



D4.1 AR App

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¹ **R**=Document, report; **DEM**=Demonstrator, pilot, prototype; **DEC**=website, patent fillings, videos, etc.; **OTHER**=other

² **PU**=Public, **CO**=Confidential, only for members of the consortium (including the Commission Services), **CI**=Classified, as referred to in Commission Decision 2001/844/EC

Modifications index	
29/07/2019	Initial Release of PLUGGY3D suite (AR App)
04/09/2019	Initial Release of this document, a short description accompanying the deliverable.



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EXECUTIVE SUMMARY

This deliverable describes the various applications (the PLUGGY3D *suite*) that were created to import, edit, process, manage and create AR and VR content within the PLUGGY Social Platform and Curatorial Tools. The PLUGGY3D suite includes the following applications:

- PLUGGY3D Create – to edit and process 3d object files within a web-based platform
- PLUGGY3D Curate – to create AR and VR exhibitions within a web-based platform
- PLUGGY3D Experience Web – to experience the exhibitions in a web-based application integrated in PLUGGY Social Platform.
- PLUGGY3D Experience Mobile – to experience the exhibitions created with the web-based application, within a mobile-based (Android) platform.

A Video demonstration of the PLUGGY3D Experience Android Demo can be found at the following link: <https://vimeo.com/350289187>

1 Introduction

D4.2 – AR App is a deliverable of type OTHER and this document is its accompanying report.

In the next paragraphs we describe the web and mobile apps that make up the *suite* we call PLUGGY3D. The web apps, divided into PLUGGY3D Create, PLUGGY3D Curate and PLUGGY3D Experience Web, are integrated into the PLUGGY social platform and a part of the platform’s curatorial tool. They are developed to manage all the content necessary to create virtual exhibitions in Augmented Reality around 3D models, enhancing on-line and/or on-site visits to museums or other indoor cultural sites. PLUGGY3D Experience Mobile allows experiencing the virtual exhibitions in Android devices supporting the AR Core technology.

Figure 1 shows a complete scenario in which the PLUGGY3D apps can be used, from the modelling of a 3D object, which lies outside the scope of PLUGGY, to the experience of an Augmented Reality exhibition around the object:

