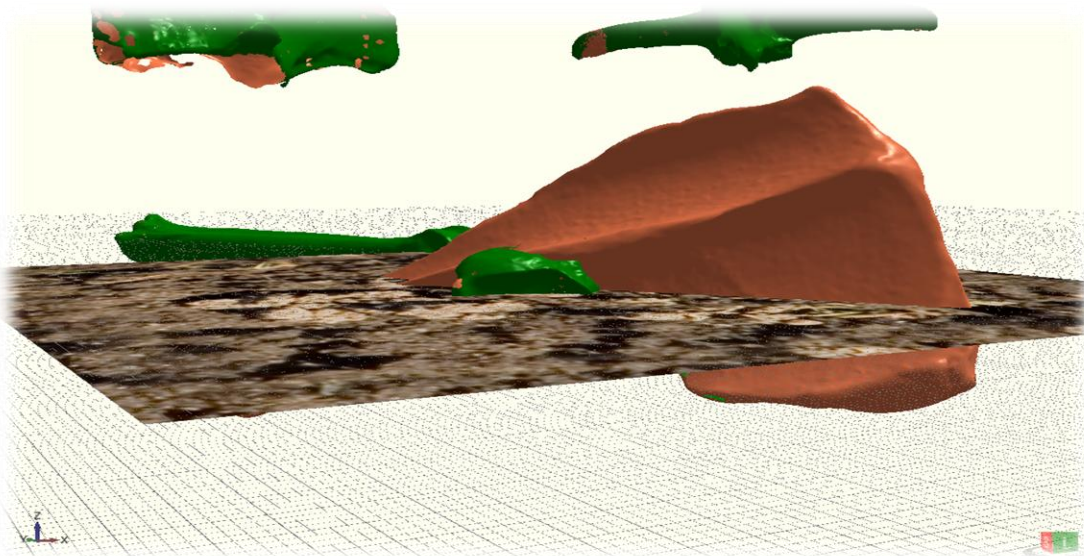**ArcchéoZoo3D: an interactive application for virtual excavation manipulation**

Report by:

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Supervised by:

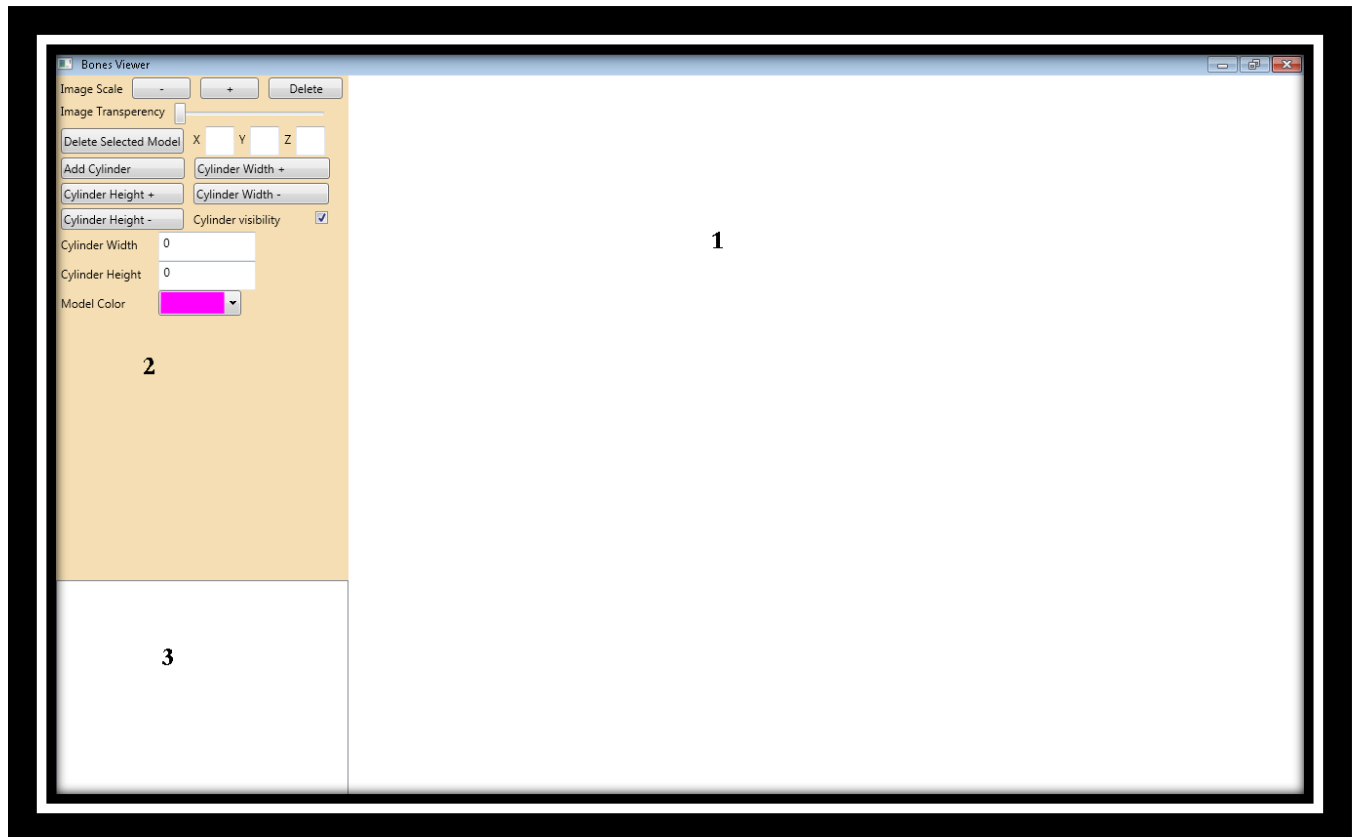Alamin Mansoury, Patrice Meniel and Patrick Juillion

