

# KINTSUGI 3D BUILDER: USER EXPERIENCE DESIGN AND IMPLEMENTATION

AUTHORS: IAN ANDERSON, JACOB BUELOW, ZOE CUTHRELL, LUKE DENNEY, ELLIOT DUFFY, AUGUSTO FREITAS, BLANE SUESS, ISAAC TESCH, AND NATHANIEL WILLIUS

ADVISORS: MICHAEL TETZLAFF AND DARCY HANNEN



## Feature Developments

### Summer 2023:

Student researchers developed several features over summer, 2023, including:

- A **grayscale calibration** process using a calibration chart to compensate for tone mapping and exposure of imported photos and allow for more accurate lighting.
- The functionality to **undistort images** to compensate for lens distortion in the original photographs.
- A **PC install wizard** to improve user experience when downloading Kintsugi 3D Builder on PC computers.

### Spring 2024:

A new team of student researchers worked on additional features through the spring semester, 2024, including:

- A simplified method for **creating Kintsugi 3D projects from existing Metashape projects**.
- Working **export button** and a simplified user experience when using file explorer.
- Simplified and **improved user experience** when using the welcome window.

## Metashape Import Structure

Metashape is a widely used photogrammetry software in industry, which is why Kintsugi 3D was specifically tailored to integrate with it. A recent focus in this integration was creating an efficient method for constructing Kintsugi 3D projects from existing Metashape projects. The primary challenge was extracting the necessary files from Metashape's project structure and passing them to Kintsugi 3D's regular construction methods.

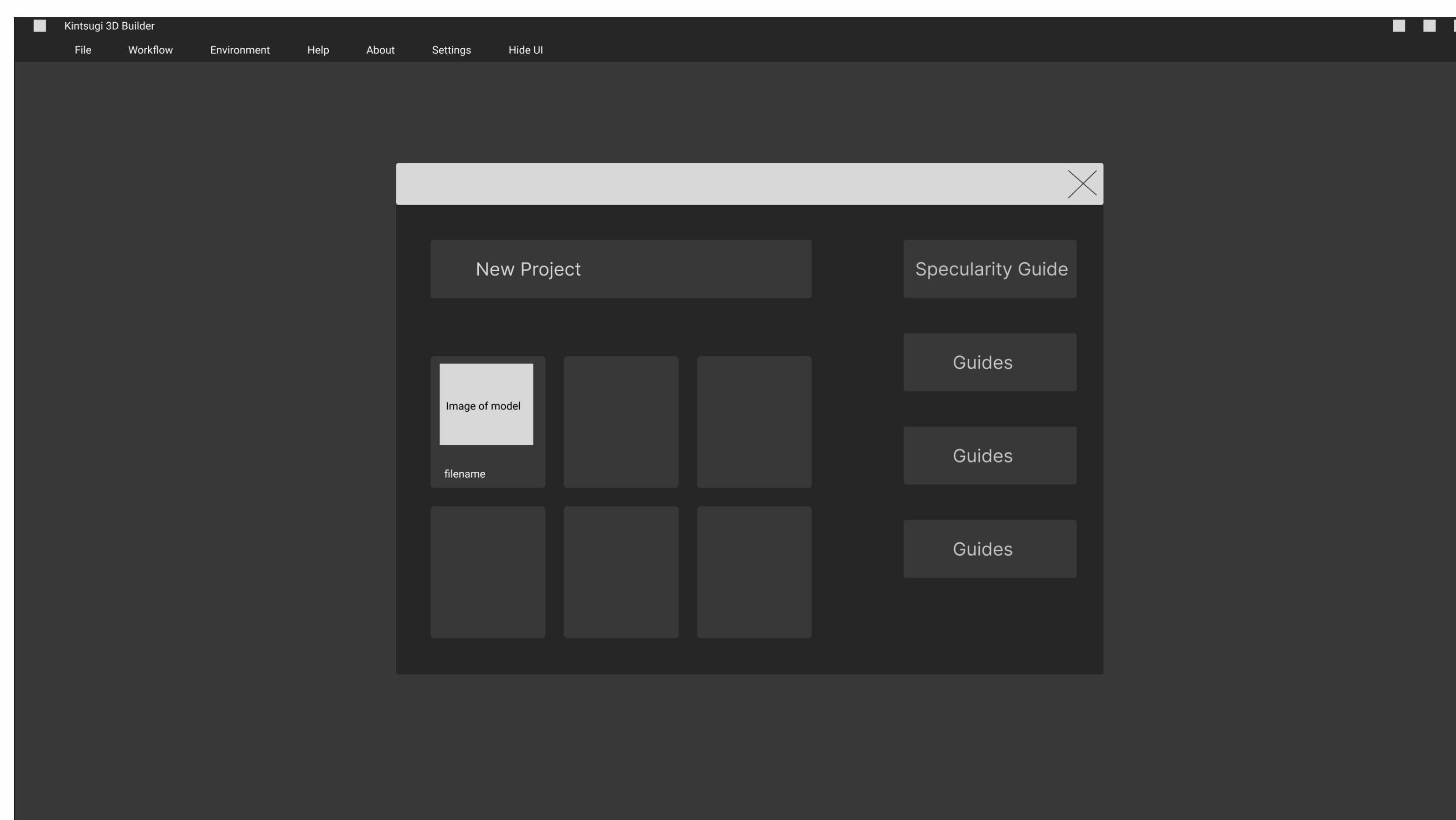
```
MetashapeProject/  
├─jade.psx  
├─images/jade_image1.jpg  
├─jade.files/  
│   └─project.zip/doc.xml  
│       └─0/  
│           └─chunk.zip/doc.xml  
│               └─0/  
│                   └─model/model.zip/model.ply  
│                       └─frame.zip/doc.xml
```