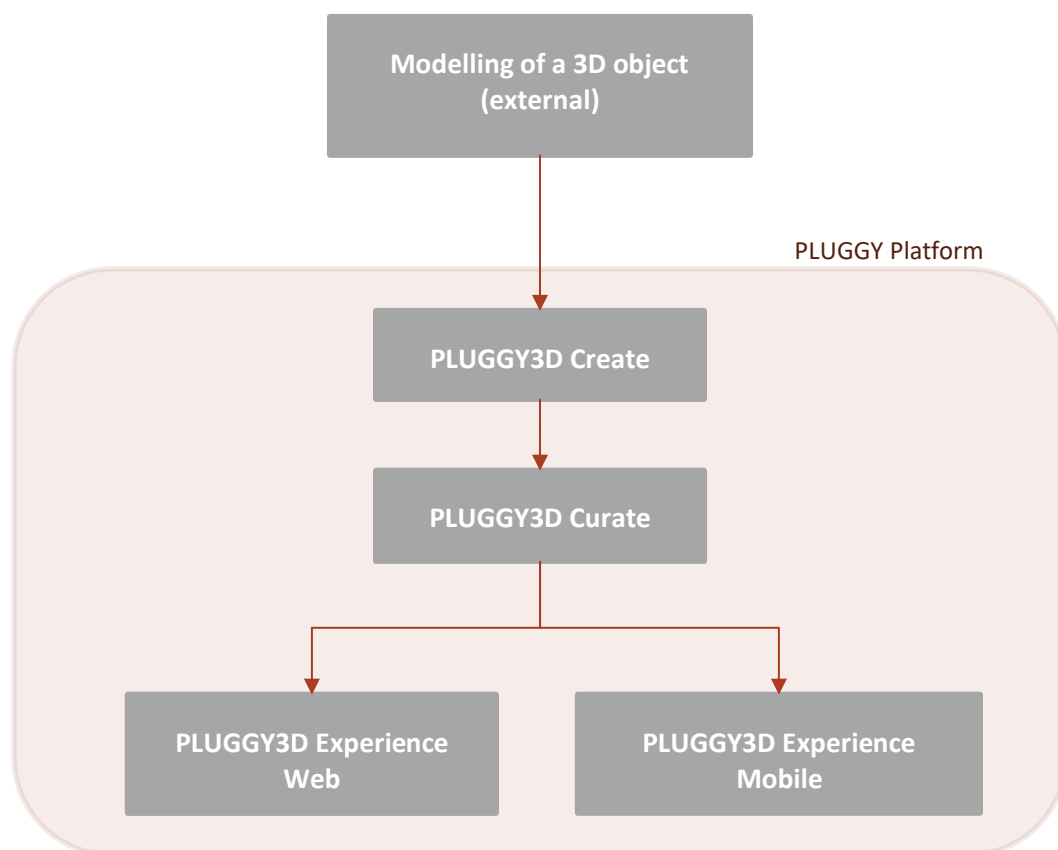


Figure 1. PLUGGY3D Suite workflow.

In this way PLUGGY users, whether institutions or citizens, are given all the necessary instruments; without the need for specific devices, external tools (software and/or hardware), specialised knowledge or resources.

The PLUGGY3D web applications are seamlessly integrated in the Social Platform and Curatorial Tool, both accessible under the address <https://pluggy.eu>; they have been developed with the Angular framework, used to create the Social Network and Curatorial Tools front-ends themselves. Interaction with the 3D content has been done using the hom3r technology³, developed in Unity3D. The hom3r technology is also the rendering core of the PLUGGY3D mobile app, while the Augmented Reality functionality is provided by Google's ARCore technology.

PLUGGY 3D Experience Mobile provides both AR and VR modes to experience content. Since not all Android devices support the ARCore technology⁴, PLUGGY3D automatically detects non-supported devices, for which only the VR mode is presented. This allows any user with an Android 8.0 or later device to experience the content.

³ <https://proyectos.diana.uma.es/hom3r/>

⁴ <https://developers.google.com/ar/discover/supported-devices>

2 PLUGGY3D Create

PLUGGY3D Create is a web application which allows basic 3D Model edit functionality for the 3D models uploaded to the Social Platform. See Figure 2.

