



## V4Design

Visual and textual content re-purposing FOR(4) architecture, Design and virtual reality games

H2020-779962

### D7.3

## Evaluation of the 1<sup>st</sup> prototype and updated user requirements

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## Executive Summary

This deliverable is reporting on the formative evaluation activities that were outlined and planned in the previous deliverables *“D7.1 Initial use case scenarios and user requirements”* as well as *“D7.2 Use cases, requirements and evaluation plan”*. The core activities were a modular design review of work package components that comprise the integrated platform accessed through two main user interfaces: The Rhino 4D plugin and the VR authoring tool. Additional evaluation activities were conducted within university activities, several focus group workshops and one game convention by the consortium partners of WP7. This deliverable presents the findings of the user walk-throughs and questionnaires that were conducted within the evaluation workshops at McNeel, DW and during the Gamescom 2019 convention.

In general, the user tests revealed a positive reception of the user groups towards the proposed solutions within the V4Design platform. They enjoyed automated generation of content and suggestions to being able to get a quick turnaround on their projects. Furthermore, people liked the positive inspiration on style and design through using V4Design assets. People expected better usability from the front-end tools. While in general, the Rhino plugin was perceived as clean with minor usability issues, the 2D UI approach in the VR Authoring Tool seemed a bit more challenging with regards to usability. Also, users asked for other options to navigate a first-person view authoring environment. Another aspect of improvement is quality of 3D models and textures, which were rated as rather average and less useful to most of the participants’ projects at the current stage. A major improvement would be to get an initially correct scaling and orientation of generated objects with dedicated inside and outside normals.

It is necessary to mention that for activities related to academic environments and the tool evaluation, the evaluation is following the academic semester system. For the first calendar semester of 2019 it has not been possible to have the tool evaluation by students and academic staff. This has facilitated a different methodology, thus to organize academic courses and activities, both theoretical and design-based. These courses introduced students and staff in the V4Design concepts, procedures and principles. It has aimed to prepare academic users for the next phase that of the actual tool evaluation, which will be deployed during fall and spring semester of academic year 2019-2020. We aim to use the actual prototype of the V4Design tool, incorporating topics addressed in the previous semesters.

In more detail, there is a series of seminars and design workshops that will take place at School of Architecture, Aristotle University of Thessaloniki. Architecture students, both undergraduate and postgraduate, will have the opportunity to use a prototype version of V4D4Rhino plugin through a series of exercises and design routines. This will give them insights on how the tool works and what it can offer to designers. Afterwards their feedback



will be documented through questionnaires, interviews and discussions. This will give us the opportunity to infuse a new round of comments and feedback back to the technical and development team of the tool.

For the professional focus groups, a dedicated user training was held in Barcelona at McNeel in July 2019. A set of registered participants were given an introduction into the project and the plugin in its 1<sup>st</sup> prototype stage. After the introduction, some guided exercises helped the participants to get a better understanding of the features and the context of the tool. This also aided the subsequent evaluation session that was held on the same day.

## Abbreviations and Acronyms

<b>AR</b>	Augmented Reality
<b>CG</b>	Computer Graphics
<b>DoA</b>	Description of Action
<b>EU</b>	European Union
<b>HLUR</b>	High Level User Requirement
<b>IP</b>	Intellectual Property
<b>IIR</b>	Interactive Information Retrieval
<b>KPI</b>	Key Performance Indicator
<b>NPV</b>	Net Present Value
<b>MMF</b>	Minimal Marketable Features
<b>OAI-PMH</b>	Open Archives Initiative Protocol for Metadata Harvesting
<b>PUC</b>	Pilot Use Case
<b>UIX</b>	User Interface Experience
<b>UG</b>	User Group
<b>UR</b>	User Requirement
<b>USP</b>	Unique Selling Proposition
<b>VR</b>	Virtual Reality
<b>VUS</b>	Virtual Urban Simulation
<b>WLAA</b>	Weighted Look Ahead Approach

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# 1 INTRODUCTION

V4Design aims at creating innovative tools for architects, designers and game creators to help them through the design process of both physical, as well as virtual spaces, taking advantage of assets extracted from visual material. In order to develop these tools, pilot use cases (PUC) have been defined and user requirements have been elicited, according to the specific user scenarios, prior user experience and market needs. In addition, a concise user-centric evaluation plan for assessing and evaluating the performance of the developed tools was developed. This has been documented extensively in the deliverables ***“D7.1 Initial use case scenarios and user requirements”*** as well as ***“D7.2 Use cases, requirements and evaluation plan”***.

Within this deliverable a report on the evaluation of the 1<sup>st</sup> prototype of the V4Design platform is given. The evaluation followed the plan that was outlined in the subsequent deliverables. Specifically, the focus for the evaluation of the 1st prototype was formative and thus drawing attention to the qualitative aspects, usefulness and usability of the implemented platform at this stage of the project. This was realized by addressing the focus groups outlined earlier that have had an interest in the PUCs and helped shape the requirements.

Section 2 reports on preliminary activities towards the focus group evaluation. Since many work packages deliver contributions to the platform, a variety of solutions at different stages existed prior to the integration into the 1<sup>st</sup> prototype version of V4Design. To allow early feedback and confirmation for research and development, a design review has been conducted following up the first technical review meeting from January, 2019. The design review consisted of a series of modular UX expert reviews that were documented in a heuristic evaluation sheet consisting of 10 usability metrics, a problem description and a recommendation section. This has helped to detect and mitigate issues and support the integration activities. Also, some important design suggestions could be given to aid the user interface implementation and necessary functionality for the front-end components.

We have decided to carry out *formative* testing at the beginning with only small groups of users who are very familiar with the project and its goals. Section 3 contains the test report from the focus group workshop that was held on July 16<sup>th</sup> 2019 in Barcelona at McNeel. It delivers a description of the conducted process and extends towards the direct feedback from the user walk-through. Additionally, a questionnaire and interview forms were provided to the participants and their feedback is documented in detail. Prior to this workshop, a dedicated user training was conducted to prepare for the evaluation.

Section 4 contains the results from the evaluation of the VR authoring tool. It has been presented by Nurogames at the Gamescom convention 2019 in August in Cologne. An additional focus group workshop was conducted on August 26th at Deutsche Welle in Bonn.

The documentation consists of a user walk-through report and an in-depth report on the interview and questionnaire feedback.

Section 5 delivers updates to the requirements and section 6 an update to the evaluation methodology and a conclusion is given in Section 7.

## **1.1 Pilot use cases**

The four pilot use cases that were considered for this evaluation have been:

- Architectural design, related to existing or historical buildings and sites and their environments (PUC1)
- Architectural design, related to artworks, historic or stylistic elements (PUC2)
- Design of virtual environments, related to TV series and VR video games (PUC3)
- Design of virtual environments, related to actual news for VR (re)living the date (PUC4)

The pilot use cases (PUC1 and PUC2, PUC3 and PUC4) had some overlap with regards to the user groups, requirements, and platform. The focus groups of architectural design were oriented towards the Rhino modeling platform, whereas the focus groups of designing virtual environments were oriented towards the VR authoring platform in Unity 3D. The first and second pilot use cases have been evaluated in the context of an academic programme, as well as a professional user training and evaluation for architects. The third and fourth pilot use cases have been evaluated at conferences and conventions for semi-professionals, game/ content creators and enthusiasts, as well as within a workshop for design and technology affiliated journalists. The four pilot use cases have been described in detail in deliverable D7.2.

## **1.2 User evaluation**

Across each of the pilot use cases, a user-centric evaluation approach has been followed. Applying the design review methodology at the beginning (consisting of a UX expert review and a heuristic evaluation<sup>1</sup>) emphasized the role of usability early on. The workshops and university seminars focused on testing the system and specific modules in a realistic scenario, by letting test users perform relevant tasks in the test setup. Since this was the evaluation of the 1<sup>st</sup> prototype version, the users were guided and given an extensive introduction into the project and the project solutions. This method ensured relevant feedback as a foundation for further development of V4Design.

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<sup>1</sup> 10 Usability Heuristics for User Interface Design (Nielsen heuristics),

### 1.3 Formative testing

The evaluation of the 1<sup>st</sup> prototype has followed the principles of formative testing. As described in deliverable D7.2, we have decided to carry out *formative* testing at the beginning with only small groups of users who are rather familiar with the project and its goals. We conducted formative evaluation with groups of 5 to 12 people as recent research has proven that – at least during formative testing – small usability studies are more beneficial than conducting large studies.

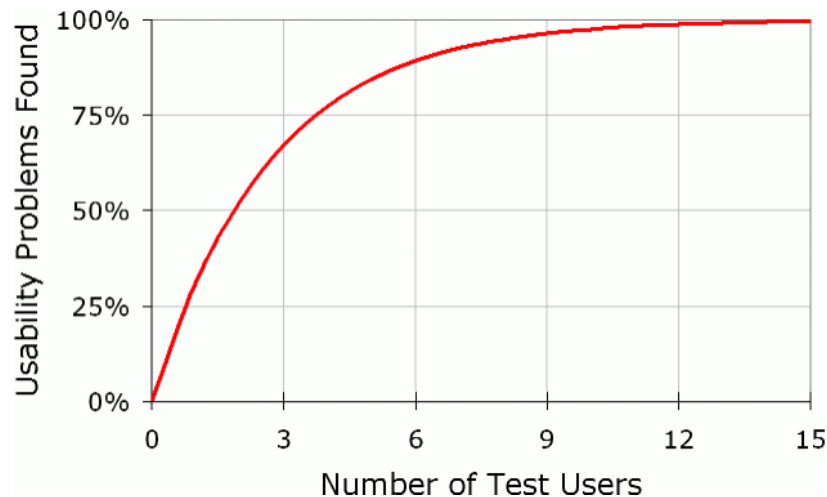


Figure 1: "Why you only need to test with 5 users", by Jakob Nielsen<sup>2</sup>

The user evaluation events consisted at large of a two-fold approach: a task-based qualitative observation of the users with recorded insights and a post-task questionnaire for general qualitative feedback. This feedback reveals that the V4Design platform provides a valuable solution to the user's needs, although some issues with regards to usability and the quality of generated models have been identified. The individual findings are described in detail in the following sections.

For further reference on the V4Design user-oriented evaluation methodology, please refer to section 7.2 of deliverable D7.2.

<sup>2</sup> [www.nngroup.com/articles/why-you-only-need-to-test-with-5-users/](http://www.nngroup.com/articles/why-you-only-need-to-test-with-5-users/)

## 2 EXPERT REVIEW

This chapter delivers the results of the expert design reviews and the heuristic evaluation. To evaluate the early stage implementations within V4Design, we have chosen to conduct a design review as part of a usability-inspection method. It can be further split into a heuristic evaluation that evaluates compliance to a set of heuristics, a standalone design critique, and an expert review.

*Expert reviews involve the analysis of a design by a UX expert with the goal of identifying usability problems and strengths.*  
- Aurora Harley, Nielsen Norman Group<sup>3</sup>

A design review can be conducted at any time of a design and development cycle with any fidelity or fragment of a solution. It allows reviewing a solution even from a specification stage on with just a set of guidelines and mockups. This was ideal for evaluation of the demonstrators, since they usually do not provide a full user experience, but rather deliver a module of the V4Design platform with a very specialized purpose. Our chosen methodology allowed us to evaluate these modules in an isolated manner.

One part of the design review is a heuristic evaluation. The four demonstrators within the scope of this deliverable have been evaluated against the 10 heuristics established by Jakob Nielsen<sup>4</sup>. The following paragraphs deliver an explanation of the heuristic criteria.

### **Visibility of system status**

The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

### **Match between system and the real world**

The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

### **User control and freedom**

Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.

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<sup>3</sup> UX Expert Reviews, <https://www.nngroup.com/articles/ux-expert-reviews/>

<sup>4</sup> 10 Usability Heuristics for User Interface Design (Nielsen heuristics), <https://www.nngroup.com/articles/ten-usability-heuristics/>



**Consistency and standards**

Users should not have to wonder whether different words, situations, or actions mean the same thing.

**Error prevention**

Even better than good error messages is a careful design, which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

**Recognition rather than recall**

Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate

**Flexibility and efficiency of use**

Accelerators — unseen by the novice user — may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

**Aesthetic and minimalist design**

Dialogues should not contain information, which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

**Help users recognize, diagnose, and recover from errors**

Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

**Help and documentation**

Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

**2.1 Test executive summary**

The design review has been conducted by usability specialists from DW and HdM and performed on early designs and intermediate demonstrators of the 1<sup>st</sup> prototype version. The following demonstrators were part of the review:

- V4Design Crawler
- Language Analysis
- Aesthetics Extraction

- Building and Object Localization

This section offers details about the design review for each of the modules that were tested within the scope of the 1<sup>st</sup> prototype. The design review process involved a usability expert that was familiar with the project and the purpose of the modules. The evaluation was performed by recording observations in text form focusing on more general aspects at first and diving deeper in to details of the tested prototypes second. The 10 heuristic principles by Nielsen<sup>5</sup> were thus processed one-by-one and problems and recommendations noted for each.

