



Bibliothèque nationale de France

Digitisation report for the theatre set MAQ-131

**Bibliothèque nationale
de France**

direction des Services et des réseaux
département de la Conservation
service Numérisation

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1. Introduction

1.1. Project Overview & Objectives

This report documents the 3D modeling process of the MAQ-131 model, as part of the innovative digitisation methods explored in the National library of France by the Conservation Department. The main objective was to create an accurate digital representation of the model, while documenting the challenges and solutions implemented. This model aims to be the prototype in the effort of scaling up the digitisation process of theatre set models preserved in the Library of the Opera Museum of Palais Garnier.

The BnF Music Department's Opera Library conserves 2500 stage set models from Parisian operas and lyric theatres, notably dating from the 19th century. These set models consist of stage designs, scenery, characters... intended to be assembled in a frame simulating the opera stage and backstage, recreating the effect of depth of the multiple planes, and were used to prepare and stage the performances. The model has long been, and remains in some institutions, a contractual object in the strict sense of the term, which the set designer is responsible for developing and transferring to their employer, and from which the realization of the sets is possible. For preservation reasons, the plans of the models are however kept disassembled and flat. The presentation of the models in volume remains rare; it has been the subject of programmed selections at the Musée d'Orsay and at the Guignols Gallery of the Opera Library.

1.2. Scope of the Modeling Project (MAQ-131 model)

The initial challenge was to provide a complete digitization, allowing not only an exhaustive visualization of the model, but also the isolation of the different layers and access to information in a clear and intuitive way. Rather than a simple visual reproduction, we aimed to create an interactive experience for researchers and the general public.

2. Data Acquisition

2.1. 2D Data Acquisition: Image Capture of Planes (recto/verso)

We quickly dismissed classic photogrammetry, as it would have been unsuitable for the complexity of these models, which are often assembled and contain delicate elements. We therefore opted for almost-complete 3D modeling, relying on our expertise in heritage photography to virtually assemble the different pieces of the model.

The first step was to photograph, following a strict protocol, all the plans and elements of the model flat.



The equipment used :

Camera : Canon 5DsR

Lens : Canon Macro Art 70mm

Copy stand : Keiser RSX Copy Stand with RTX camera arm



Color Calibration : Calibrite ColorChecker Passport Photo 2 and ColorChecker 24 patches
(cf mire.jpg)
Lighting : 2 Broncolor Siros 800 S

Image resolution: according to scale 1:1

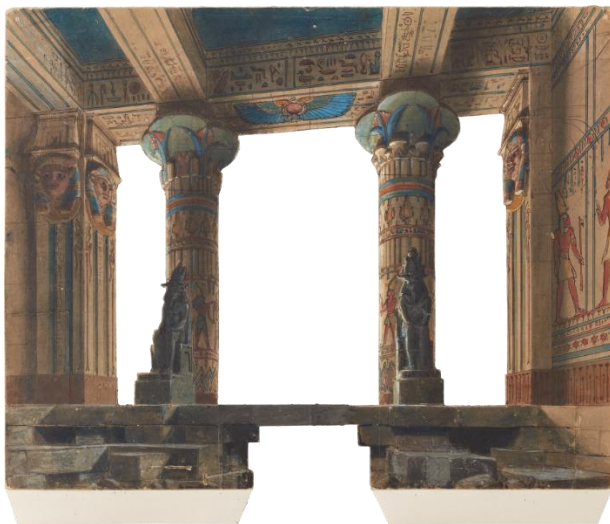
Nom fichier	Type	Taille	Dimension s	Résolution
esclaves_planBbis-recto	Fichier PNG	1,44 Mo	1225 x 836	400 ppp
esclaves_planBbis-verso	Fichier PNG	1,22 Mo	1225 x 836	400 ppp
Praticable-escalier_pharaon-recto	Fichier PNG	1,06 Mo	1039 x 1039	400 ppp
Praticable-escalier_pharaon-verso	Fichier PNG	928 Ko	1039 x 1039	400 ppp
Praticable-pharaon-recto	Fichier PNG	1,14 Mo	1417 x 1417	300 ppp
Praticable-pharaon-verso	Fichier PNG	962 Ko	1417 x 1417	300 ppp
Praticable-serveur-recto	Fichier PNG	29,4 Mo	8688 x 8688	4400 ppp
Praticable-serveur-verso	Fichier PNG	26,5 Mo	8688 x 8688	4400 ppp
praticable1	Fichier PNG	1,91 Mo	1024 x 1024	72 ppp
praticable2-femme-recto	Fichier PNG	1,66 Mo	1313 x 1313	400 ppp
praticable2-femme-verso	Fichier PNG	1,18 Mo	1313 x 1313	400 ppp
praticable3-langnette	Fichier PNG	1,45 Mo	1320 x 918	1400 ppp
praticable3	Fichier PNG	5,96 Mo	2046 x 2046	72 ppp
praticable4	Fichier PNG	1,17 Mo	1024 x 1024	72 ppp
praticable5	Fichier PNG	2,74 Mo	2511 x 2511	400 ppp
praticable6	Fichier PNG	1,14 Mo	1024 x 1024	72 ppp
praticable7-recto	Fichier PNG	3,46 Mo	1904 x 893	370 ppp
praticable7-verso	Fichier PNG	3,26 Mo	1900 x 1103	370 ppp
praticable8-escalier-recto	Fichier PNG	23,9 Mo	6775 x 5633	950 ppp
praticable8-escalier-verso	Fichier PNG	26,1 Mo	6775 x 5633	950 ppp
praticable9	Fichier PNG	2,74 Mo	2511 x 2511	400 ppp
Principale C - Milieu-recto	Fichier PNG	27,0 Mo	3892 x 5425	400 ppp
Principale C - Milieu-verso	Fichier PNG	18,8 Mo	3892 x 5425	400 ppp
Principale C_sol-recto	Fichier PNG	9,76 Mo	4523 x 1550	400 ppp
Principale C_sol-verso	Fichier PNG	7,51 Mo	4523 x 1550	400 ppp
Principale E-recto	Fichier PNG	59,5 Mo	7047 x 5659	400 ppp
Principale E-verso	Fichier PNG	54,0 Mo	7047 x 5659	400 ppp
PrincipaleC_volet_droit-figurine_droit-recto	Fichier PNG	28,9 Mo	3274 x 7310	2400 ppp
PrincipaleC_volet_droit-figurine_droit-verso	Fichier PNG	18,4 Mo	5792 x 8688	2400 ppp
PrincipaleC_volet_droit-figurine_gauche-recto	Fichier PNG	12,9 Mo	5792 x 8688	2400 ppp
PrincipaleC_volet_droit-figurine_gauche-verso	Fichier PNG	11,1 Mo	2111 x 6490	2400 ppp
PrincipaleC_volet_droit-recto	Fichier PNG	10,2 Mo	1184 x 5469	400 ppp
PrincipaleC_volet_droit-verso	Fichier PNG	7,45 Mo	1184 x 5469	400 ppp
PrincipaleC_volet_gauche-figurine_droit-recto	Fichier PNG	16,0 Mo	5792 x 8688	2400 ppp
PrincipaleC_volet_gauche-figurine_droit-verso	Fichier PNG	11,7 Mo	2986 x 6195	2400 ppp
PrincipaleC_volet_gauche-figurine_gauche-recto	Fichier PNG	18,4 Mo	5792 x 8688	2400 ppp
PrincipaleC_volet_gauche-figurine_gauche-verso	Fichier PNG	19,9 Mo	3592 x 6718	2400 ppp
PrincipaleC_volet_gauche-recto	Fichier PNG	32,7 Mo	1367 x 5709	400 ppp
PrincipaleC_volet_gauche-verso	Fichier PNG	28,0 Mo	1367 x 5709	400 ppp