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A general feeling:

BonesViewer is developed to help archaeologists to better visualize bones - found in excavations - in 3D, the image above shows the 3 main sections in the application. The first section is the main section where users can build their scenes and load their models. The second section contains the necessary controls that apply operations or show information regarding the scene/models loaded in section 1. The third section is where the user loads a folder of models to choose from.

Technologies used:

Since the main aim of the software is to *visualize* bones, we have investigated the best ways to do this 3D visualization process and we

came up with the idea of using Multi-touch devices and develop a software accordingly, using Multitouch, the user may use one or both hands to visualize the scene in a very natural and intuitive way. The user can rotate, zoom out, zoom in and translate the scene or the models in addition to the ordinary tasks of loading files or creating scenes etc .., we also considered the case where no Multitouch device is present, the application then has to fully support mouse manipulations.

Microsoft has implemented some built-in Multitouch functionality in their Windows 7 operating system, Windows 8 is fully Multitouch supported, we decided to use then Microsoft environment for our application. We benefited from and used the following technologies.

- ❖ .NET framework (C#).
- ❖ WPF (Windows Presentation Foundation), Microsoft technology for building desktop applications using XAML.
- ❖ HelixToolKit, a free source XAML-based library to build 3D application.
- ❖ Microsoft Surface framework 2.0.
- ❖ Dell Multitouch screen.

Files:

We have two different files to deal with, firstly we have bones models files with .obj extension, we need to load these files into our scene. An empty panel (section 3 in figure 1) is created where a folder can be loaded with the models files being inside it, the files will appear with their names as a list in the panel, the user can then drag and drop one

file at a time to be loaded at scene origin, drag and drop can be done with left mouse button or using one finger if touch is used.
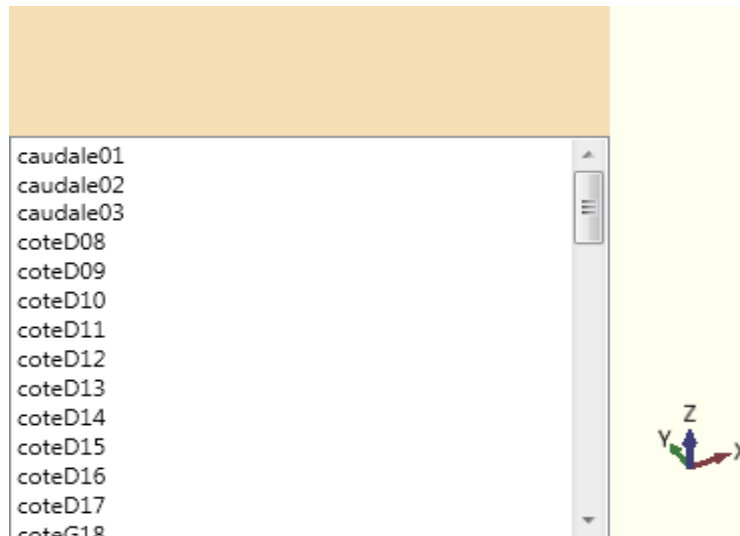
Secondly, we have our own files type for the application, this is for the projects created by the user and we want to be able to save them and load them again when needed. The application save a project file with .XAML extension – can be changed though – since the 3D models are contained within our XAML controls, the user can then save the file for later review. Similarly the user may want to load – and edit, obviously - whatever he saved earlier using the same file project. These options exist in the application context menu (see Context menu in page No. 7).