### 2.1.1 V4Design Crawler

The purpose of the V4Design crawler and crawling process is to demonstrate the text and image crawling capabilities of the V4Design platform. Its purpose within the platform is to provide users with additional textual and visual information and input to repurpose them and inspire new designs.

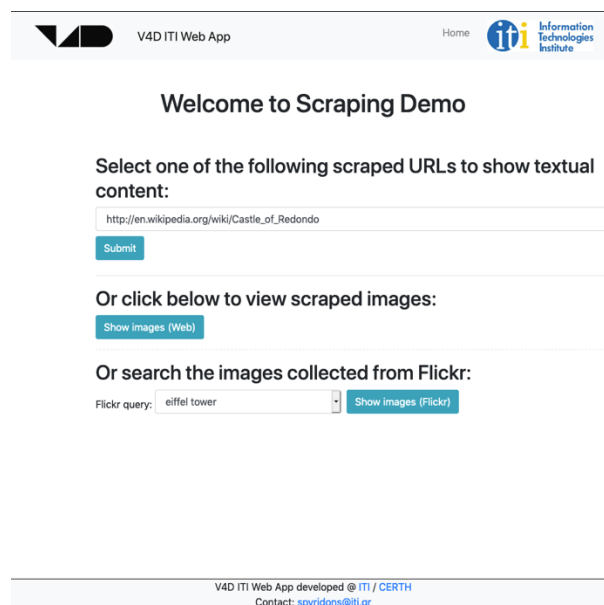


Figure 2: Screenshot of the Scraping Demo

**Overall impression:** The overall design is clean and simple. The service provides three different datasets (one textual and metadata, two for images) from different sources. By clicking a query, the user is provided with a clearly structured results page. A return button on top allows easy navigation back to the main site. The purpose of the service becomes clear very quickly and the main functions can be learned with ease. It is not yet fully clear,

<sup>5</sup> <https://www.nngroup.com/articles/ten-usability-heuristics/>

how the results are being used, but that can be attributed to the service being a demonstrator of the scraping results, only. Apart from some problems described in more detail in the evaluation section, the service is working well.

**Evaluation:** A detailed evaluation is given in Table 1.

Table 1: Heuristic evaluation for the V4Design Crawler Demo.

Heuristic criteria	Problems	Recommendation
Visibility of system status	<p>Initial view is a clean page, however:</p> <ul style="list-style-type: none"> <li>• Call to action is not clear (3 similar buttons with different functionality)</li> <li>• Some indication is missing on what services are actually included, and where data comes from (e.g. images from web → what are the query parameters?)</li> </ul> <p>Images collected from web don't reveal</p> <ul style="list-style-type: none"> <li>• timestamp of last collection</li> <li>• parameters of query</li> <li>• collection criteria</li> <li>• available or license used for search</li> </ul> <p>Images collected from flickr don't reveal</p> <ul style="list-style-type: none"> <li>• timestamp of last collection</li> <li>• parameters of query</li> <li>• collection criteria</li> <li>• available or license used for search</li> <li>• a search directly on flickr returns other results, in case of the Konzerthaus (Berlin), the direct results via flickr return much more relevant results</li> </ul> <p>It is not very clear, that the results are derived from local, already retrieved data</p>	<ul style="list-style-type: none"> <li>• Clearly separate each task from each other visually and conceptually</li> <li>• Clearly state sources, whether static or dynamic</li> <li>• Give an indication and relevant info to assess the quality and content of each of the three scraping methods</li> <li>• Provide more info on the dataset status other than that it is scraped or collected content</li> <li>• Provide a breadcrumb to show the user, what task they have selected first</li> </ul>
Match between system and real world	<p>Since natural language is used, a user does not need to guess any</p>	<p>An improvement could be some visual element (e.g. grouping or clustering) to</p>

	functionality of the system	distinguish different purposes (e.g. scraping text or image databases)
User control and freedom	<ul style="list-style-type: none"> <li>When searching for a term, users are only allowed to pick from a pulldown list, but have no way of searching for a term on their own</li> <li>Users can not refine search criteria to match their needs, e.g. set a timeframe, region or style</li> </ul>	<ul style="list-style-type: none"> <li>Allow free text search with autocomplete functionality</li> <li>Allow to refine search criteria</li> </ul>
Consistency and standards	<ul style="list-style-type: none"> <li>Image search returns results in <ul style="list-style-type: none"> <li>A table for the web search</li> <li>A tile page for flickr</li> </ul> </li> <li>The scraped text returned is unformatted and thus valuable information on the text structure is lost</li> </ul>	<ul style="list-style-type: none"> <li>Image search should return a similar page design (e.g. add some metadata and creator information for flickr, where the web search contains source information)</li> <li>Find a common design to return both web and flickr image search results (as table, sections or tiles/cards)</li> <li>Keep original markup of the scraped text</li> </ul>
Error prevention	Cannot really make an error	
Recognition rather than recall	Once used, it is easy to remember how everything works	
Flexibility and efficiency of use	<ul style="list-style-type: none"> <li>Everything can be executed with a single click and functionality is not overwhelming, which is good</li> <li>Pulldown search can be a bit tedious</li> </ul>	<ul style="list-style-type: none"> <li>Provide autocomplete for pulldown menu</li> <li>Allow for more refined search options</li> </ul>
Aesthetic and minimalistic design	Design is very clean and functional, which is good	Presentation of tasks and results could make use some of the Gestalt principles (like proximity, grouping) a bit more
Help users recognize, diagnose and recover from errors	<ul style="list-style-type: none"> <li>The system does not provide error messages</li> <li>Images that have been removed in the meantime appear with an empty image symbol</li> </ul>	<ul style="list-style-type: none"> <li>Remove 404 images from the set</li> <li>Provide an indication, instead of letting users run into a 404 on a target webpage</li> </ul>
Help documentation	There is no additional documentation available	Provide a small demo or tour of the tasks and results

### 2.1.2 Language Analysis

The Language Analysis module provides the V4Design platform with the capability to extract relevant information and entities from text in order to generate useful metadata for the knowledge base.

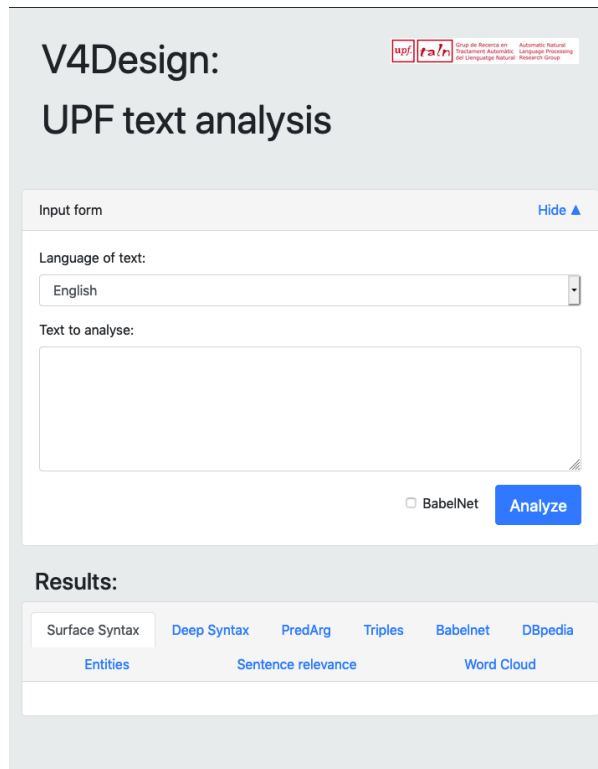


Figure 3: Screenshot of the Language Analysis Demo

**Overall impression:** The central element is an input form to paste some arbitrary text and execute the 'Analyze' button. When hit, a processing indicator shows that the system is busy processing. The results page is initially available as well - one might be prompted to selecting something there as well. When an analysis is complete, the input form is hidden to focus on the results. Similarly, the results could be hidden before an analysis is being triggered. The Surface Syntax and Deep Syntax result pages provide concise information on the text analysis, which might be overwhelming for the average user, but provide valuable and clear information to a language specialist.

**Evaluation:** A detailed evaluation is given in Table 2.

Table 2: Heuristic evaluation of the Language Analysis

Heuristic criteria	Problems	Recommendation
Visibility of system status	While a user quickly gets to enter and process a text, the operation itself lasts	Focus on first things first

	<p>quite long</p> <ul style="list-style-type: none"> <li>There is a spinning wheel to indicate it is processing</li> <li>The user can still click on some buttons to switch around and nothing happens</li> <li>What does the BabelNet checkbox do?</li> </ul> <p>User needs additional knowledge to distinguish the result variants (different algorithms used)</p>	<ul style="list-style-type: none"> <li>Enter text</li> <li>process</li> </ul> <p>Hide more options, until they become relevant, as they might confuse users</p> <p>Clearly state, that this processing takes long</p> <ul style="list-style-type: none"> <li>Offer a link to come back to or a notification via mail</li> <li>What does the BabelNet checkbox do?</li> </ul>
Match between system and real world	<ul style="list-style-type: none"> <li>The task at hand is quite clear with the input text expecting a piece of text to be submitted</li> <li>Clear and structured visualisation of the text entities</li> </ul>	<ul style="list-style-type: none"> <li>Explain functionality of results options</li> <li>What does the BabelNet checkbox do?</li> </ul>
User control and freedom	<ul style="list-style-type: none"> <li>Paste text, process and view result</li> <li>There is not much more a user can do, but this is also not necessary</li> </ul>	<ul style="list-style-type: none"> <li>Avoid presenting the results bar before processing has ended</li> </ul>
Consistency and standards	<ul style="list-style-type: none"> <li>Use of material design is established standard</li> </ul>	
Error prevention		
Recognition rather than recall		
Flexibility and efficiency of use		
Aesthetic and minimalistic design		<p>Presentation of tasks and results could make use some of the Gestalt principles (like proximity, grouping) a bit more</p>
Help users recognize, diagnose and recover from errors		
Help documentation and	<p>There is no additional documentation available</p>	<p>Provide a small demo or tour of the tasks and results</p>

### 2.1.3 Aesthetics Extraction

The purpose of the Aesthetics extraction module is to provide images via a search tool for aesthetic styles and aesthetic artists to provide relevant content to V4Design users and also provide intelligent metadata for the knowledge base.

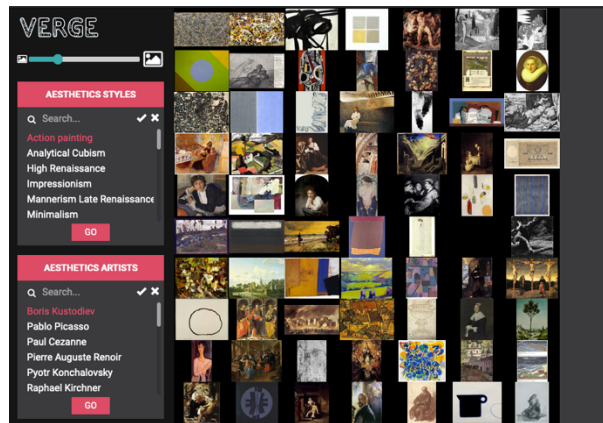


Figure 4: Screenshot of the Aesthetics Extraction Demo

**Overall impression:** Upon entering, the user gets a dark blank canvas and three category options to select from. There is also a scale slider on the very top that does not indicate its usage, yet. All categories can be opened simultaneously and present a list of search terms. The autocomplete functionality helps finding the right elements. More than one selection per category is allowed, however only the results of the category last clicked are displayed. Nonetheless, if a previous category was used, its selection remains, even if it is not reflected in the search results. The building localization category is hard to understand - does it provide information on the location of a building or is it the detection of a building structure in footage? From trying to use it a bit, the second must be the case, as it is about detecting the selected category in footage. The results page for every selection provides a range of tiles, with no additional information or sorting and display options. If there are more than a certain number of images, a next button is available at the bottom. Clicking a link, deep-links to the image source.

