Animating 3D antique statues and engravings

Post-doctoral Position, ANIMA team, Inria Grenoble, Laboratoire Jean Kuntzmann
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Figure 1: Examples of antique statues (left: real models, right: virtual models) wearing clothes that could be animated within this project.

1- General context and objective

Antique statues and engraving in rocks are fascinating pieces of history which survived through time. They depict both shapes and ancient lifestyle as seen in Fig. 1. Although constrained to be engraved as a single static shape, these art works commonly illustrate living animated scenes and therefore contain intrinsic visual information about animated story scenarios.

The general objective of this post-doc is to take advantage of such visual information and 3D acquisition of real antique data from museums, to deform and animate a virtual reproduction of antique statues and engravings. In being able to bring life to these 3D model, in accordance with the antique lifestyle, this work would help to enhance attractiveness to antique history to the general public.

2- Methodology

While 3D scanning method is able nowadays to acquire the geometry of existing antique statues or bas-relief engravings with high precision, generating the deformation and the animation of such virtual statue remains a scientific challenge. Indeed, the deformation should be applied on the character skin geometry which is not visible as characters are generally wearing cloth layers such as long covering tunics. Entire parts of the model may also be missing, as they may not exists anymore on the real model, or related to the engraving process which doesn't depicts a fully 3D scene.

The static model must further be made compatible with animation parameters, also called rig, in order to be deformed in a plausible manner, and lead to a dynamic animated antique scene. During the project, we will focus on the particular case of bas-relief engravings, which raise specific problems that need to be addressed specifically, i.e., the characters to be animated are only partially visible and their occluded parts have to be deduced, the depth is compressed and the true proportions of the characters have to be reconstructed. To address these challenges, we will develop the following contributions in this postdoc project.

Firstly, we will develop a semi-automatic approach to infer the 3D body geometry under the clothes and ornaments from the available surface information. Using the silhouette obtained from the user's annotations, we will have to estimate the pose of the skeleton. The silhouette and pose of the skeleton will then be used to deduce a 3D skin surface (mesh) that best matches the silhouette and thus the pose of the character in the bas-relief scene [BK+16,CH+17]. Particular attention has to be paid to hidden body parts and to the depth position of each character with respect to the others. Possible extensions of this work could include other details in the scene, such as clothes, hairs and non-human characters [BB08, GCZZ12].

Secondly, the static character model will be rigged in order to be deformed, i.e., associated with an embedded skeleton linked to the skin surface through skinning weights. This rigging part is usually designed by hands by skilled computer artists, and should instead be computed in a more automatic manner from the pose in which the statue has been captured [BP07, PYX+09, BTST12, GCR13]. The other objects, ornaments, and garments of the character will further need to be efficiently associated to the character and animated accordingly [RPC+10].

Thirdly, an animated scenario will be inferred and authored from both clues provided by the static scene depiction and knowledge on antique lifestyle as well as the development of dedicated annotation inspired from storyboarding conventions, such as textual content [RS14] or visual annotation primitives [GIZ09, GRGC15], allowing to play meaningful antique scenarios.

Drawing on our previous work [CRH19, FCD19] as well as related work in animation of artworks [WCK19] and bas-relief generation [JFS21], we will propose new methods for animating bas relief engravings.

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3- Position information

Research team: The post-doc will take place within the Inria Grenoble research center, in the ANIMA research team, part of Laboratoire Jean Kuntzmann (CNRS), on authoring and directing story worlds.

Funding: application to the INRIA PostDoc campagne, April 15, 2022.

Start and duration: The post-doc is expected to start in September/October 2022 for a period of 12 months.