Scene and models Manipulation:

There is a default grid in a every scene/project, right there we have our origin point (0,0,0), this center point is where zooming in and out are based on, the user may use the mouse wheel to do that. To change the zoom center point a double right-click on the new point is required.

Right click with mouse movements will perform rotations, left click with mouse movements will perform translation.
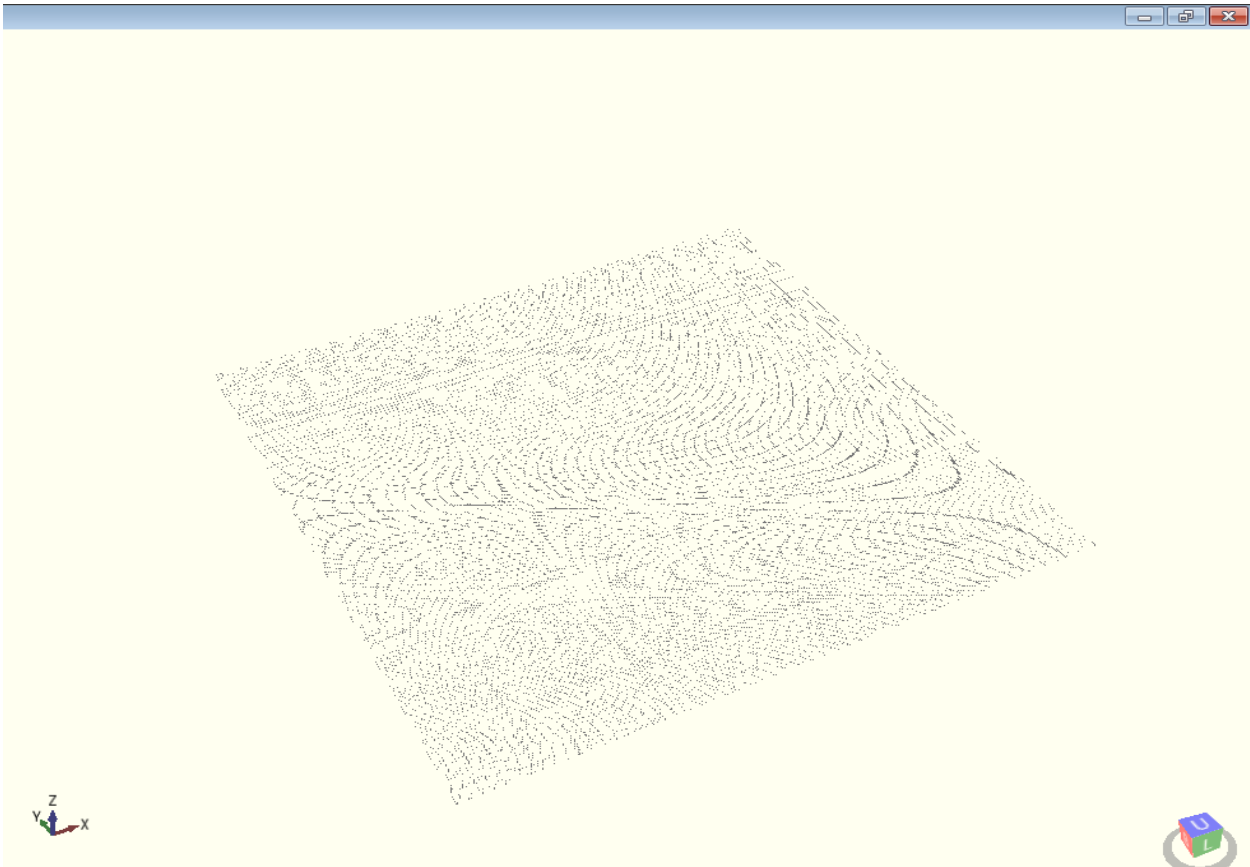
Using the Multitouch, user can zoom in and out using two fingers, the gesture consists of these two fingers moving towards each other or moving away from each other depending on the zoom gesture wanted, of course the zoom center point depends on the location of these two fingers, and it is always in the middle between them. One finger is used for translation and rotation, to change between the two operations, one touch on the scene is required.