**Evaluation:** A detailed evaluation is given in Table 3.

Table 3: Heuristic evaluation of the Aesthetics Extraction Demo

Heuristic criteria	Problems	Recommendation
Visibility of system status	<ul style="list-style-type: none"> <li>Call to action is not clear (3 similar selection areas with different functionality)</li> <li>Some indication is missing on what</li> </ul>	<ul style="list-style-type: none"> <li>Clearly separate each task from each other visually and conceptually</li> <li>Clearly state sources, whether static or dynamic</li> </ul>

	<p>services are actually included, and where data comes from</p> <p>One does not know the real purpose of the checkmark button, the search results remain the same, whether clicked, or not (See Figure 5)</p> <ul style="list-style-type: none"> <li>A user doesn't know what source media the building localization results come from</li> <li>When selecting more than one term, one cannot distinguish whether the results are additive or based on common criteria (See Figure 6)</li> </ul>	<ul style="list-style-type: none"> <li>Provide info on which media the results come from</li> <li>Provide info on why a result appears</li> </ul>
Match between system and real world	<p>Since natural language is used, a user does not need to guess any functionality of the system</p>	<p>An improvement could be some visual element (e.g. grouping or clustering) to distinguish different purposes (e.g. scraping text or image databases)</p>
User control and freedom	<ul style="list-style-type: none"> <li>When searching for an aesthetic style or a painter, I get back mostly expected results and can view them in a new tab</li> <li>When searching for a term, users are only allowed to pick from a pulldown list, but have no way of searching for a term on their own</li> </ul>	<ul style="list-style-type: none"> <li>Allow to search for style and artists combined</li> <li>Allow for an own search term</li> </ul>
Consistency and standards	<ul style="list-style-type: none"> <li>Drop-down and simple selection work as expected</li> <li>Select/unselect of an option is not always immediately visible</li> </ul>	<p>Remove selected options from dropdown and show in separate selected area</p>
Error prevention	<p>One cannot really make an error; however, some selection might be confusing or have no effect</p>	<p>Clearly design buttons and symbols according to their purpose and give corresponding feedback to the user</p>
Recognition rather than recall	<p>It takes a bit of practice to get used to the selection style, however once learned, it is easy to remember</p>	<p>Clearly indicate functionality of buttons and remove, where they don't do anything of value (e.g. the checkmark button)</p>
Flexibility and efficiency of use	<ul style="list-style-type: none"> <li>Upon selecting, the system outputs result immediately and a user can quickly browse buildings, which is very efficient</li> </ul>	<p>No specific recommendations</p>



	<ul style="list-style-type: none"> <li>The functionality of the system is simple and designed to provide the user with direct output, so flexibility is not an issue here</li> </ul>	
Aesthetic and minimalistic design	<ul style="list-style-type: none"> <li>The design is simple and minimalistic (good)</li> <li>The color coding (e.g. call to action/info) could be improved, to not mix them up</li> </ul>	Use different color for <ul style="list-style-type: none"> <li>Call to action (CTA)</li> <li>Info/Selection</li> </ul>
Help users recognize, diagnose and recover from errors	<ul style="list-style-type: none"> <li>The system does not provide error messages</li> <li>Some selection might not work as intended</li> </ul>	Provide better indication of selection
Help documentation	There is no additional documentation available.	Provide a small demo or tour of the tasks and results.

The following paragraph contains images referenced from the table above.

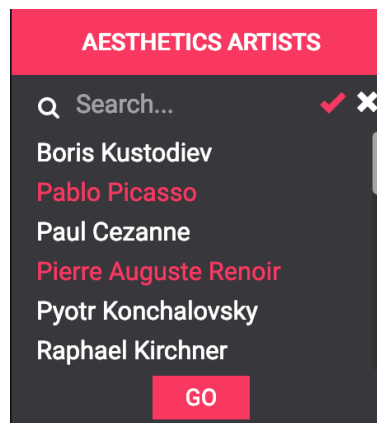


Figure 5: Marked items in the aesthetics extraction interface.

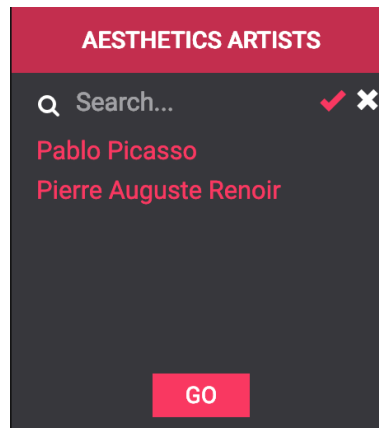


Figure 6: Masked or selected items in the aesthetics extraction interface.

#### 2.1.4 Building Localization Demo

The purpose of the *Building Localization* module is to provide the V4Design users with visual recognition of building entities in images. This is very helpful for indexing visual content for the knowledge base, as well as providing an object-based search on further image resources that can be indexed using image recognition. It can also be used on video frames to detect indoor and outdoor locations.

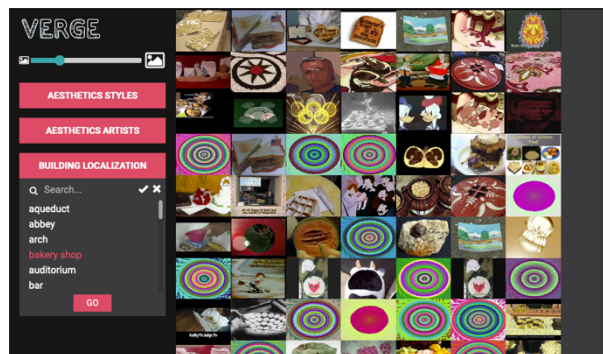


Figure 7: Screenshot of the Building Localization Demo

**Overall impression:** Upon entering, the user gets a dark blank canvas and three category options to select from. There is also a scale slider on the very top that does not indicate its usage, yet. All categories can be opened simultaneously and present a list of search terms. The autocomplete functionality helps finding the right elements. More than one selection per category is allowed, however only the results of the category last clicked are displayed. Nonetheless, if a previous category was used, its selection remains, even if it is not reflected in the search results. The building localization category is hard to understand - does it provide information on the location of a building or is it the detection of a building structure in footage? From trying to use it a bit, the second must be the case, as it is about detecting the selected category in footage. The results page for every selection provides a range of tiles, with no additional information or sorting and display options. After a given number of

images, a next button is available at the bottom. Clicking a link deep-links to the image source.

**Evaluation:** A detailed evaluation is given in Table 4.

Table 4: Heuristic evaluation of the Building Localization Demo

Heuristic criteria	Problems	Recommendation
Visibility of system status	<p>Initial view is a clean page, however:</p> <ul style="list-style-type: none"> <li>• Call to action is not clear (3 similar selection areas with different functionality)</li> <li>• Some indication is missing on what services are actually included, and where data comes from</li> <li>• I don't know the real purpose of the checkmark button, the search results remain the same, whether I click this, or not (See Figure 8)</li> <li>• As a user, I don't know what source media the building localization results come from</li> <li>• When selecting more than one term, I cannot distinguish whether the results are additive (which I would guess) or based on common criteria (See Figure 9)</li> </ul>	<ul style="list-style-type: none"> <li>• Clearly separate each task from each other visually and conceptually</li> <li>• Clearly state sources, whether static or dynamic</li> <li>• Provide info on which media the results come from</li> <li>• Provide info on why a result appears</li> </ul>
Match between system and real world	<p>Since natural language is used, a user does not need to guess any functionality of the system</p>	<p>An improvement could be some visual element (e.g. grouping or clustering) to distinguish different purposes (e.g. scraping text or image databases)</p>
User control and freedom	<ul style="list-style-type: none"> <li>• When searching for images of a building type, I get back mostly expected results and can view them in a new tab</li> <li>• When searching for a term, users are only allowed to pick from a pulldown list, but have no way of</li> </ul>	<p>No specific recommendations</p>

	searching for a term on their own	
Consistency standards and	<ul style="list-style-type: none"> <li>Drop-down and simple selection work as expected</li> <li>Select/unselect of an option is not always immediately visible</li> </ul>	Remove selected options from dropdown and show in separate selected area
Error prevention	One cannot really make an error; however, some selection might be confusing or have no effect	Clearly design buttons and symbols according to their purpose and give corresponding feedback to the user
Recognition rather than recall	It takes a bit of practice to get used to the selection style, however once learned, it is easy to remember	Clearly indicate functionality of buttons and remove, where they don't do anything of value (e.g. the checkmark button)
Flexibility and efficiency of use	<ul style="list-style-type: none"> <li>Upon selecting, the system outputs result immediately and a user can quickly browse buildings, which is very efficient</li> <li>The functionality of the system is simple and designed to provide the user with direct output, so flexibility is not an issue here</li> </ul>	No specific recommendations
Aesthetic and minimalistic design	<ul style="list-style-type: none"> <li>The design is simple and minimalistic (good)</li> <li>The color coding (e.g. call to action/info) could be improved, to not mix them up</li> </ul>	Use different color for <ul style="list-style-type: none"> <li>Call to action (CTA)</li> </ul> Info/Selection
Help users recognize, diagnose and recover from errors	<ul style="list-style-type: none"> <li>The system does not provide error messages</li> </ul> Some selection might not work as intended	Provide better indication of selection
Help and documentation	There is no additional documentation available.	Provide a small demo or tour of the tasks and results.

The following paragraph contains images referenced from the table above.

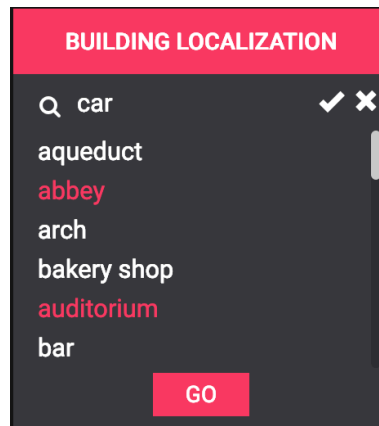


Figure 8: Marked items in the building localization interface.

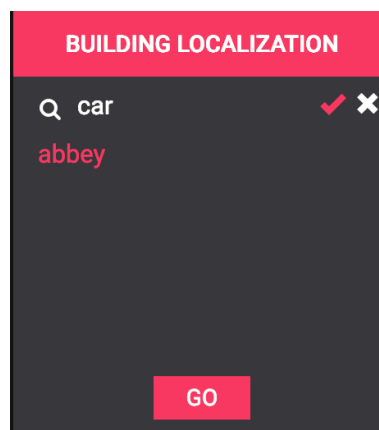


Figure 9: Masked or selected item in the building localization interface.

### 3 USER TRAINING

Task T7.3 of WP7 and reported on in this deliverable is responsible for user training in the new applications developed in order to ensure that the users of the creative industries are capable of exploiting all the functionalities and evaluate them. This task also deals with the deployment of the tools in the working space of the users. With respect to architecture, the trained users will vary from professional architects (HdM) to architecture students (AUTH), while in the gaming applications the users will include both experienced (NURO) and non-experienced users (DW). NURO and McNeel will deal with the system deployment.

This chapter is reporting on the performed activities in the time frame of D7.3. AUTH performed user training and evaluation through a series of courses. DW performed user training and evaluation at Global Media Forum 2019 and during a journalist centered session at DW Bonn in August 2019. McNeel performed a dedicated user training for architects and designers in July 2019.

#### 3.1 Academic User Training

In addition to the Barcelona workshop (see next section), AUTH initiated the user training activities, besides the evaluation procedure, through a series of courses, theoretical and design-based, during the fall and spring semesters of academic year 2018-2019, to help students and staff familiarize with concepts and principles of V4Design. The main goal was to introduce and train users to some of the V4Design technologies and assess the overall user requirements of the tool. By familiarizing and training students with theoretical and technical concepts of the V4Design tools and pipelines, they had the opportunity to enrich their understanding of the technologies and better evaluate the workflows (manual or automated). By manually reproducing V4Design pipelines AUTH had the chance to further evaluate and refine the needs and requirements from the platform. This led to some refinement on the HLUR and URs but also gave significant feedback that AUTH was able to communicate to the technical team.

AUTH developed training strategies in the light of the evaluation workshops. AUTH assisted in the organization of the training and evaluation activities. AUTH as Task Leader of Task 7.3 coordinated the definition of focus groups participating in the training and evaluation. Task 7.3 is related to user training in the new applications developed, in order to ensure that users of creative industries are capable of exploiting all the functionalities and evaluating them. This task also deals with the deployment of the tools in the working space of the users. With respect to architecture, the trained users varied from professional architects (HdM) to architecture students and staff (AUTH), while in gaming applications, users included both experienced (NURO) and non-experienced users (DW). AUTH lead this task, in close collaboration with HdM, SLRS and McNeel for the architecture scenarios. NURO and DW collaborated for the two game scenarios and SLRS will participate as a content provider.

