Music Archaeology on GÉANT

The reconstruction of two ancient musical instruments from Pre-Colombian Latin America through GÉANT and the ALICE2 transatlantic link

1 Quena de Hueso and Tambór: two instruments

The quena de hueso (literally bone flute) was a traditional flute of the Andes belonging to the Nasca culture (southern Peru). The reconstructed quena is a wonderful 9.5cm long instrument located at the Museo Chileno de Arte Precolombino (Chilean Museum of Pre-Colombian Arts) and it has four holes, dating back to 1000-700 B.C.

The tambor (drum) was a percussion belonging to the Gentilar culture (northern Chile) and it is more ancient that the quena, we can date it between 1200 and 1470 B.C. The reconstructed tambor is a relatively small instrument. The drum head had a diameter of 17cm and it was most probably played suspended by a small leather string.

2 The reconstruction technique: physical modelling

The technique used to reconstruct the two instruments is called physical modelling synthesis and it has been extensively tested on GÉANT and EU-MEDCONNECT2 network during the past years by the ASTRAT project. Equations and algorithms describe the physical structure of the instrument, while sounds are generated by modelling it as a mechanical system with different configurations for each note. Each instrument is defined by:

- an algorithm, describing the structure of the instrument
- a set of fixed constants, such as its dimensions and material properties
- a set of time-dependent functions, describing how the musician interacts with it.

For example, the frame drum is modelled by defining constants like the stiffness and mass density of its membrane, while a formula works out the energy injected into the system when it is struck with a particular force by the musician, producing a unique note.

3 Using ALICE2 transatlantic link to enable collaboration

Data about the two instruments were sent through the ALICE2 transatlantic link between Europe and Latin America. Several GB of data were securely exchanged in almost real time by two teams of researchers in the two continents (historians and archaeologists in Latin America, archaeologists, musicians and engineers in Europe), enabling an effective collaboration at all levels.

The software engineers in UK and Italy created two models for the two ancient instruments based on the data from Latin America. Due to the complexity of the physical modelling process, the reconstruction algorithms were run simultaneously on hundreds of computers throughout Europe and the lower Mediterranean area using the GRID infrastructures, which link computing resources through the GÉANT and EU-MEDCONNECT2 research networks, using EGIDI middleware.

Once the reconstruction phase was finished, the sounds were transferred back to Santiago in Chile, to be listened by the researchers and used by the musicians.

The two reconstructed instruments were used for the first time in public on May 14th 2010, during the official launch of ALICE2 and the second generation of the RedCLARA network.

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