The arrows on the bottom left in figure 3 show the orientation of the 3 axes X,Y and Z, and the box on the bottom right shows the camera orientation between Left, right, up, down, front and back.
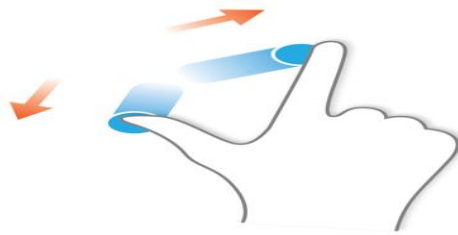
The same operations can be applied on models but in a different way, a model can be selected using double left-click or one simple touch, a *manipulator* is then attached to the selected model (the model appears in purple in figure 5), where the user can use the *manipulator* colored bars or circles to translate or rotate over axes respectively.
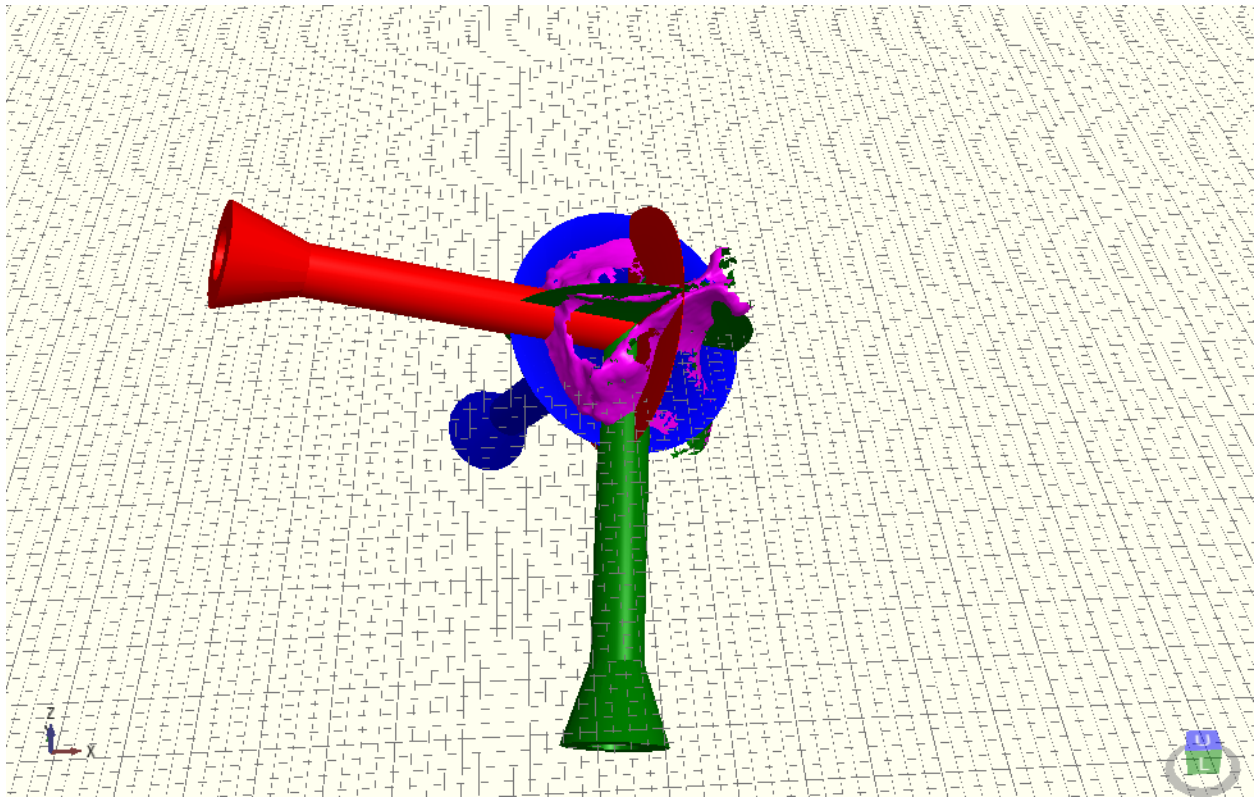

Figure 5, Manipulator

Context menu:

An ordinary Windows-like context menu won't fit well with a Multitouch application, instead a circular context menu is developed. When using the mouse, one right click is required to trigger it up, using Multitouch, a long press gesture is required.