AUTH has initiated courses that simulated the V4Design process and familiarized and trained students for using V4Design tools. Twelve (12) lectures took place during a theoretical course in the fall semester, titled ‘Critical Images’, from October 2018 (M10) till January 2019 (M13) related to the main object and purpose of the V4Design. Speakers in those lectures have been professionals, academics, landscape architects and artists. Besides that, a special design course, titled ‘Spatial Investigations’, has taken place, from February 2019 (M14) till July 2019 (M19) experimenting with design principles of V4Design and related to the PUC1 (scenario 1).

Both courses simulated the V4Design process and prepared the students for the evaluation procedure of the architectural authoring tool in fall semester of academic year 2019-2020, starting October 2019, which will take place at Aristotle University of Thessaloniki. The focus group will include undergraduate and postgraduate students. The evaluation workshop will have the same structure with the evaluation workshop in McNeel’s premises in July 2019. The users will answer evaluation questionnaires and results of the questionnaires will be providing feedback to the tool development procedure.

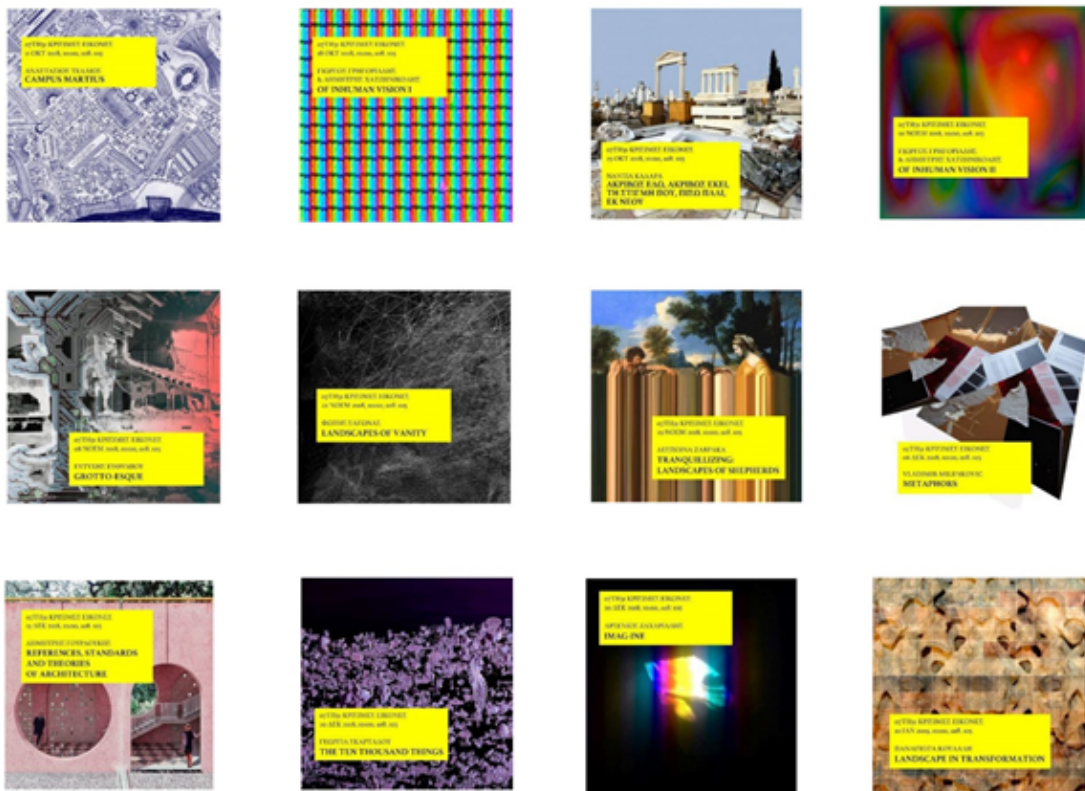


Figure 10: Theoretical course ‘Critical Images’, lecture posters  
Fall semester 2018-2019, School of Architecture, AUTH

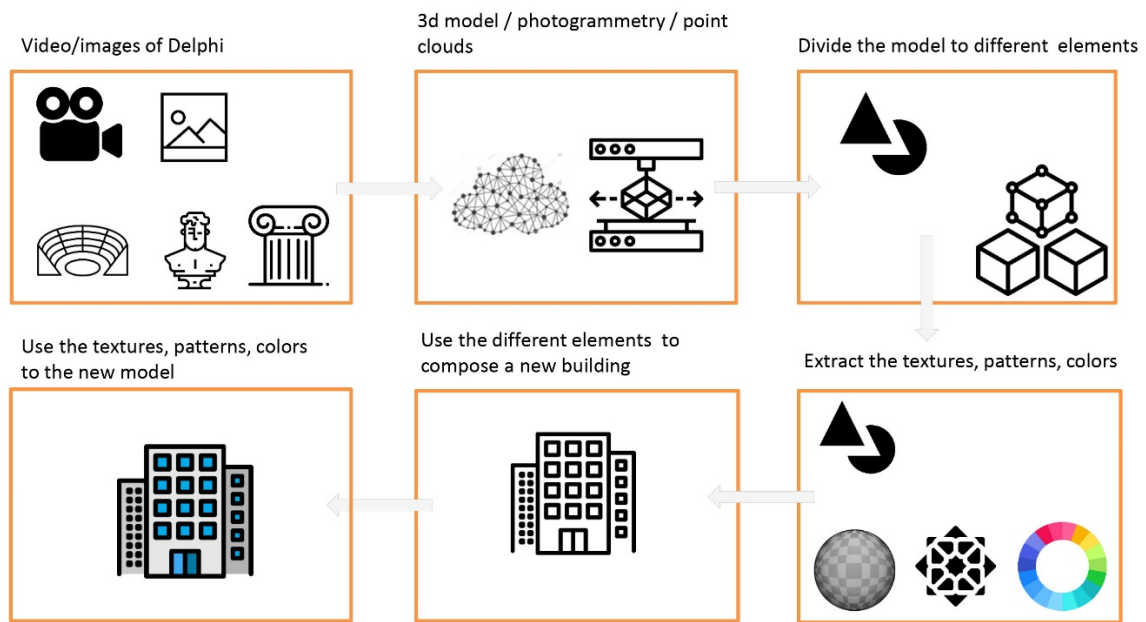


Figure 11: Design course 'Spatial Investigations', simulation of V4Design process  
Spring semester 2018-2019, School of Architecture, AUTH

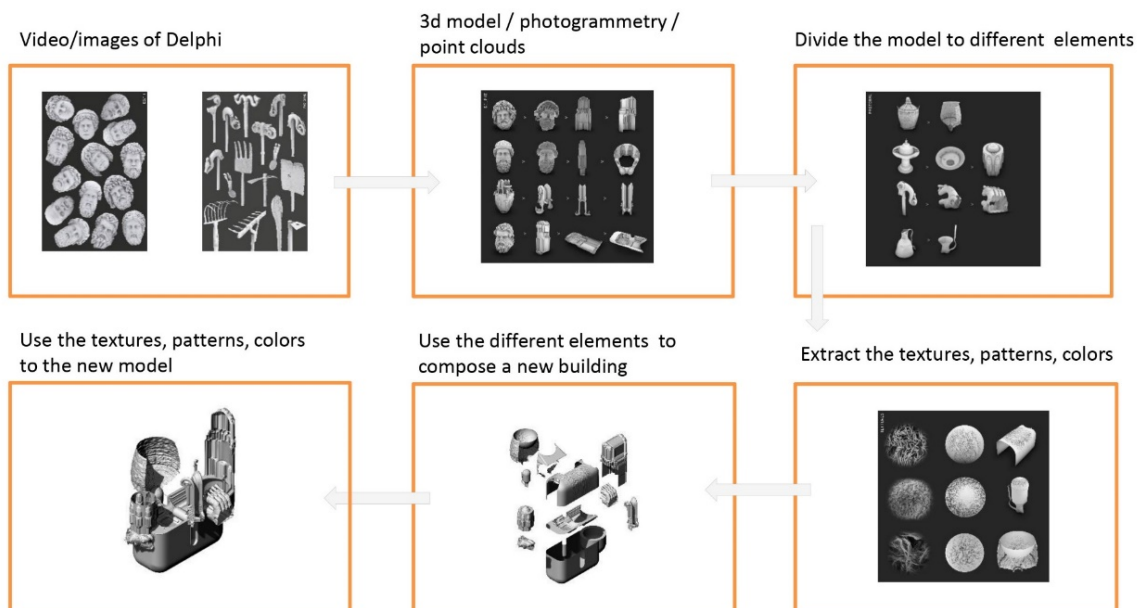


Figure 12: Design course 'Spatial Investigations', simulation of V4Design process  
Spring semester 2018-2019, School of Architecture, AUTH



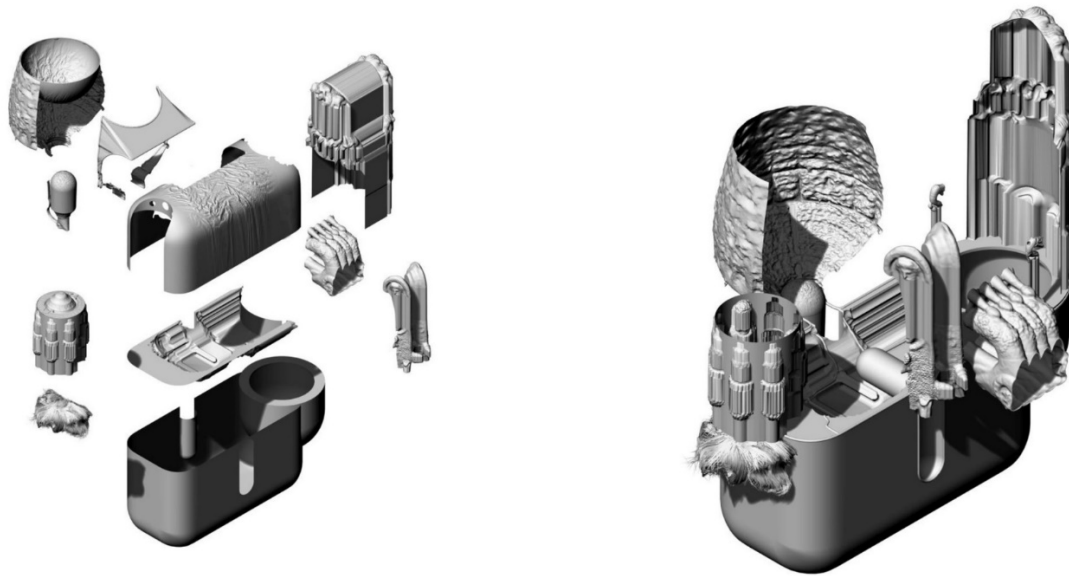


Figure 13: Design course ‘Spatial Investigations’, Designing building elements/composition procedure, Spring semester 2018-2019, School of Architecture, AUTH

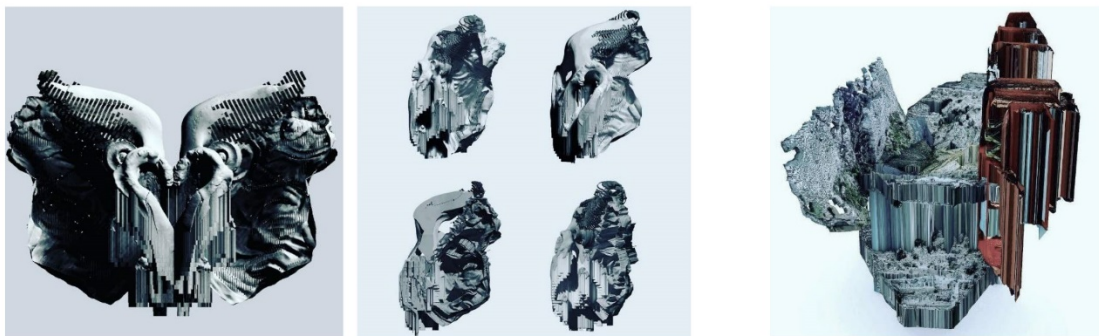


Figure 14: Design course ‘Spatial Investigations’, Designing building elements/composition procedure, Spring semester 2018-2019, School of Architecture, AUTH

### 3.2 V4Design User Introduction at Global Media Forum

In early June 2019, DW and Nurogames conducted an introduction of the VR Authoring Tool to visitors and interested professionals from journalism and media. It was not a comprehensive and dedicated training but introduced the concept to a wider audience and served as an informative session towards a broader range of people than originally planned. People were highly interested in the possibilities of immersive media for the purposes of journalism and media.