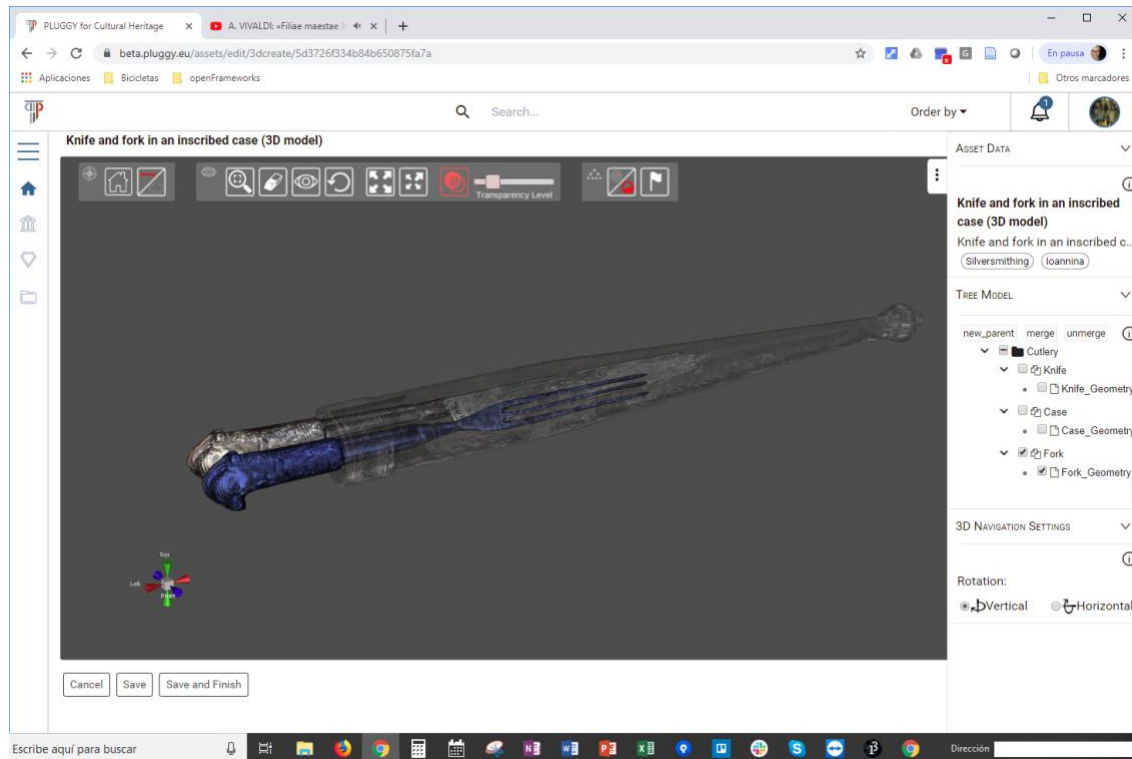


Figure 2. PLUGGY3D Create is a web application which allows basic edition of product tree and 3D navigation settings.

The functionality of PLUGGY3D Create includes:

1. Edit of Product Tree, including merging geometries into nodes, or creating groups of nodes by adding new parent nodes. This allows multiple selection of model parts for exhibitions that use the object.
2. Edit of main rotation axis in 3D navigation. This allows a more natural navigation for elongated objects which have a natural main axis of rotation. For example, a tall building will have a vertical main axis.

3 PLUGGY3D Curate

PLUGGY3D Curate is a web application that allows the creation and edition of virtual exhibitions using the 3D models uploaded to the Social Platform. See Figure 3 and Figure 4.

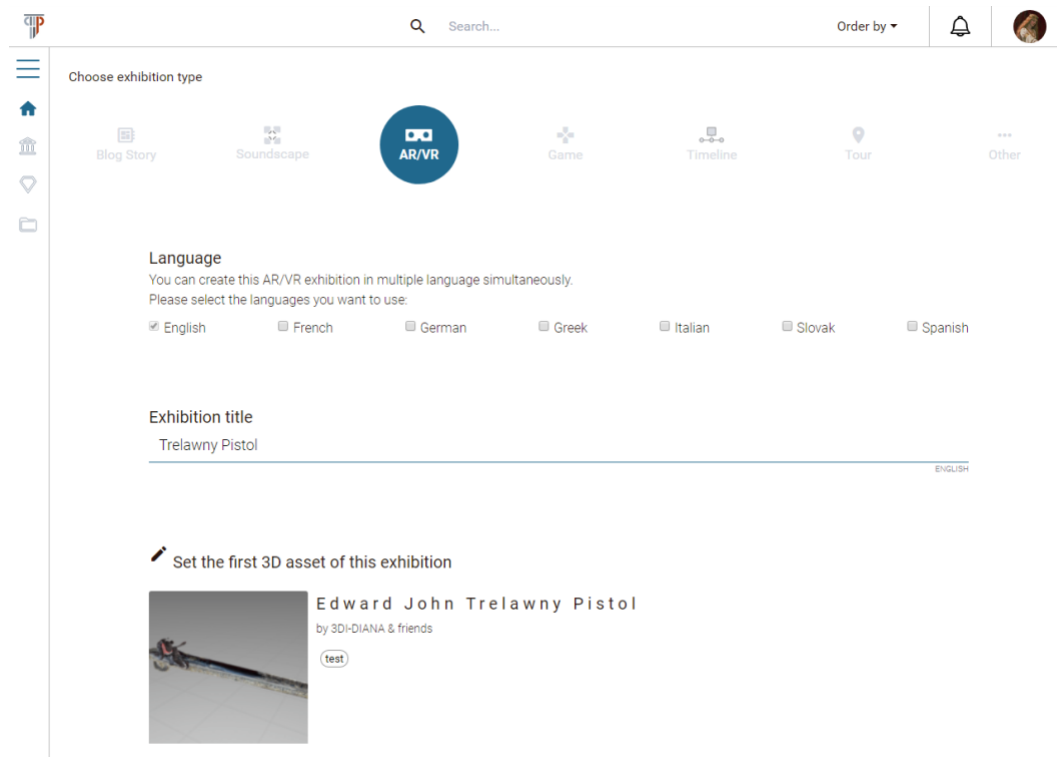


Figure 3. PLUGGY3D Curate is a web application that allows the creation of AR and VR exhibitions in different languages.