Figure 6, long press gesture

From the context menu, the user can do the following tasks

- ❖ Create a new scene/project (New).
- ❖ Open an existing saved scene/project (Open).
- ❖ Load another grid (Load Grid).
- ❖ Open the" About" window of the application (About).
- ❖ Save the current scene/project (Save As).
- ❖ Load an image (Load Image).
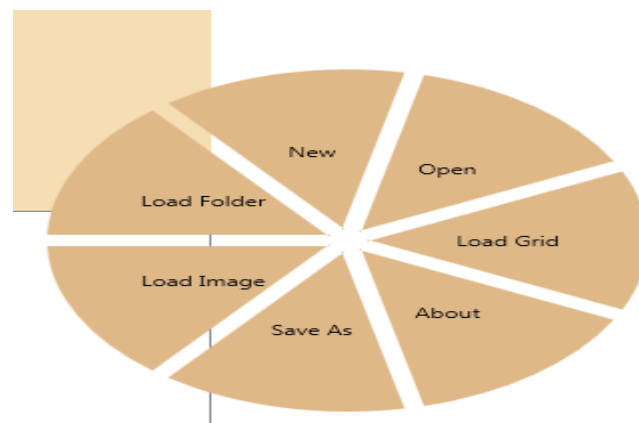- ❖ Load a folder of models (Load Folder).

Figure 7, Context menu

Operations:

After loading the models and be able to manipulate them, some other operations may be required to be applied on them or some information to be shown about them, section 2 in figure 1 contains few controls to achieve these requirements.

❖ **Loading an image:**

Sometimes it is necessary to load an image – from excavation field – to help guide positioning the bones, user can load an image on a certain height, scale it and then remove it, check figure 8, the slider controls the transparency of the image in case the user wants to keep it and see through it.
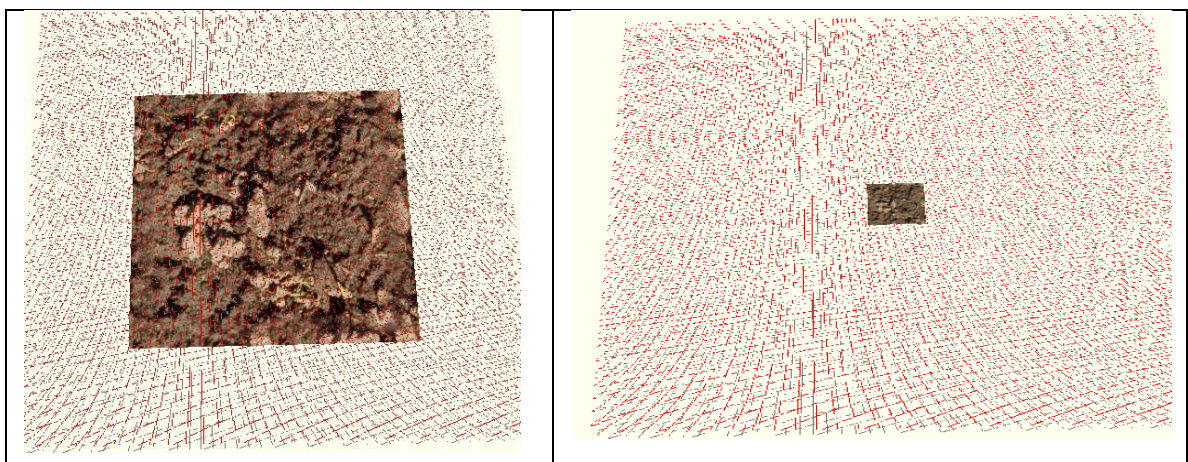

Figure 8, Image controls

Figure 9, An image with different scales

8

❖ Models:

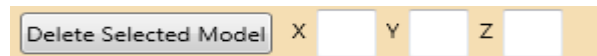The user can remove the selected model and check its position in the 3D space.

