

Article

A New Practical Approach for 3D Documentation in Ultraviolet Fluorescence and Infrared Reflectography of Polychromatic Sculptures as Fundamental Step in Restoration

Luca Lanteri ^{1,*}, Giorgia Agresti ^{1,†} and Claudia Pelosi ^{2,†} 

¹ Laboratory of Diagnostics and Materials Science “Michele Cordaro”, University of Tuscia, 01100 Viterbo, Italy; agresti@unitus.it

² Department of Economy, Engineering, Society and Business Organization, University of Tuscia, 01100 Viterbo, Italy; pelosi@unitus.it

* Correspondence: llanteri@unitus.it; Tel.: +39-0761-357017

† These authors contributed equally to this work.

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Abstract: The aim of this work is to present a new practical approach to digital photogrammetry to obtain 3D models of polychromatic sculptures under ultraviolet fluorescence and near-infrared by starting from photographic images. This digital photogrammetry was applied recently to a 17th-century reliquary bust representing St. Rodonio, a saint particularly venerated by the Orthodox Church, presently under restoration in the Laboratories of University of Tuscia and belonging to the Museum of Colle del Duomo of Viterbo (Italy). The acquisitions of ultraviolet fluorescence and infrared frames were performed using a Nikon D5300 digital SLR camera and a modified low-cost digital camera (Samsung Model NX3300), respectively. The three-dimensional UV and IR models were obtained using Agisoft PhotoScan[®] software. The generated ultraviolet 3D model of the bust makes visible, in a single file, the fluorescence induced by UV radiation on the entire sculpture, highlighting surface abrasions, organic dyes, and ancient protective features. The infrared 3D model allowed for better definition of the details of the drawing used for eyes, nose and mouth definition. In conclusion, the ultraviolet fluorescence and IR 3D models of Saint Rodonio were particularly useful as documentation tools for the conservation status and for the painting construction, allowing us to perfectly map the original and restoration materials and to detect the drawing in single dynamic 3D files following a totally non-invasive, cost-effective, and rapid approach.

Keywords: 3D documentation; digital photogrammetry; ultraviolet fluorescence photography; infrared photography; sculptures; restoration

1. Introduction

The aim of this paper is to report the potentiality of ultraviolet fluorescence (UVF) and infrared (IRR) photography applied on 3D models generated through digital photogrammetry. To our knowledge, this cost-effective approach was never applied to wooden polychromatic sculptures, but only to paintings, with the aim of investigating the surface layers [1,2]. Our application is completely different because it is applied to 3D objects to obtain easy-to-manage 3D models with UV fluorescence and infrared response that can be observed and rotated in pdf file format or at a specific link (as reported in the results), supplying a very useful instrument for conservators during the restoration phases.