

LOSS COMPENSATION OF MARBLE AND ALABASTER ARTIFACTS WITH DIGITAL
TECHNOLOGIES

Theses of DLA Dissertation

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INTRODUCTION

In the field of documenting and preserving our cultural values, the knowledge and use of digital tools and opportunities are gaining increasing importance. Digitizing artifacts in the practice of restoration helps overcome the limitations of traditional methods. Degradation can be monitored through digital models, which can be used for creating reconstructions, restoring artifacts, and further research. These digital methods can lead to the discovery of new techniques, potentially enhancing examination methods and offering materials for loss compensation of sculptures. The dissertation presents the processing of digital assets, followed by the execution of modeling, along with the proactive planning processes, through four individual case studies of 3D printing.

THESES OF THE DISSERTATION

Aim of the research

The research aims to introduce new procedures using 3D techniques that can assist in the loss compensation for transparent rocks. The most challenging task in complementing the two examined rocks, marble, and alabaster, is conveying their unique aesthetic appearance, an effect that is generally difficult to reproduce even with organic binding additions.

Structure of the thesis

The dissertation can be divided into four main content units that build upon each other.

1. Chapters I-IV: These chapters explore changes in restoration techniques since the 16th century and the ethical approach defining contemporary perspectives on restoration. From the historical overview of sculpture restoration, it is evident that there is no one-size-fits-all ideal and universal restoration material or method for each restoration case. The use of traditional retouching and plastically workable restoration materials is presented because

the more techniques we are familiar with, the more solutions we have for performing expert and high-quality restoration and creatively addressing unique problems.

2. Chapters V and VI provide a general overview of applicable 3D techniques in restoration. Among the digitization techniques, structured light-based scanning and photogrammetry are elaborated upon and compared. Subsequently, the thesis presents various 3D printing technologies (FFF, SLA, DLP, MJF, CJP).
3. Material Examination: This section assesses the aesthetics of 18 sample materials (16 PLA filaments, 1 DLP, and 1 CJP printing material) used for 3D printing, evaluating subjective comparisons, color measurements, surface workability, and changes due to environmental effects.
4. In Chapter IX, the author presents the opportunities offered by 3D techniques while addressing the unique restoration issues of four artifacts (Unknown Artist: Abduction of Europe and Poseidon Alabaster Small Sculptures /Collection of NÖF Non-profit Ltd./; Unknown Artist: Roman Relief /private ownership/; Masterpiece: Circle of Giovanni da Bologna: Bearded Male Head /Museum of Fine Arts/) by executing reconstruction, combining traditional and new techniques, and experiences with fixation possibilities.

The final chapters of the dissertation include acknowledgments, the sources of the images used, a list of the literature cited, as well as an appendix containing technical data sheets and visual materials of the research results, along with the curriculum vitae.

Summary of the Results

- The application of 3D technologies in restoration is already more widespread in some countries. After reviewing numerous studies, we aimed to explore areas that have not been previously addressed or have not been examined in relation to each other. This led to the study of sample materials under different climatic conditions, the assessment of deformations caused by these effects, and the effort to summarize the methods for working with printed surfaces and their limits.
- Based on the research findings, it can be stated that the examined materials are suitable for indoor museum use in their current condition, as they experience deformation at higher

environmental temperatures. The research also anticipates the relevance of investigating 3D printed materials that can withstand outdoor effects and remain cost-effective in the future. This direction is definitely worth pursuing, as it holds numerous possibilities for the future.

- A significant advantage of using 3D printed additions lies in their repeatability. Their replacement is straightforward, as the digital files are retained, and with time, aging additions can be replaced with increasingly suitable materials.
- The range of materials that can be used for printing spans a very wide spectrum, and the product offerings are changing rapidly and continuously. In a museum environment, protecting artifacts can be facilitated by insulating fracture surfaces before applying replacements, as well as the use of previously established, tested reversible adhesive materials.
- In the case of fixation, the use of magnets can reduce the number of damaging interventions on the artifact, and the contact area of adhesive material can be minimized, thus reducing the surface contact with foreign substances.
- The suitability of the method is demonstrated by the marble portrait of Giovanni da Bologna's circle: Bearded Male Head (IN.4842), which has been restored using traditional techniques and supplemented with 3D printed augmentations. This sculpture is the first marble statue in the Museum of Fine Arts to be restored using 3D techniques.

Publication

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Agárdi F, Káldi R, Szemerey-Kiss B (2018) EFOP at the Conservation Department of the Hungarian University of Fine Arts

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Agárdi F, Káldi R, Szemerey-Kiss B (2018) Loss compensation of marble, laboratory experiments and practical consideration. In: Török Ákos, Görög Péter, Vásárhelyi Balázs Engineering Geology - Rock Mechanics 2018 (ISBN:978-963-313-283-8)

Agárdi F, Káldi R, Szemerey-Kiss B, Török Á (2016) Loss compensation of marble, laboratory experiments and practical consideration. Poster presentaion. 5th International Conference of Youth in Conservation of Cultural Heritage (YOCOCU) 21st-23rd September 2016 – MADRID, Spain