Figure 10, models controls

❖ Cylinder:

Cylinders are there to imitate excavation holes, the user can load a cylinder, manipulate it in the scene, control its height, width and control its visibility to better arrange models inside it.
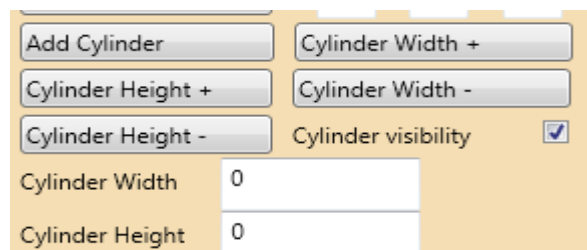

Figure 11, Cylinder controls

❖ Color palette:

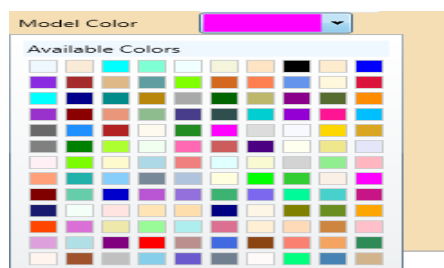User can choose from a large collection of colors to load models with.
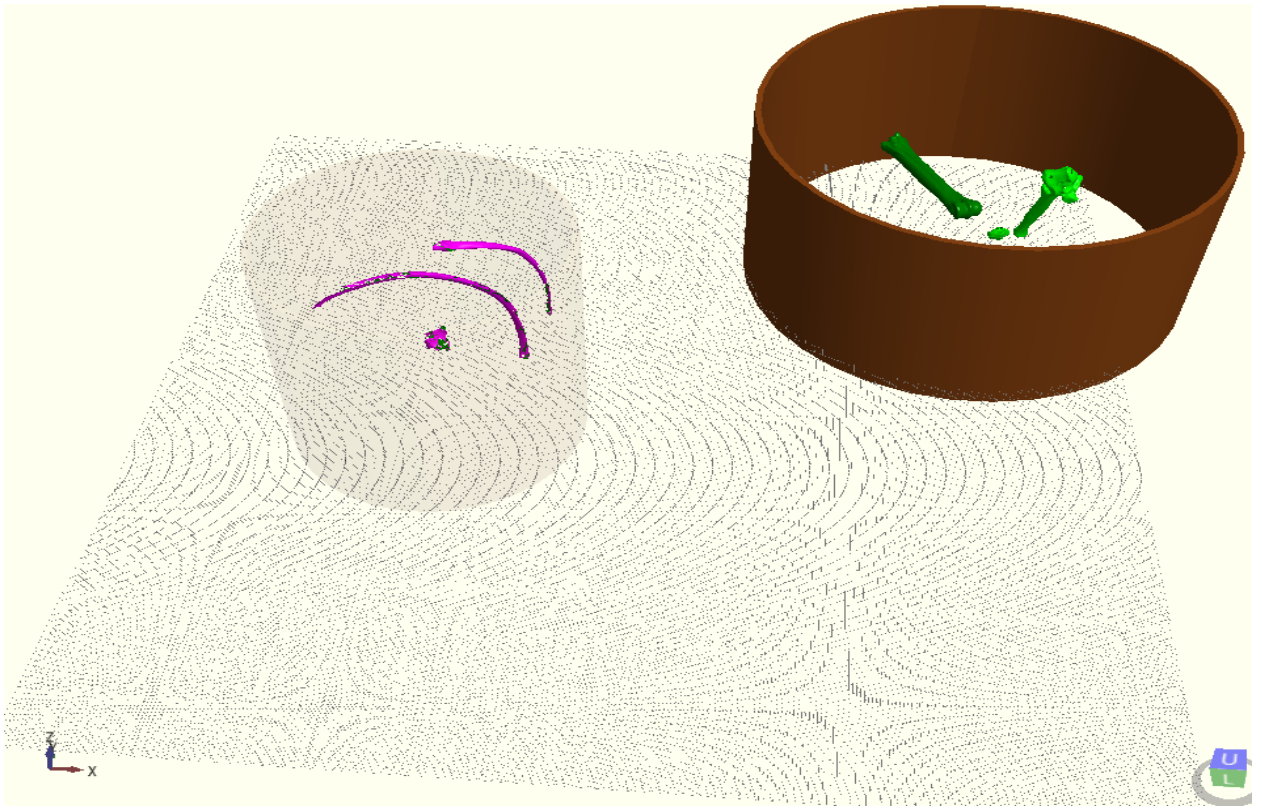

Figure 12, Models colors

Figure 13, 2 different cylinders with two different group of models