An Example Metashape Project File Structure

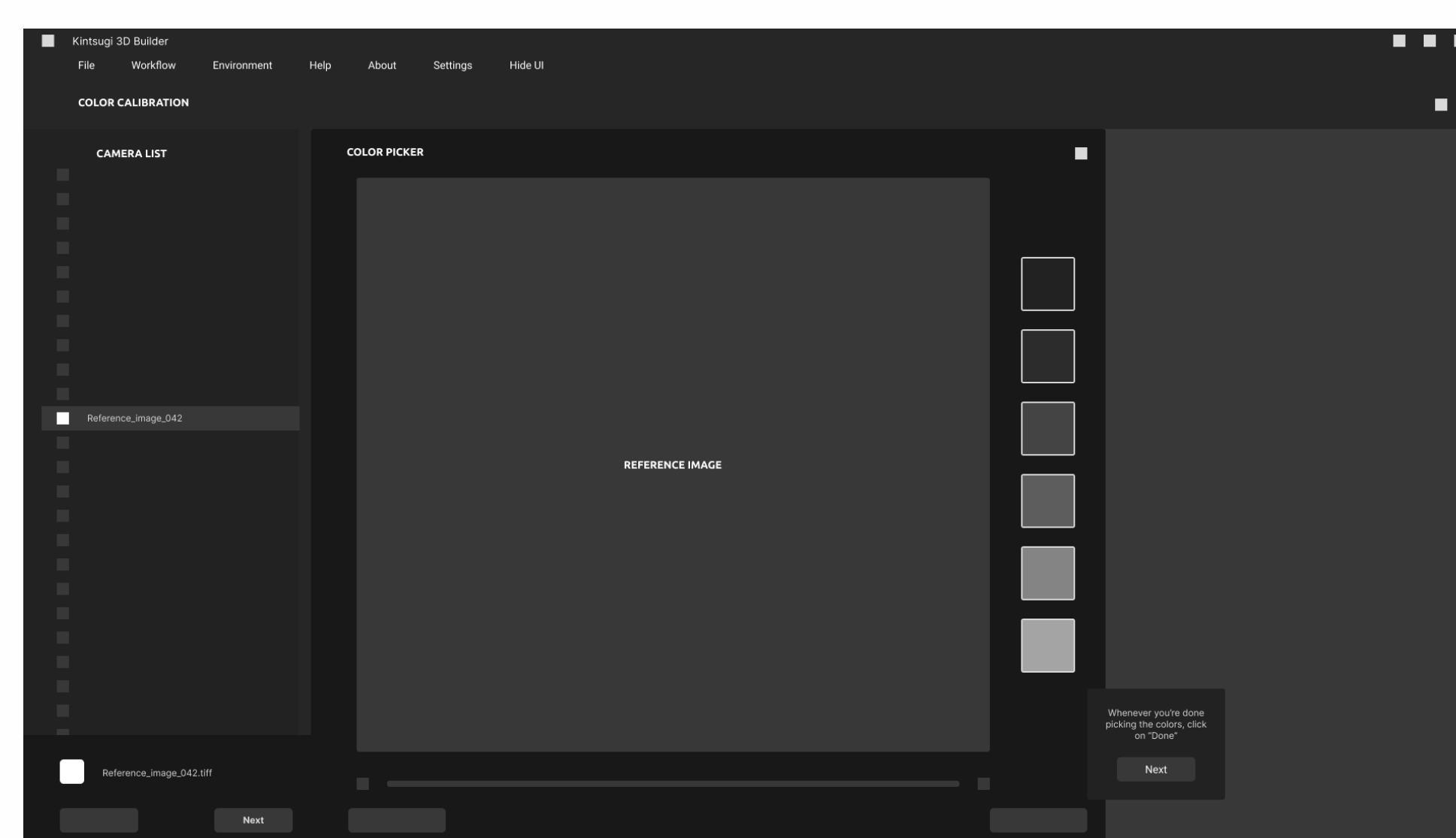
## Abstract

Photogrammetry is the process of using 2D photographs to generate a 3D model of a real object. Developed by researchers at UW-Stout, Kintsugi 3D is a new software suite that allows users to import and process data from photogrammetry software to generate a more accurate digital representation of a 3D object. Using information derived from source photographs, Kintsugi 3D captures texture, color, material, and shininess more accurately than standard photogrammetry software. Thanks to contributions from UW-Stout students and staff in the summer of 2023, the Kintsugi 3D suite supports several features to enhance user experience. These features include a PC install wizard, built-in grayscale calibration, automated undistortion of photographs from photogrammetry calibration, and direct importing of projects from photogrammetry software. We also aim to observe current photogrammetry tools, particularly Metashape, and extend the Kintsugi 3D suite to include features and UI design choices from these tools and export them in glTF format for other software.

