaps one of the main cult objects associated with Hathor was the sistrum, a musical rattle. Its name is derived from the Greek, *seiein*, meaning "to shake". In this paper we will reconstruct the metal Sistrum instrument which found in Tutankhamen tomb –18 dynasty –located in the Egyptian museum, Cairo, Reconstruction procedures as well.

The Oxus and Meroë Auloi: Charting the Edges of Hellenic Musical Culture

Olga Sutkowska

It is common knowledge in music archaeology that the aulos was one of the most important musical instruments of the ancient Graeco-Roman world. Nevertheless, many aspects of this instrument still

remain unexplored. This paper will focus on two exceptional sets of archaeological auloi finds: the first from the Oxus temple in Takht-i-Sangin, Tajikistan (3rd to 2nd century BC); the second from the pyramid of Nubian Queen Amanishakheto in Meroë, Sudan (15 BC). Both the Oxus and Meroë auloi were found far away from the Hellenic center. By analyzing the construction of these instruments and comparing them with contemporaneous artifacts from Megara, Pergamon or Pompeii, the research presented here should contribute to a better understanding of the impacts of Hellenization on a transcontinental scale

Iron Age and Roman period Ceramic Rattles from The Netherlands: Sound Tools, Amulets, Votive Objects, Depositions?

Annemies Tamboer

At least 90 ceramic rattles dating from the Iron Age and the Roman period have been found in the man-made dwelling mounds in the coastal areas of The Netherlands. Lemon or double cone shape in a size fitting in the hand are most common. Of these many are broken in two caused by an imperfect joint. As a lack of ceramic skills seems improbable, durability of the joint was of no primary concern apparently. These rattles are fired at a low temperature that in experimental reconstructions appeared to produce a soft sound. Recent archaeological investigations led to new insights in the spiritual life of the people that made them, deposited object ensembles point to rituals being performed. Probably the rattles have to be interpreted in this light. Not being conceived as durable musical rhythm instruments, their symbolic meaning may have mattered most.

The Early Medieval Organ

Lucy-Anne Taylor

The Early Medieval Pneumatic organ, unlike its hydraulic classical counterpart, is little understood, perhaps due to the limited evidence. Despite no categorised archaeological remains, it has been possible to begin to re-understand this instrument. This paper will lay out what has so far been established from assessing the available sources using archaeological, organological and musicological analysis to understand the instrument's construction. In addition, acoustical and mathematical analysis allowed for comprehension of the tuning pattern and also plausible sizes of organ pipes, also presented in this paper. This research has culminated in the re-creation of a wind chest for a rank of pipes, which will be demonstrated, using the Winchester organ as a case study.

Some thoughts on the structure and function of the Megara auloi

Chrēstos Terzēs

Two professional modulating auloi associated with metal slider keys, resembling the structure of the Pergamon aulos model, are exhibited at the Archaeological Museum of Megara. Both instruments reflect a standardised design concerning the arrangement of bone section as well as the distribution of finger/slider holes and keys along the tubes. It appears that the finer details of their design are informed by ergonomic considerations regarding partial and complete plugging of fingerholes and operation of slider keys. Apart from the defined order of the fingerholes, the presentation will investigate and experimentally evaluate the structure and function of the slider keys as well as the options of controlling them during performance.

Digital Phenomenology in Sound Archaeology

Rupert Till

Music cannot be experienced through writing, writing freezes time onto paper, and as a time-based medium, sound cannot be heard without temporal motion. More than this, for an experience of music to be complete it needs to address our bodies. Digital technologies offer a number of powerful approaches to understanding the music and other sounds of the past. This presentation will explore a number of those affordances. It will explore how an app that illustrates music archaeology performances set digitally within visual and acoustic archaeological cultures, was used with school groups to explore history curriculum covering Roman culture, early British history, and European prehistory. It will discuss ways of engaging live group audiences further with similar content, expanding to include video projection, acoustic simulation, and live performance, and suggest the use of new digital phenomenology within multimedia music archaeology performances. It will also explore how the Oculus Rift S VR headset can be used to create a sense of flow within an audience member, and immerse them in an experiential understanding of music archaeology as well as its context.

The ‘Apulian sistrum’ on the Italiote vase-painting: searching contexts of musical performance (4th century B.C.)

Fábio Vergara Cerqueira

South Italian iconography from the 4th century B.C. reveals an interesting musical instrument with rectangular shape, reminding a ladder, which has arisen attention from scholars for its singularity. The name and nature of this musical object – and even if it is really a musical instrument – has been discussed since the 19th century. It has been given identifications as “*scalae*”, “*xylophone*”, “*platage*”, “*Apulian sistrum*” or “*rectangular sistrum*”, among others. We cannot arrive to a conclusive denomination, but it doesn’t retract from its importance for the study of ancient Mediterranean music. Some authors questioned its musical nature, proposing, for example, that it could be an abacus. There is a reason for this skepticism: it is represented mainly not being played, but carried by a figure, or suspended on the field or lying on the floor. However, a few iconographical testimonies show it being played as a kind of percussion instrument, as we can see on the *lekythos* Essen 74.158, dated from c. 360-350 B.C. Once its status as a musical instrument was confirmed, studies have focused more on subjects as its symbolic meaning (mainly amorous and funerary) or technical aspects (as its structure and how it should be played). One can identify that in many cases the painter represents it as a symbol, linked with Aphrodite and to love scenes, or as a mystic object used in rituals, in a similar way as they did with mirrors. Nevertheless, I want to approach here the context of musical performance, observing in which situations iconographical evidence testifies its musical use. This aspect has been not yet systematically analyzed. The Italiote vase-painting points to a couple of social situations, in which its sound took part on the musical atmosphere. For example, accompanying dances, as the “*veiled dance*” depicted on the vase from Essen, or during a wedding party, as on a *pelike* from Copenhagen, as well as a ritual instrument played together with the *aulos* during a worship in front of a *thymiaterion* (censer), probably on a cult devoted to Aphrodite, as on a Gnathian *lekythos* connected to the Konnakis Group from a private collection. An amazing Campanian vase now in Naples may be the only example for its use as a solo instrument (?) at a recital, played by a professional musician.

The study and reconstruction concept on the remains of plucked instruments unearthed from the Tomb of Madam Wuwei, Gansu Province, China

Wang Xidan

This article analyses the remains of plucked instruments unearthed from the madam Wu’s tomb in Wuwei, Gansu Province, China. Then the article points out the reconstruction concept about instruments themselves and performing techniques. It divided into four parts: 1.A brief introduction

on the remains of plucked instruments in madam Wu's tomb. 2. Through the analysis about literature and archaeological materials, these remains are confirmed belongs to Ruanxian (a type of Pipa in ancient China). 3. Taking account of Ruanxians in Shosoin of Japan from Tang Dynasty, we reconstruct the Ruanxians of madam Wu's tomb and discuss their performing techniques, accompaniment with other musical instruments. 4. The value of plucked instrument remains from madam Wu's tomb from the respective of Chinese musical history and Asian musical exchange

The Development of Experimental Music Archaeology in China

Wang Zhichu

As a new brunch of musical archaeology, experimental music archaeology has been widely concerned by scholars all over the world. Experimental music archaeology mainly contains the music archaeological study with the methods of experiment, and the study in laboratories, too. The application of experimental methods in music research can date back to 3000 years ago in China. The music archaeological studies in laboratories are beginning from Liu Fu in 1930s. This article introduces the author's work about restoration and reconstruction on hundreds of Chinese musical relics in recent years.