Figure 15: Introduction of the VR Authoring Tool at GMF 2019

### 3.3 Rhino User Training

Prior to the evaluation workshop on July 16<sup>th</sup> in Barcelona, a project introduction and user training were conducted. The invited participants had a background in architecture and design and had experience in modelling using Rhino. Each participant had Rhino 6 and the Rhino Authoring Tool (a V4Design plugin) installed on their laptops. In total, 10 participants (3 female, 7 male) joined the user training and the subsequent evaluation.

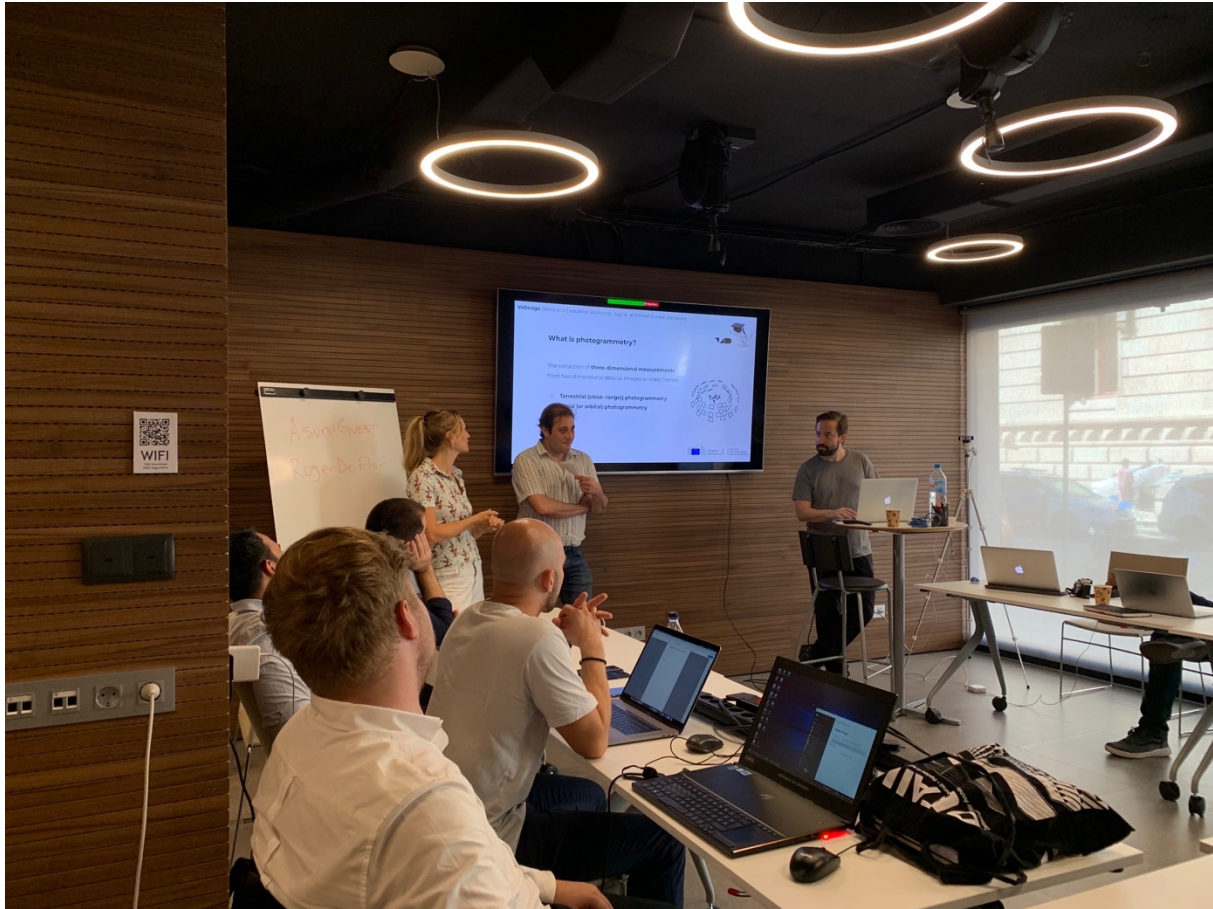


Figure 16: Introduction of the V4Design project by McNeel

The participants had a professional background in architecture, landscape architecture, industrial design, and computer science. The age range was 25 to 44 years. The user training was split into three parts:

- Welcome and introduction of V4Design and the project consortium
- A plugin demonstration, introduction into the user interface and feature description
- A guided exercise to introduce the practical benefit of the tool to the participant group

The basic tasks of the guided exercise contained the acquisition of 3D models through the V4Design UI, the combination of the models within Rhino, and adding an additional NURBS geometry to the scene. The participants were able to follow along on their laptops at any time.





Figure 17: Impressions from the user training

After a short break, the exercise was refined and each participant was closely monitored in a think-aloud process. These thoughts have been written down by members of the consortium.

## 4 EVALUATION OF THE ARCHITECTURE AUTHORING TOOL

The goal of this study is to evaluate and report on the 1<sup>st</sup> prototype version of the V4Design platform and its components. It shall collect feedback from potential users on the platform's value proposition, usability and user satisfaction. This evaluation is taking place with the finalization of the 1<sup>st</sup> prototype of the V4Design platform and its front-end components. The basic steps of the evaluation process are as follows:

1. Basic introduction into the platform, capabilities and tools; demographic survey (GDPR)
2. Walk-through (with/without recording) interview; Noting questions (specific per task or work-flow step, summative at the end)
3. System Usability Scale survey/ Post-exercise questionnaire

The methodology for the formative evaluation of the 1<sup>st</sup> prototype is described in this paragraph. In order to gain relevant insights into the demographic structure of the participants, a **demographic survey** was conducted with explicit consent by the participants to use their anonymized input solely for the project's evaluation purpose. The survey consists of questions about profession and familiarity with the work field, gender and age. Gender and age are requested to demonstrate a balanced participant group. After a short introduction into the project and the platform, a **user walk-through** was performed. In order to successfully run the user walk-through, critical tasks to access the features, functionality have been determined upfront. Users then are set to fulfil these tasks while thinking out loud. This activity is recorded by written protocol and also screen captured on some devices. Further detail on the tasks is given in **Walk-through task and story**. The user walk-through is concluded with a **Follow-up interview** in form of a questionnaire with open-ended questions and multiple-choice questions as well as an integrated **System Usability Scale (SUS) Survey** to get quantitative input on several aspects of the platform using a 1-5 Likert-scale.

### 4.1 Test executive summary

#### Test Scenario 1: Academic level / students and academic staff

- **Participants liked** the ability to hover over an asset and get additional information on the asset. This kind of information is mostly about the history and context of the asset (creator, country etc.). They believed that this is going to be useful in a creative process, to help progress and enrich the design strategies and narratives.
- **Participants asked for** more technical information on the asset when hovering over it. This information could be related to the number of points on the reconstructed point cloud, bounding box dimensions etc. They also asked for a warning when an asset is too large to open, as this would help avoid software crashes.

- **Participants had some challenges and dislikes** regarding the user interface and its responsiveness. For example, it was not clear when the asset was fully downloaded, as there was not a relevant message. This led to multiple downloads of the same asset in the tool library.

#### Test Scenario 2: Professional level / experienced users

- **Participants liked** the clean interface and the overall idea of **easily finding and importing 3D models** to include in projects.
- **Participants asked** for means to manage and organize items in the library in a better fashion through **folders and tags**. They would also like to add their **own content** to the library or start a 3D reconstruction from own material.
- **Participants had some challenges and dislikes** regarding the actual import of a V4Design asset into a scene. Also, the **model integrity and quality** were lacking in some parts. Participants also had trouble with regards to **scale and orientation** of models and suggested that the tool should add functionality to aid with these and determine an initial valid value for scale, e.g. have a standard range for statue or building objects depending on some meta data provided.

## 4.2 Test rationale

**Test Scenario 1 and 2:** The goal of this test was to conduct a formative evaluation of the 1<sup>st</sup> prototype of the V4Design platform and use these results to validate the user requirements through qualitative feedback. This feedback is used to improve the V4Design platform and individual solutions for the subsequent 2<sup>nd</sup> prototype implementation and the final solution. The qualitative evaluation is focused on whether the users find the platform useful and usable.

## 4.3 Detailed test description

**Test Scenario 1 and 2:** User testing took place during one day at the facilities of McNeel on July 16, 2019. 10 participants registered who represent professions like Industrial Designer, Architects, Landscape engineer or Software Developer. There were 3 female and 7 male attendants ranging from 25 to 44 years of age. The workshop requirements were:

- Experience in 3D modelling with Rhino
- Strong background in architecture and design
- Rhino 6 and Rhino Authoring Tool (V4Design) installed

The user testing was conducted as follows:

- Step 1: Welcome and introduction of V4Design and the team; demographic survey and consent

- Step 2: Plugin demonstration, UI and plugin features
- Step 3: Guided exercises
- Step 4: Test exercise with evaluation (performed as walkthrough test)
- Step 5: Follow-up questionnaire



Figure 18: Exercise result of a participant including a landscape model and a statue provided by V4Design and a NURBS geometry.

The demographic survey consists of four questions regarding the participant information on profession, gender and age. Optional contact information could be provided. Explicit consent to process the evaluation results was requested per written form. The demographics relevant to the test are summed up in Table 5.

Table 5: Demographic survey

Participant Key	Gender	Profession
P1	F	Industrial Designer
P2	M	Software Developer
P3	M	Illustrator
P4	M	Model maker
P5	M	Industrial Designer
P6	M	Architect
P7	M	Architect

P8	F	Environmental and landscape engineer
P9	M	Architect
P10	F	Filmmaker

#### 4.4 Walk-through task and story

**Test Scenario 1 and 2:** During the test exercise, the participants were exposed to a set of three tasks and closely monitored by an evaluation partner from HdM, AUTH, DW, McNeel, and Nurogames. The participants were encouraged to think aloud and tell the evaluation partners about their next steps, thoughts on what they observe, plan and how they are trying to achieve their tasks. The tasks to perform were:

1. Query for two 3D models in the V4Design content library: (1) environment + (2) object
2. Combine both models
3. Add NURBS geometry to the scene and create a 3D and 2D view of the scene

These tasks have been defined prior to the evaluation workshop among the evaluation partners and material has been provided accordingly. All models from the test have been produced using the V4Design pipeline. Table 6 shows direct user feedback observed from the participants while executing the first part of the task set using the V4Design plugin UI to search and download an environment and an object model.

Table 6: Rhino Plugin Interface Evaluation

Task	Feedback	Recommendations
Model/ content discovery	<ul style="list-style-type: none"> <li>• Duplicate models in the queries are confusing</li> </ul>	<ul style="list-style-type: none"> <li>• Clearly highlight differences and avoid duplication in the database</li> </ul>
	<ul style="list-style-type: none"> <li>• Plugin UI and detail cards UI seem different</li> </ul>	<ul style="list-style-type: none"> <li>• Apply the same UI principle for both</li> </ul>
	<ul style="list-style-type: none"> <li>• Creator field in details is unclear (Where does Pablo Picasso come from as creator of Michaeliskirche Erfurt)</li> </ul>	<ul style="list-style-type: none"> <li>• Check metadata pipeline</li> </ul>
	<ul style="list-style-type: none"> <li>• Missing personal content to add</li> </ul>	<ul style="list-style-type: none"> <li>• Allow adding personal content (e.g. videos, images to process)</li> </ul>
	<ul style="list-style-type: none"> <li>• Submit search on enter did not work</li> </ul>	<ul style="list-style-type: none"> <li>• Submit search on pressing [Enter] key</li> </ul>
Model download	<ul style="list-style-type: none"> <li>• Some models not downloadable</li> <li>• Models that had empty data were</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure models that show in the interface have valid data</li> </ul>



	confusing	<ul style="list-style-type: none"> <li>Notify the user about a failed download</li> </ul>
	<ul style="list-style-type: none"> <li>Some models can be multiply downloaded</li> </ul>	<ul style="list-style-type: none"> <li>Prevent multiple downloads, if already present, or inform user to explicitly download a new version</li> </ul>
Model library	<ul style="list-style-type: none"> <li>No delete button for cached files</li> </ul>	<ul style="list-style-type: none"> <li>Allow users to manage and organize their library better</li> <li>Show downloaded, used or in progress as additional state for assets</li> </ul>
	<ul style="list-style-type: none"> <li>Users were unsure, how to categorize models</li> </ul>	<ul style="list-style-type: none"> <li>Allow users to organize their material based on categories as well</li> </ul>
	<ul style="list-style-type: none"> <li>Tags were not very useful to filter, yet</li> </ul>	<ul style="list-style-type: none"> <li>Allow managing tags for users as well (CRUD)</li> </ul>
	<ul style="list-style-type: none"> <li>Missing information on 3D models</li> </ul>	<ul style="list-style-type: none"> <li>Show more details on technical specs of a model <ul style="list-style-type: none"> <li>Size</li> <li>Faces</li> <li>Vertices</li> <li>MB</li> <li>Mesh count</li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>Library got deleted after closing Rhino</li> </ul>	<ul style="list-style-type: none"> <li>Keep local store of downloaded items</li> </ul>

The participants were asked to perform a set of complex tasks to facilitate an evaluation that follows a real world scenario. Using an environment model and an object model, they were supposed to create a complex scene and render it with added NURBS geometries inside the Rhino authoring environment.