The functionality of PLUGGY3D Curate includes:

1. Create exhibition content in different languages.
2. Add new chapters to the virtual exhibition. Each exhibition is divided in steps called chapters. Each chapter shows a scene of the selected 3D object, which can be augmented with additional information (see below).
3. Add short text content of a 3D model in the form of 3D labels. These text labels are attached to a selected part of the 3D model. The location of the label is editable.
4. Add a long description text in each chapter in the form of a 3D panel. This panel can be located around the scene.
5. Highlight a selected area of the 3D model in use with a color.
6. Hide areas of the 3D model in use. This functionality allows a better display of the parts of the model from different points of view.

- Set the transparency level of an area of the 3D model in use. This functionality allows a better display of the parts of the model from different points of view.

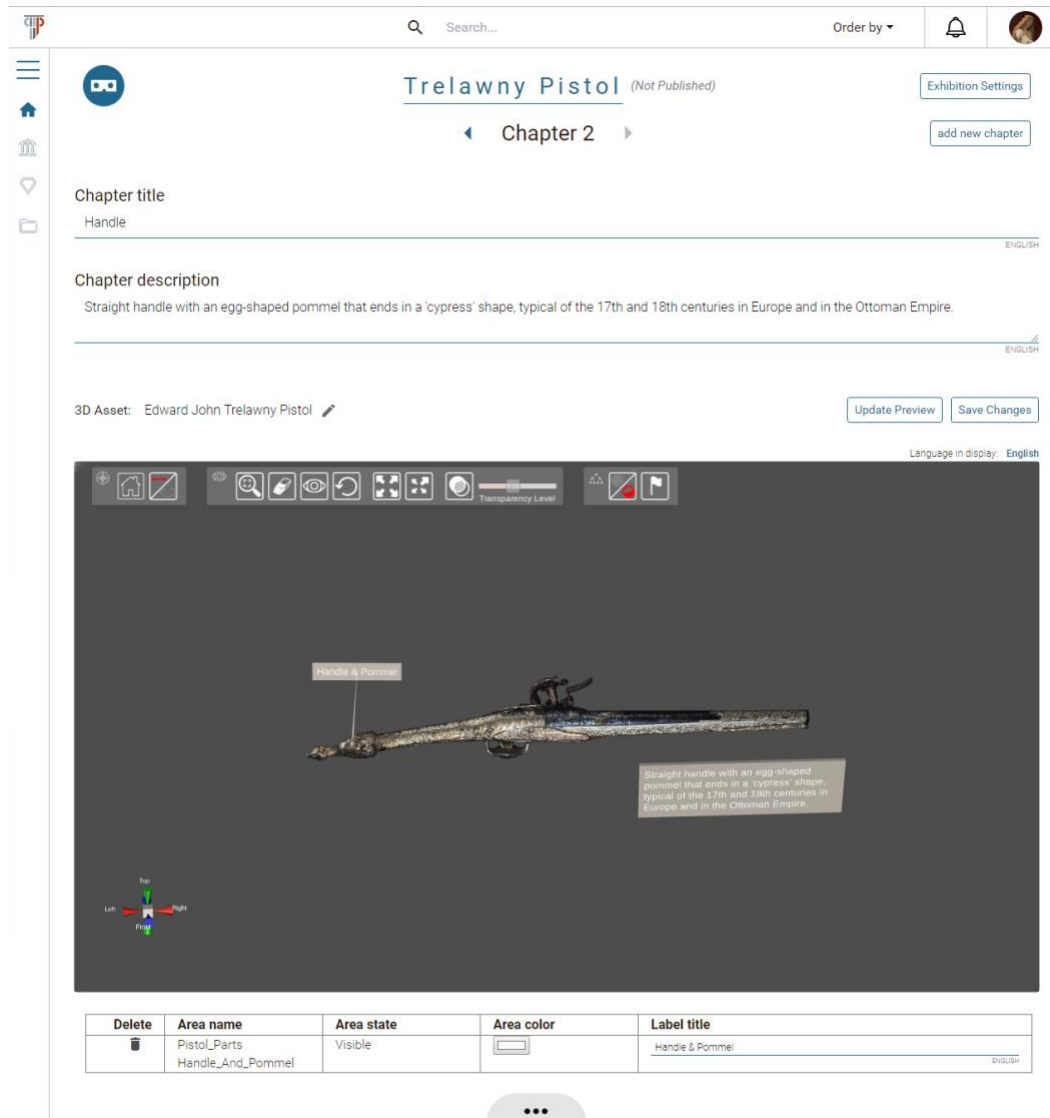


Figure 4. PLUGGY3D is a web application that allows the curation of AR and VR exhibitions using 3D models and additional text content, plus various ways of highlighting or focusing specific areas of the models.

4 PLUGGY3D Experience Web

PLUGGY3D Experience Web is in a web-based application integrated in PLUGGY Social Platform to experience virtual exhibitions created with PLUGGY3D Curate. See Figure 5.

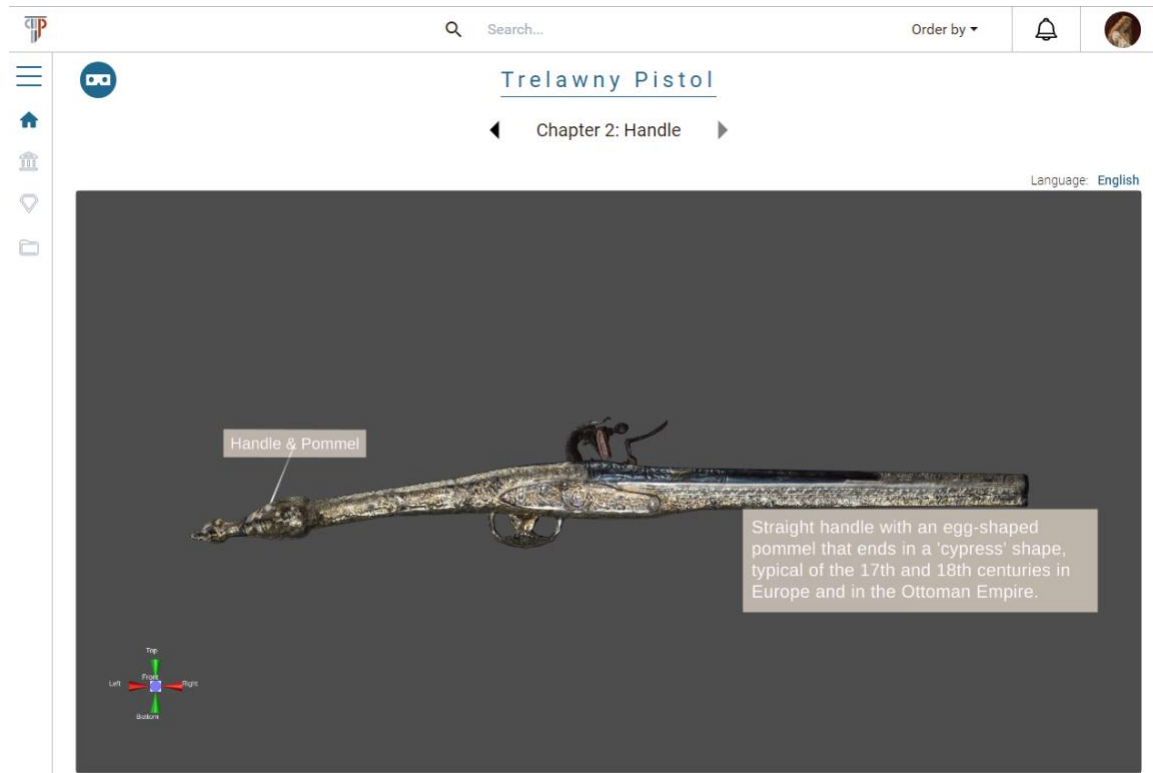


Figure 5. PLUGGY3D Experience Web is a web-based application integrated in PLUGGY Social Platform to experience the exhibitions created with PLUGGY3D Curate.

