## Physical Modeling of Woodwind Ancient Greek Musical Instruments: The Case of Plagiaulos

Authors : Dimitra Marini, Konstantinos Bakogiannis, Spyros Polychronopoulos, Georgios Kouroupetroglou

**Abstract :** Archaemusicology cannot entirely depend on the study of the excavated ancient musical instruments as most of the time their condition is not ideal (i.e., missing/eroded parts) and moreover, because of the concern damaging the originals during the experiments. Researchers, in order to overcome the above obstacles, build replicas. This technique is still the most popular one, although it is rather expensive and time-consuming. Throughout the last decades, the development of physical modeling techniques has provided tools that enable the study of musical instruments through their digitally simulated models. This is not only a more cost and time-efficient technique but also provides additional flexibility as the user can easily modify parameters such as their geometrical features and materials. This paper thoroughly describes the steps to create a physical model of a woodwind ancient Greek instrument, Plagiaulos. This instrument could be considered as the ancestor of the modern flute due to the common geometry and air-jet excitation mechanism. Plagiaulos is comprised of a single resonator with an open end and a number of tone holes. The combination of closed and open tone holes produces the pitch variations. In this work, the effects of all the instrument's components are described by means of physics and then simulated based on digital waveguides. The synthesized sound of the proposed model complies with the theory, highlighting its validity. Further, the synthesized sound of the model simulating the Plagiaulos of Koile (2nd century BCE) was compared with its replica build in our laboratory by following the scientific methodologies of archeomusicology. The aforementioned results verify that robust dynamic digital tools can be introduced in the field of computational, experimental archaemusicology.

1

Keywords : archaeomusicology, digital waveguides, musical acoustics, physical modeling

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