Figure 19: Results from the evaluation exercise.

Table 7 shows participants feedback from the second part of the task set of using the downloaded 3D model in a Rhino scene, merging them into a scene and adding a geometry to create a 3D and 2D view of the scene.

Table 7: Evaluation of Rhino workspace and model usage

Task	Feedback	Recommendations
Model import scene	<ul style="list-style-type: none"> <li>Model orientation and scale seems random or off</li> <li>Hard to find model in scene, if scaled too small</li> <li>Imported model out of camera frustrum</li> <li>Model had to be rotated and scaled manually</li> </ul>	<ul style="list-style-type: none"> <li>Help users get the model to scale</li> <li>E.g. provide auto-scaling for known object types (building scale, object scale) to get an estimate bounding box scaling</li> <li>Auto-scale object to be within reasonable camera frustrum settings</li> </ul>
	<ul style="list-style-type: none"> <li>Difficulty to find front or back side of the model</li> <li>Back and front face are not set automatically</li> </ul>	<ul style="list-style-type: none"> <li>Set back and front face automatically</li> </ul>
	<ul style="list-style-type: none"> <li>Model import can't be drag and dropped</li> </ul>	<ul style="list-style-type: none"> <li>Allow model to be dragged and placed into scene</li> </ul>
	<ul style="list-style-type: none"> <li>Imported/used model does not show in library</li> </ul>	<ul style="list-style-type: none"> <li>Mark model that has been imported into the current Rhino scene</li> </ul>
	<ul style="list-style-type: none"> <li>No feedback upon adding model to scene (except showing up on</li> </ul>	<ul style="list-style-type: none"> <li>Add user facing message upon status of operation, esp. when it fails because of incomplete data</li> </ul>

	success)	<ul style="list-style-type: none"> <li>Zoom to newly imported model</li> <li>Place model close to world origin</li> </ul>
	<ul style="list-style-type: none"> <li>Asset name and layer name are different</li> <li>Needs to rename layer every time</li> </ul>	<ul style="list-style-type: none"> <li>Name layer same as imported object</li> </ul>
	<ul style="list-style-type: none"> <li>Meshes needed to be grouped or joined</li> </ul>	<ul style="list-style-type: none"> <li>Already group meshes of object on import into scene</li> </ul>
	<ul style="list-style-type: none"> <li>Textures are not appearing in the material tab</li> </ul>	<ul style="list-style-type: none"> <li>Show textures in the material tab</li> </ul>
Model quality	<ul style="list-style-type: none"> <li>Texture in Bauhaus Weimar is not appealing</li> </ul>	<ul style="list-style-type: none"> <li>Investigate video quality and proximity of shots to establish minimum requirements for quality reconstruction shots</li> </ul>
	<ul style="list-style-type: none"> <li>Statue model (William) had a lot of noise to clean up</li> </ul>	<ul style="list-style-type: none"> <li>Check particular source and 3D reconstruction pipeline for improvements</li> </ul>
	<ul style="list-style-type: none"> <li>Some issues with meshes in Rhino <ul style="list-style-type: none"> <li>Incomplete meshes</li> <li>Breaking textures</li> <li>dirty mesh</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Improve 3D reconstruction pipeline to generate valid and clean meshes</li> </ul>
	<ul style="list-style-type: none"> <li>Shadow on textures causes issue with scene lighting in Rhino</li> <li>Lighting does not affect shadows well</li> </ul>	<ul style="list-style-type: none"> <li>Provide textures without shadows from natural lighting <ul style="list-style-type: none"> <li>Use material that is recorded without direct sunlight</li> <li>Use texture filters that can reduce shadow effects</li> </ul> </li> </ul>

## 4.5 Questionnaire and results

**Test Scenario 1 and 2:** After the walk-through, a follow-up interview has been conducted using a feedback questionnaire evaluating the exercises and additional questions with a combination of open-ended questions and Likert-scale questions to obtain a System Usability Scale (SUS). The SUS provides a score between 0-100% to assess the user friendliness of the 1<sup>st</sup> prototype version of the V4Design platform. The full questionnaire can be found in Annex A.

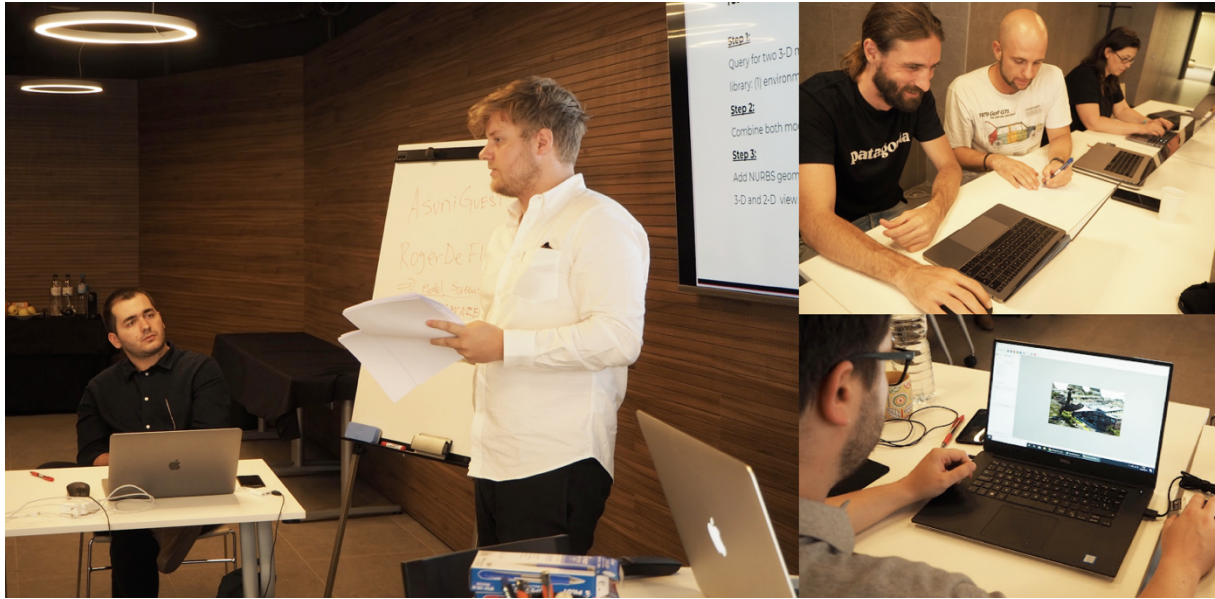
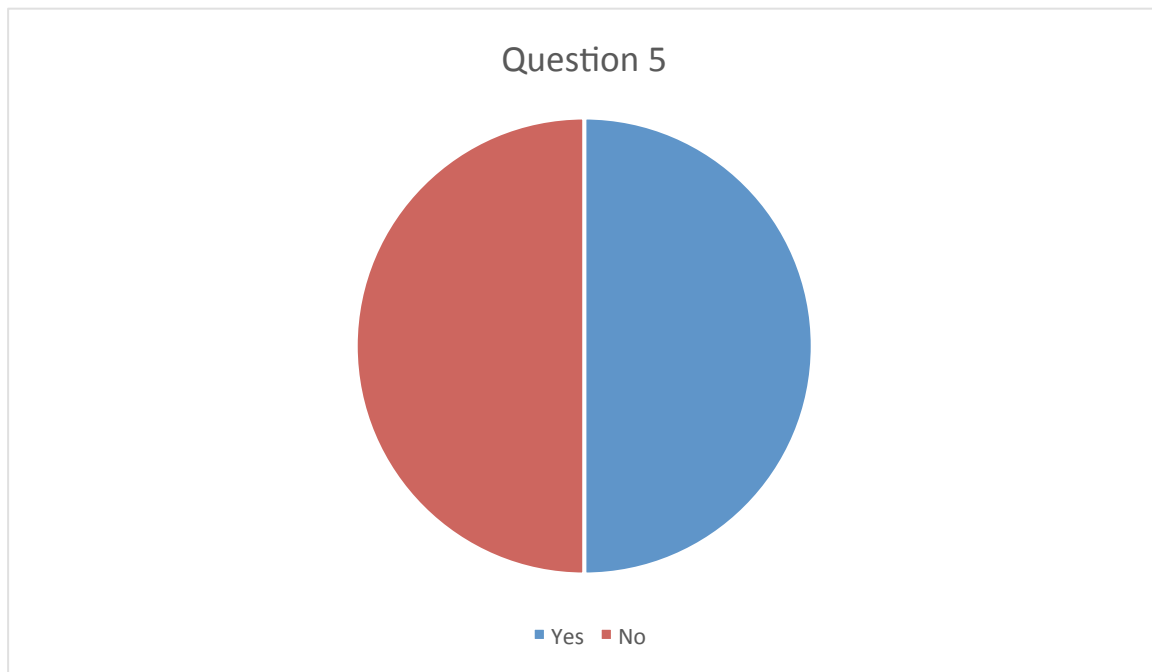


Figure 20: Impressions from the Evaluation Workshop and Questionnaire Presentation

#### 4.5.1 Binary and open-ended questions

Missing points or answers to the total number of participants indicate no answer given.

**Question 5:** In your architecture projects, do you use premade assets, such as those sold on online marketplaces and repositories?



**Question 6:** If yes, please indicate from where you usually obtain or buy these assets.

- *TurboSquid*
- *Free 3D models*
- *Flying Architecture*

**Question 11 (User Evaluation Task 01):** Did you encounter any workflows or behavior which were unexpected or counter intuitive?

- *After writing "London", click enter and the first of the list "13.41053" was added too. I wanted to start the search. (London x will be great!)*
- *Return key doesn't work to accept the query*
- *More info on the assets*
- *A double enter would be nice to start the search.*
- *Hard to delete tag. Hard to find close button in detail window. Search should filter objects*
- *Yes, after typing "London" for tags, I didn't find the "Figure Emerging" and the rest of items were not ordered alphabetically*
- *No, I think it's really intuitive*

**Question 12 (User Evaluation Task 02):** Describe your experience of using the search function (Step 02).

- *It's good, easy.*
- *I have no reference on how big the model is. Would be good to have a bounding box preview under the cursor before download.*
- *Easy*
- *Basic functions, but works well.*
- *I like the auto fill but it would be nice to have main categories*
- *Ok*
- *Missing feedback when downloading samples and inserting them in the model*
- *Easy and intuitive interface*

**Question 13 (User Evaluation Task 02):** Describe your experience when adding objects to the scene (Steps 03 & 04).

- *It took me a while to identify the assets, the name on layers was the same.*
- *Is just placed somewhere. May be good to ask for insertion point, maybe and orientation and finally allow the user to scale the model.*
- *Need to scale and rotate, missing references. Also, exploding the mesh and deleting some parts is needed.*
- *The objects are neither scaled nor oriented. The meshes would need some cleaning.*
- *Importing models (loading) is fast, but the scale and orientation isn't.*
- *Need more info on the status of the project while downloading, loading, etc.*
- *After clicking "+" button, nothing happens in the first attempt. Object is rotated and is difficult to place it right*
- *Good, but the scale really small, and you have to rotate the objects.*

**Question 14 (User Evaluation Task 02):** Did you encounter any workflows or behavior which were unexpected or counter intuitive?

- *It took me a while to place, scale and cut the asset. They were in a different scale.*
- *Sometimes model doesn't download, or download but are not inserted.*
- *No*
- *Drag and drop is a nice idea, and face normals displayed with different colours would be a plus.*
- *Could be nice if it's easier to search.*

**Question 16 (User Evaluation Task 03):** Describe any difficulties encountered when adding items to the library (Step 02).

- *They were added when downloading. If I open a new document, even if I downloaded them before, they are not in the library.*
- *No.*
- *Orienting & Scaling*
- *It works fine and it is very easy and simple.*
- *Library not ready*
- *I get duplicate objects undesired.*
- *Any problems, just you cannot delete after adding objects there.*

**Question 17 (User Evaluation Task 03):** To productively utilize your own custom library, what additional features would you need (Step 03)?