The functionality of PLUGGY3D Experience Web includes:

1. Three-dimensional visualization of the exhibition in the web browser.
2. Manipulation of the 3D Model in view. This functionality allows the user to rotate and zoom in and out of the object.
3. Change of language in display. If the exhibition is available in different languages, PLUGGY3D Experience Web allows the selection of the preferred language to display the text information in labels and panels.
4. Navigation through the exhibition (change of chapter).

5 PLUGGY3D Experience Mobile

PLUGGY3D Experience Mobile is an Android application that allows to experience the exhibitions created with the web-based application PLUGGY3D Curate in Augmented Reality and Virtual Reality. See Figure 6, Figure 7 and Figure 8. A video demonstration can be found in the following link: <https://vimeo.com/350289187>

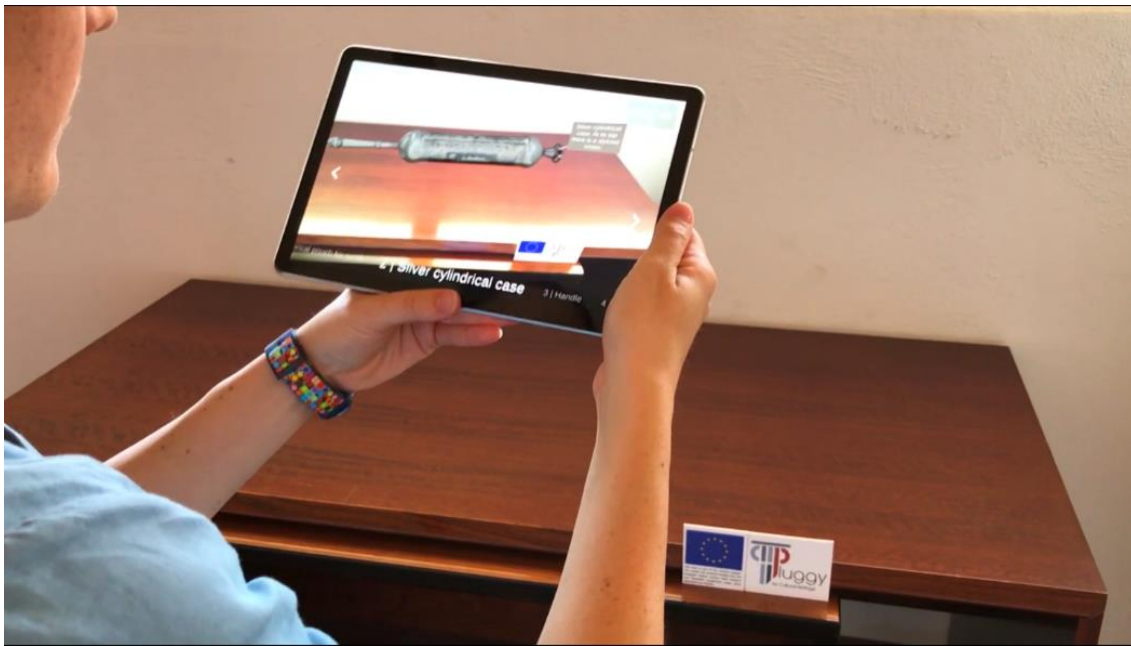


Figure 6. PLUGGY3D Experience Mobile is an Android application that allows to experience the exhibitions created with PLUGGY3D Curate



Figure 7. PLUGGY3D Experience Mobile – virtual exhibition in Augmented Reality.