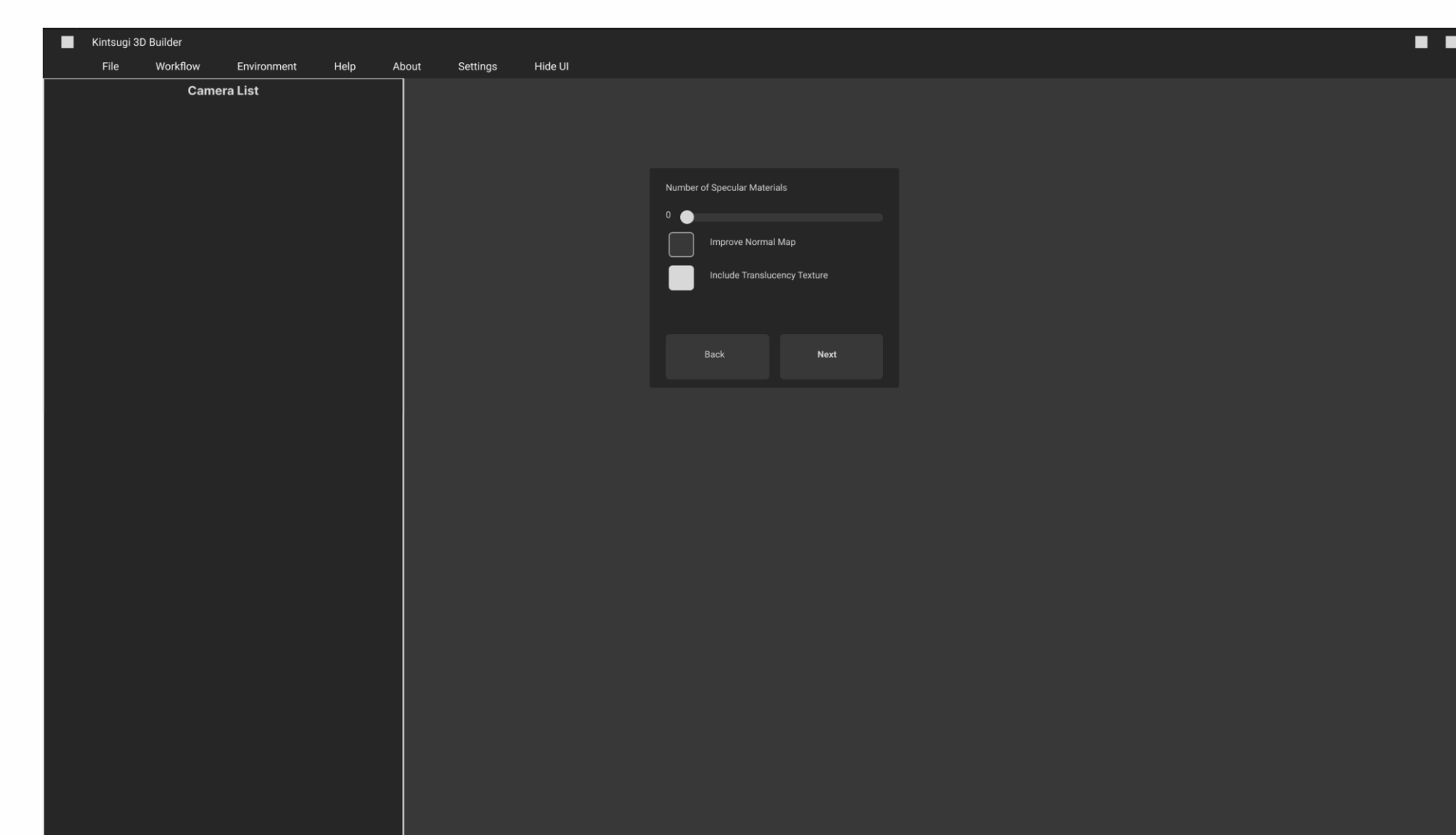
## Wireframes



Welcome Window



Grayscale Calibration

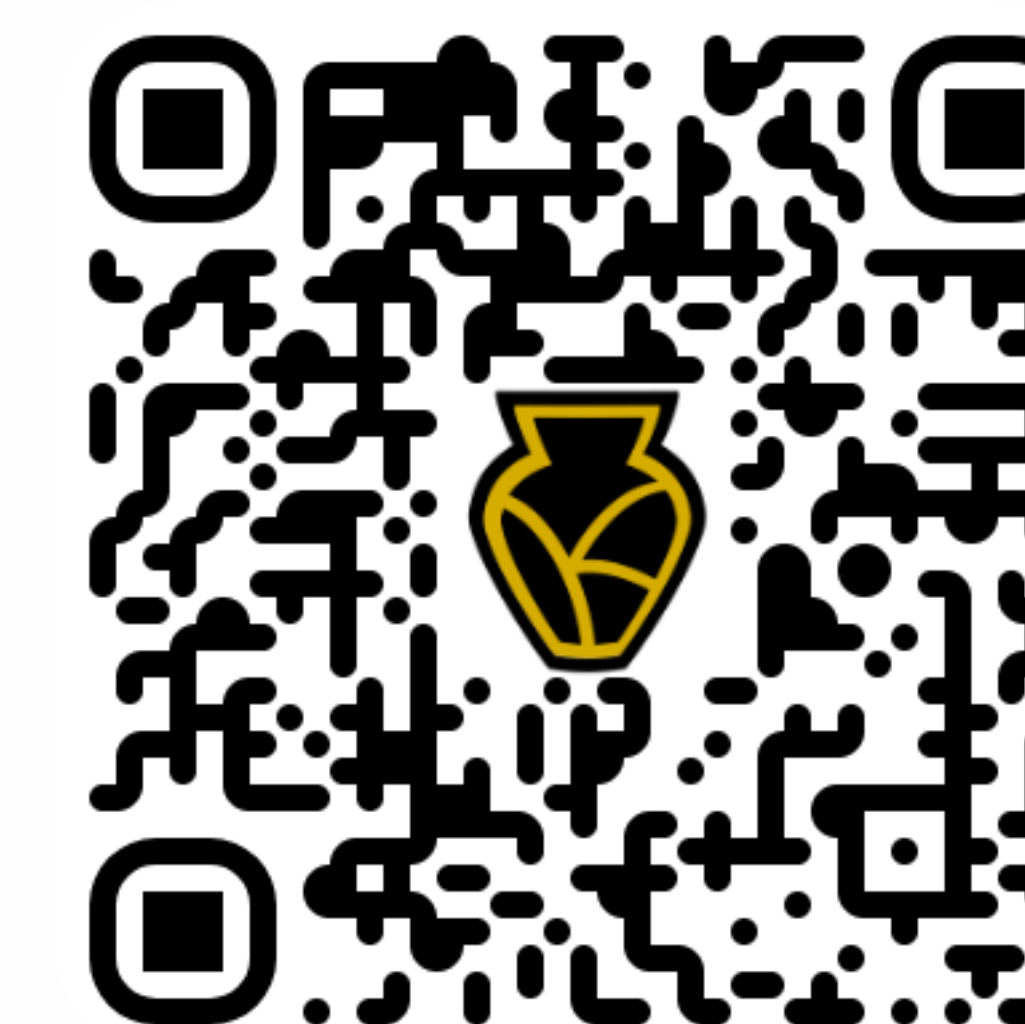


Texture Process Options

## Features

Kintsugi 3D Builder is a software program for enhancing 3D models created from photogrammetry (using flash-on-camera illumination) by synthesizing an empirically-based specular material derived from the source images. Kintsugi 3D Builder allows the user to:

- Import projects from Agisoft Metashape.
- View highest-quality results in the related project, Kintsugi 3D Viewer.
- Export diffuse, normal, specular reflectivity, and specular roughness maps to be uploaded to Sketchfab for medium quality rendering.
- Export in glTF format for broad support in many 3D applications at an acceptable quality level.
- Use a color reference chart to reverse tonemapping and calibrate textures to represent absolute reflectance.
- Calibrate the offset of the flash from the camera to mask shadows and prevent normal map bias.



## User Interface Developments

A priority in development is creating a workspace that is functional, but also easy to understand and use. As such, student researchers worked on creating wireframes that outline designs for layouts that will be implemented in the future.

A major part of the UI design so far has been the creation of an onboarding process which can teach new users or refresh existing users.

## What's Next

Currently Kintsugi has only been used with the Agisoft Metashape software, to help support a wider range of users for Kintsugi 3D. To reach that goal we researched other photogrammetry software's commonly used in the industry.

**Meshroom** has a simple and clean looking interface but is also very cluttered because everything is open at once. The user is only able to close two of these windows. This cluttered UI affects how well the user can see the model.

We also plan to add support for **Reality Capture**.

The next phase of the project will also involve implementing more of the UX wireframes into the working software.

## Acknowledgements

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