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Use of 3D laser scanning for replication and digital restoration of sculptures: most important recent cases studies in St. Petersburg, Russia

Vadim Parfenov*

St. Petersburg Electrotechnical University, Popova str., 5, 197101, St. Petersburg, Russian Federation
*restlaser@gmail.com

Laser 3-D scanning is powerful measurement technique which can be used for documentation and analytical techniques of any objects. At the moment there is a growing interest in the use of this technology in preservation of Cultural Heritage. Recording in 3D can produce detailed archives of important objects and makes possible digital reconstruction of sculptures and architectural fragments. One more important application is concerned with manufacturing moulds and replicas for replacements of sculptures in case their preservation requirements do not allow them to remain in their original place.

In this paper some of the most important case studies of use of 3D laser scanning for replication and digital reconstruction of out-door sculptures in St. Petersburg city (Russia) are presented. In our works we used a triangulation based scanner made by Konica Minolta (model Vi9I).

One of most important projects was the replication of an out-door marble sculpture “Primavera” (18th century, Italy) from the collection of the State museum-preserve “Tsarskoye Selo”.

Fig. 1. The Primavera: : left – original, right - replica

The post-processing of the scanning data resulted in a finished data set of approximately two and half million polygons (approximately 80 MB). Machining was done by using a 7-axis CNC milling machine, which created precise copy from a new block of Carrara white marble. When machining was complete, a small amount of hand finishing was done for removal of small, localised, drill markings. Now the replica of “Primavera” is on display on its historical place in front of the Caterina Palace in town Pushkin near St. Petersburg (see Fig.1). This work was the first case study of non-contact replication of stone sculptural monuments in Russia.

Another important case study concerns the digital reconstruction of zinc sculpture "Eve at the Fountain", which was the XIX-century copy of a marble sculpture by English sculptor Edward Hodges Baily. The mentioned copy was a part of the art collection of Maximilian Joseph Eugene Auguste Napoleon de Beauharnais, 3rd Duke of Leuchtenberg, who had a country estate Sergievka near St. Petersburg. This collection was almost completely lost during Second World War as it was a place of fierce fighting between Soviet and German troops. Fragments of the sculpture were found in the earth in the process of construction works in 2007, but they represent only 7% of total surface of the sculpture. This does not allow one to use conventional techniques of reconstruction of damaged sculptures. We created 3D model of the sculpture using of both scans of found fragments and “sculpturing” procedure carried out using software (RapidForm, Zbrush and KeyShot). The latter allowed us to create a photo-realistic images of a “reconstructed” sculpture that made it possible to create the virtual replica of the lost sculpture, which can be used for its display.