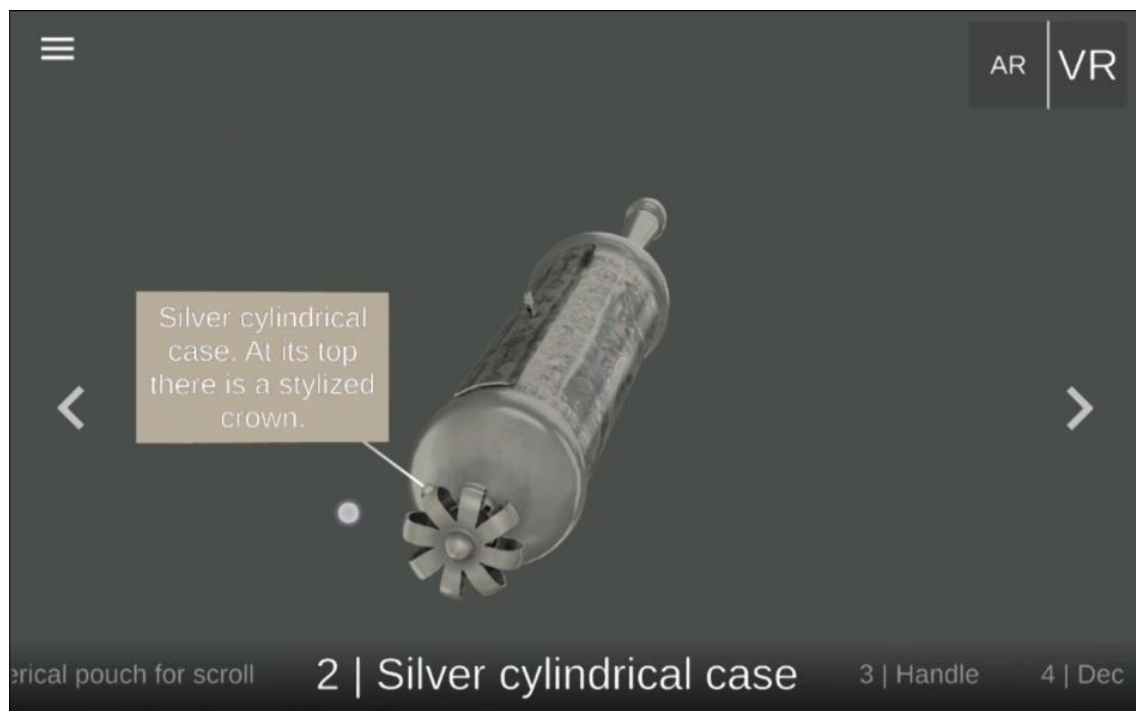


Figure 8. PLUGGY3D Experience Mobile – virtual exhibition in Virtual Reality.

The functionality of PLUGGY3D Experience Mobile includes:

1. Visualization of virtual exhibitions in Augmented Reality on an ARCore compatible Android device⁵.
2. Visualization of virtual exhibitions in Virtual Reality on any Android 8.0 or above device.
3. Navigation through the exhibition (change of chapter).
4. Manipulation of the 3D Model in view in Virtual Reality. This functionality allows the user to rotate and zoom in and out of the object.
5. Scanning of the room surfaces and placement of the virtual exhibition scene on one of the read surfaces.
6. Change of language in display. If the exhibition is available in different languages, PLUGGY3D Experience Mobile allows the selection of the preferred language to display the text information in labels and panels.
7. Display of the exhibition general information, such as creator, description and social data.

6 Deviations from Description of Action

Looking at the original text appearing in the submitted version of the DoA, the following description of **T4.1 AR App design and implementation** is reported:

The aim of this task is to design and implement an application which allows registration and rendering of virtual assets 3D and 2D over live video streams. The app authoring interface extends the Curation Tool to allow association of assets and behaviours to markers for augmenting real exhibitions and other indoor experiences with virtual content.

The only deviation from this description is that the application no longer associates assets and behaviors to markers, which has been substituted by the use of ARCore marker-less technology. ARCore functionality includes the scanning of surfaces, and PLUGGY3D Experience Mobile uses this surfaces textures to place assets without the need of a marker. The reason for this change is that ARCore marker-less technology appeared after writing the DoA.

⁵ See <https://developers.google.com/ar/discover/supported-devices> for a list of supported devices.

7 Conclusions

This deliverable presented the results obtained in the design and implementation of the PLUGGY3D suite. The suite includes:

- PLUGGY3D Create – a web application to edit and process 3d object files.
- PLUGGY3D Curate – a web application to create AR and VR exhibitions.
- PLUGGY3D Experience Web – a web application, part of the Pluggy Social Platform, to experience the exhibitions created with PLUGGY3D Curate.
- PLUGGY3D Experience Mobile – an Android application to experience the exhibitions created with PLUGGY3D Curate.

Therefore, the PLUGGY3D suite gives institutions and citizens an immediate and easy way to curate and enjoy cultural heritage content in different ways and formats, without the need for specific knowledge or understanding of the underlying technologies.