principale_A-recto	Fichier PNG	52,3 Mo	6559 x 5613	370 ppp
principale_A-verso	Fichier PNG	31,4 Mo	6575 x 5609	96 ppp
Principale_B-recto	Fichier PNG	57,3 Mo	6432 x 5599	370 ppp
Principale_B-verso	Fichier PNG	34,1 Mo	6432 x 5599	370 ppp
Rideau_de_fond-recto	Fichier PNG	46,2 Mo	5874 x 4517	370 ppp
Rideau_de_Fond-sol-recto	Fichier PNG	11,8 Mo	5565 x 2185	400 ppp
Rideau_de_Fond-sol-verso	Fichier PNG	9,41 Mo	5565 x 2185	400 ppp
Rideau_de_Fond-sol_escalier-centre-recto	Fichier PNG	868 Ko	1297 x 352	400 ppp
Rideau_de_Fond-sol_escalier-centre-verso	Fichier PNG	488 Ko	1297 x 352	400 ppp
Rideau_de_Fond-sol_escalier-droit-recto	Fichier PNG	650 Ko	454 x 248	400 ppp
Rideau_de_Fond-sol_escalier-droit-verso	Fichier PNG	568 Ko	454 x 248	400 ppp
Rideau_de_Fond-sol_escalier-gauche-recto	Fichier PNG	302 Ko	459 x 341	400 ppp
Rideau_de_Fond-sol_escalier-gauche-verso	Fichier PNG	204 Ko	459 x 341	400 ppp
Rideau_de_fond-verso	Fichier PNG	31,9 Mo	5876 x 4516	370 ppp
sol_planBbis-recto	Fichier PNG	9,66 Mo	5484 x 1516	400 ppp
sol_planBbis-verso	Fichier PNG	8,01 Mo	5484 x 1516	400 ppp

2.2. Addressing Challenges: Collated Plans & Hidden Elements

We immediately encountered a first problem: some of the plans were glued together. It was then necessary to separate the plans and create clean files for each one. We used Adobe Photoshop to carefully separate the plans, meticulously outlining each one to account for any transparencies. This ensured that each individual layer could be accurately reconstructed in the 3D model. We prioritized maintaining the integrity of the original artwork during this process, employing non-destructive editing techniques where possible to preserve detail and allow for potential future adjustments.



3. Modeling Process

For the modeling, we used the open-source software Blender. To create the geometry of the plans, we opted for inserting the images into the 3D scene as planes. This function in Blender allowed us to generate the geometry directly from the image.



We then cut the plane following the transparencies in the image, creating a shape geometrically identical to the original plan. This operation was repeated for each plan to obtain a 3D object for each element. There were some elements that should have volume, which we achieved by folding the source plan accordingly.

The next step was to assemble all the elements into a single 3D scene to virtually reconstruct the model. At this stage, the assistance of the restorers was essential. We relied on their documentation and research to reconstruct the positioning of each plan, and validated each element with them to ensure historical accuracy. This collaborative approach was critical to maintaining the integrity and authenticity of the virtual reconstruction.

For the double faced planes we used nodes in Blender shading according to the following protocol :