- *Folders, add notes.*
- *Being able to remove elements from library.*
- *Coordinates, scale*
- *It would be nice (to prompt) a question if you want to add model to library (maybe you are just testing)*
- *Manage favourites in folders and subfolders*
- *I would like to have folders*

**Question 18:** Did you encounter any workflows or behavior, which were unexpected or counter intuitive?

- *No.*
- *Some crashing (with WIP)*
- *Duplicate models in the library*
- *I don't know if objects are downloading at all or not.*

**Question 23 (General):** Would you like to extract assets from media (videos and image collections) of your own raw data? Please elaborate.

- *Yes, I would like to extract objects from images for a virtual museum project.*

- *Yes, from videos I take when I travel.*
- *Yes, as an explicit photogrammetry tool for instance, to model objects taken from videos.*
- *Yes, it would be amazing to set my own spots.*

**Question 24 (General):** Where do you think extracting and reusing visual assets from existing media could improve your projects? Please elaborate.

- *When the objects can't be exhibited on a museum.*
- *Generating sample models.*
- *Custom landscapes.*
- *Models of old buildings without documentation.*
- *Yes, not just architecture but naval design to extract the hull of the ship. Generating built VR models to show experiences to customers.*
- *For site plans - modelling the "environment" of your project.*

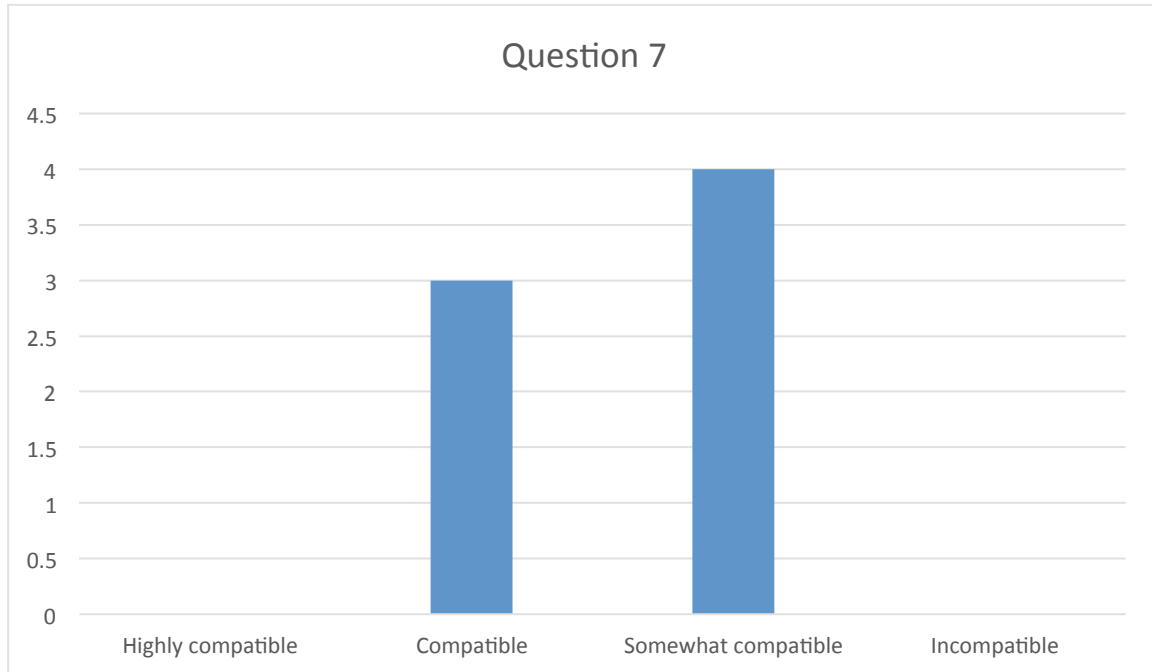
**Question 27 (General):** How do you think this extraction and recycling process can be improved to better meet your expectations?

- *Real scales, assets already rotated and correctly placed. It took a long time to get them right.*
- *I think size and orientation are necessary.*
- *Don't know. I've seen how to import scenes. No idea how the scenes were created from videos.*
- *Better meshes.*
- *It would be useful to extract distances, areas or projections to generate models for air flow or sunlight simulations.*
- *The process is not clear to me yet.*
- *It's really useful, because you have a general version and you can see your design in context (talking about landscape design). I don't need to develop all the environment and I don't need to use Photoshop.*

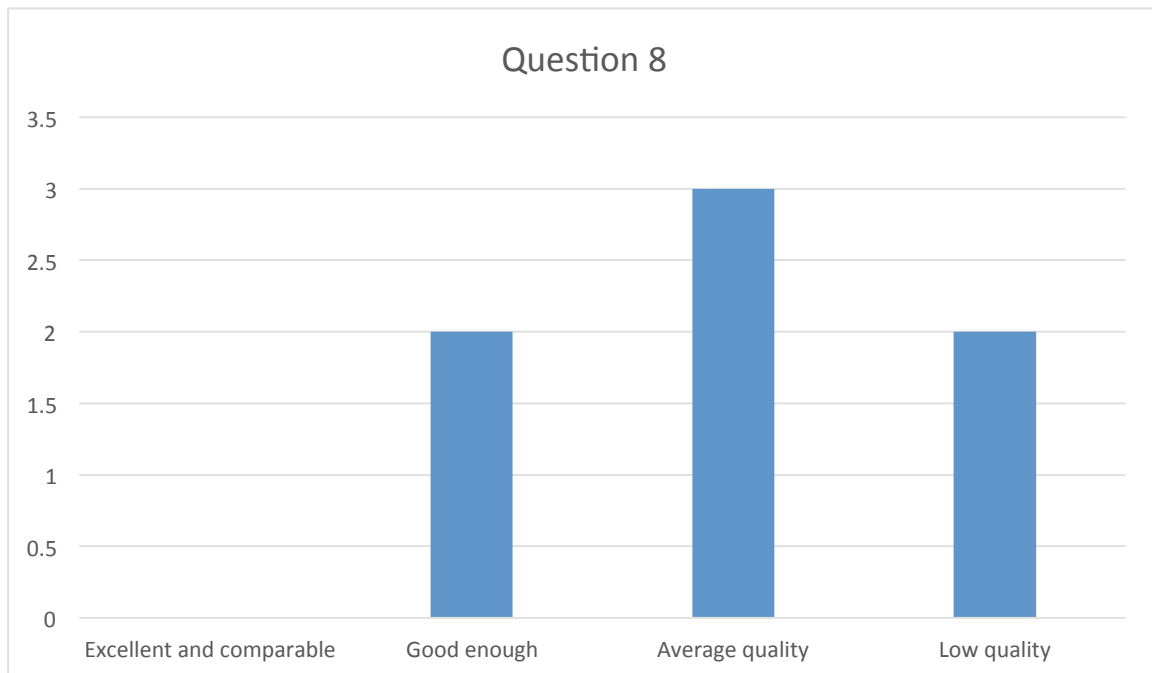
#### 4.5.2 Rated questions

Missing points to the total number of participants indicate no answer given.

**Question 7:** How would you describe the compatibility of these assets with your project?

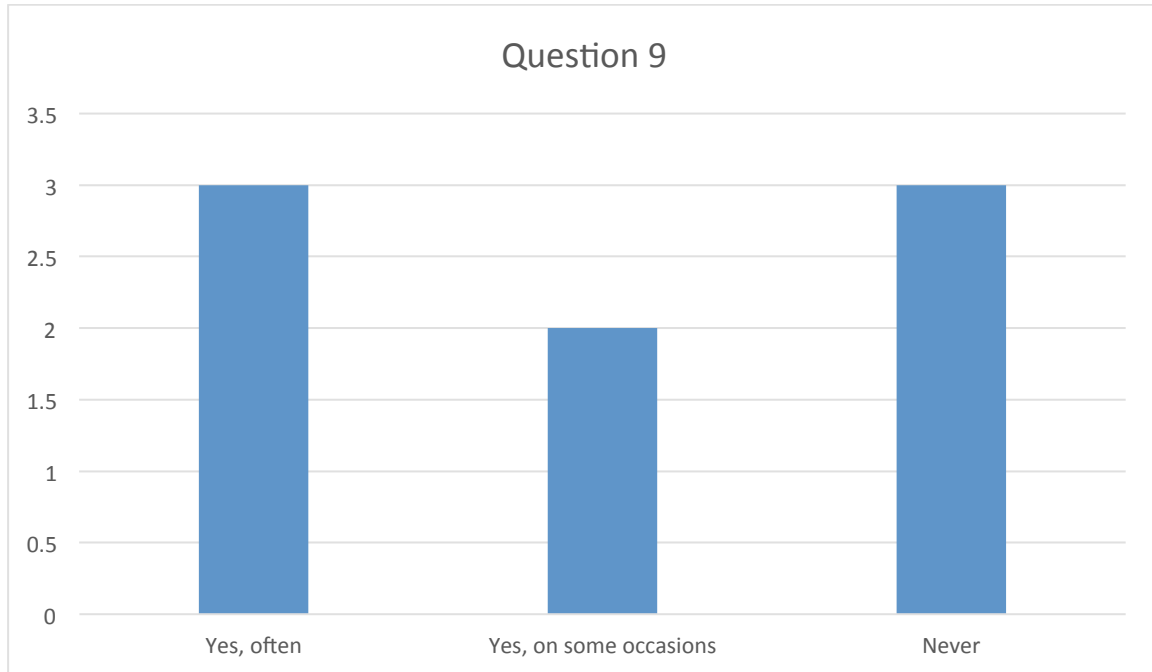


**Question 8:** How would you describe the quality of these assets on average?

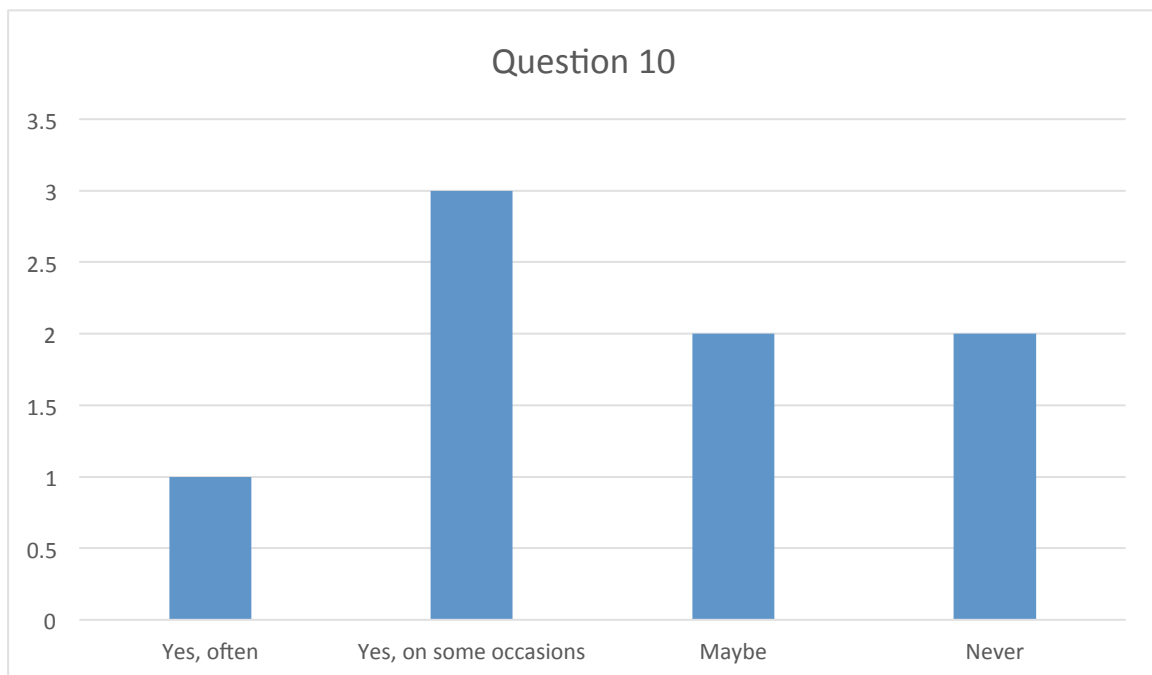


**Question 9:** Have you ever attempted to extract assets from existing media (images, videos, web pages, etc.) and transform them into assets for your project?

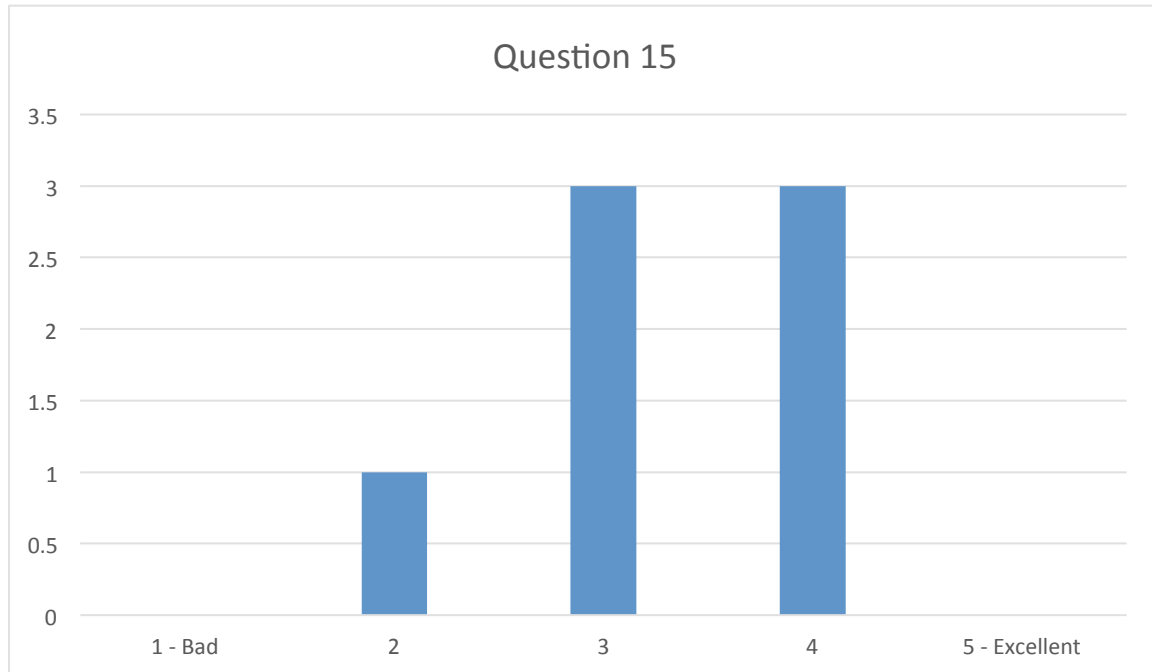




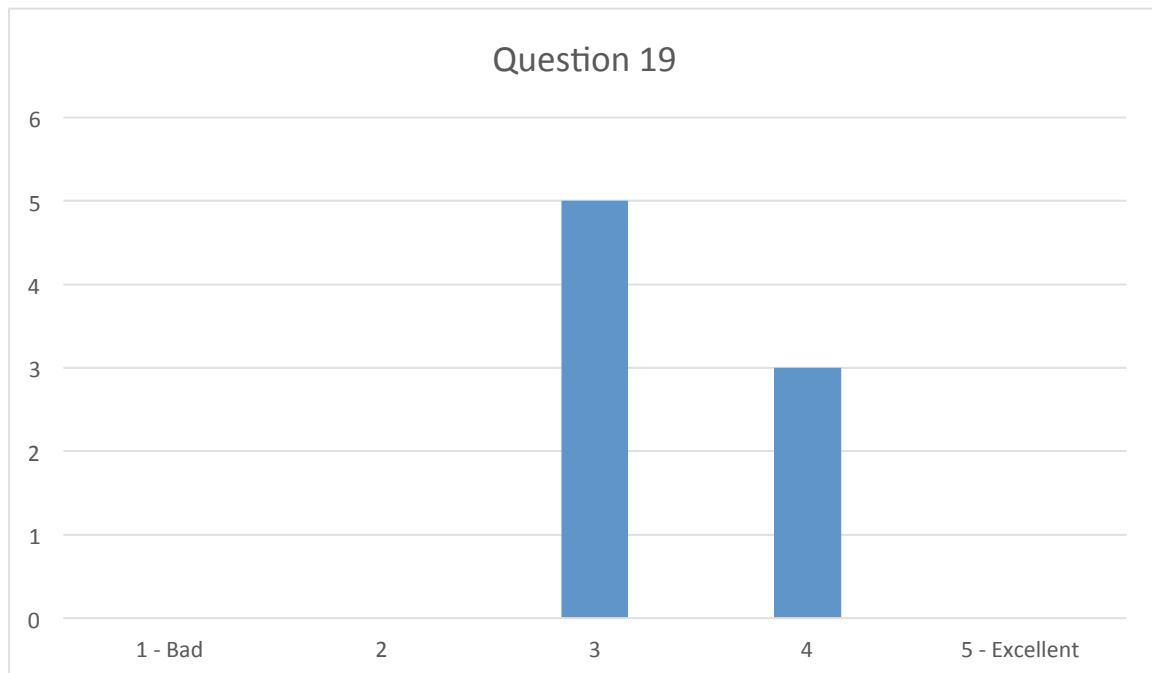
**Question 10:** Have you ever identified items in films, documentaries, videos, or image collections, that could be relevant for your projects?



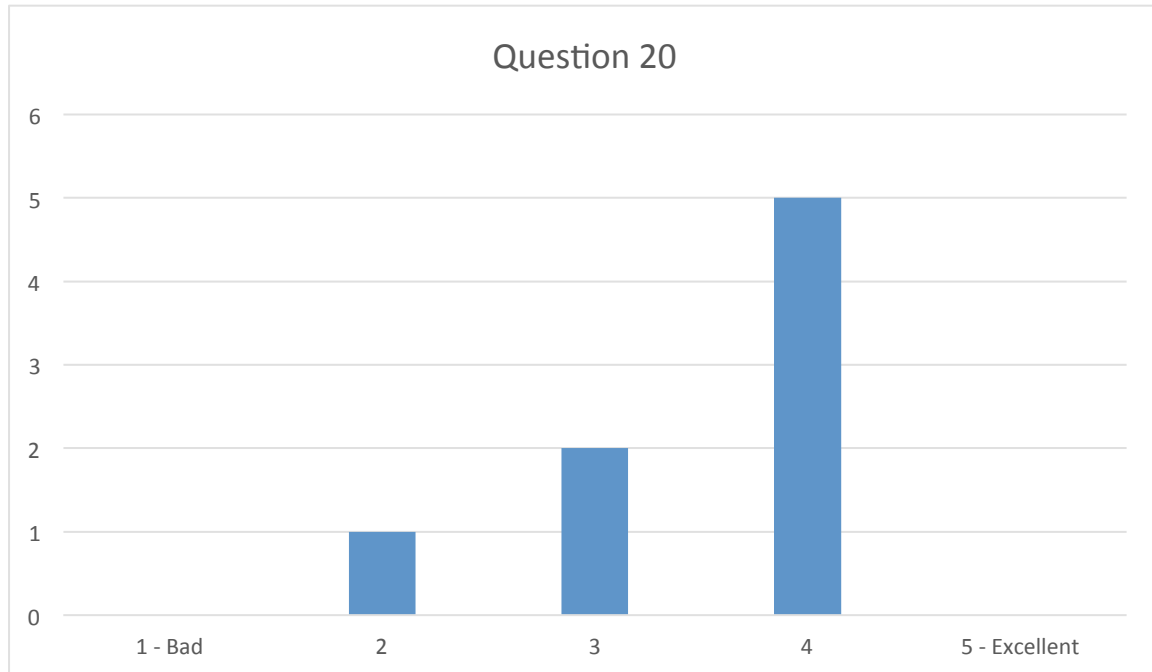
**Question 15 (User Evaluation Task 02):** Rate the quality of the retrieved 3D model.



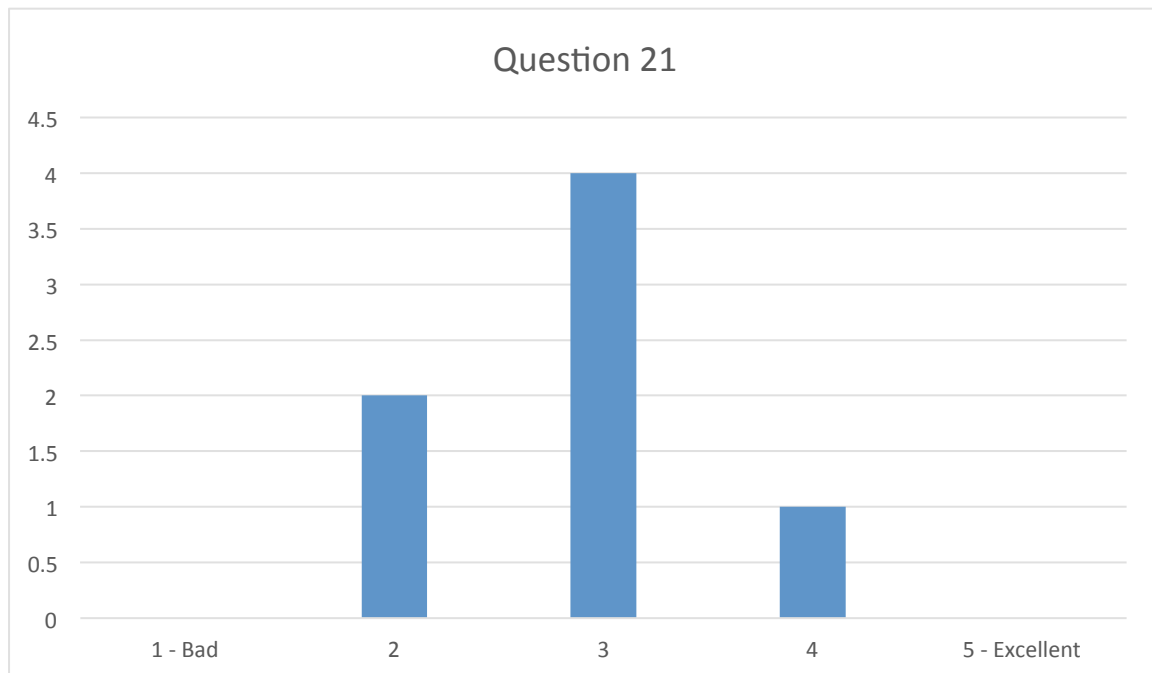
**Question 19 (General):** How do you find the overall quality of the 3D models?



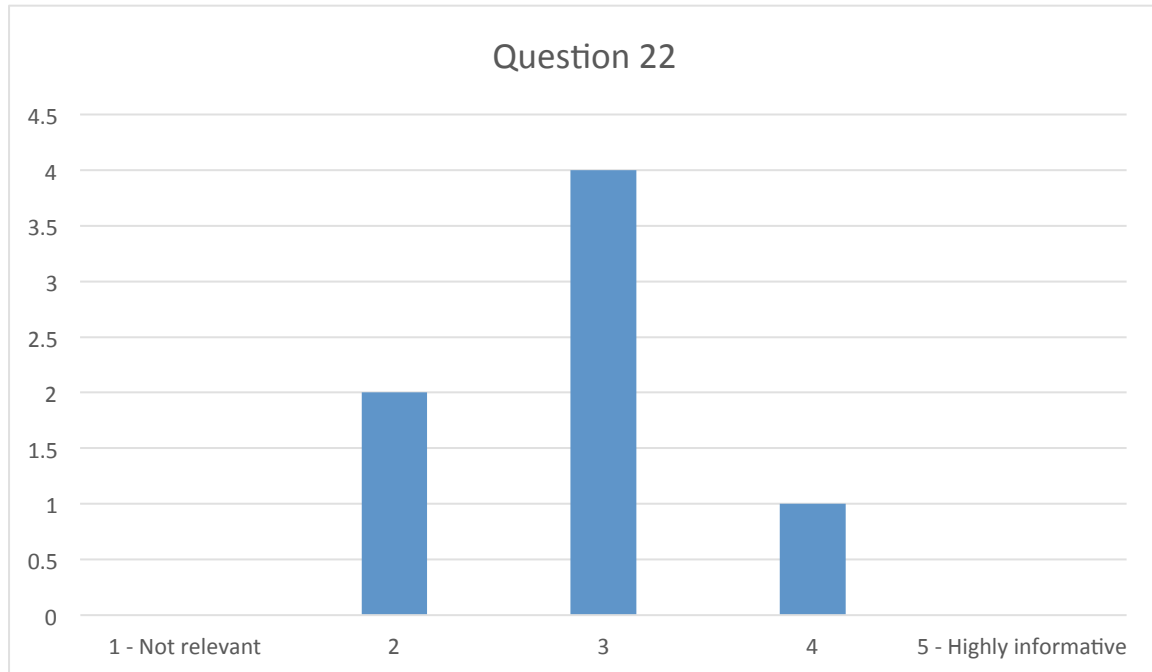
**Question 20 (General):** How do you find the overall quality of the textures?



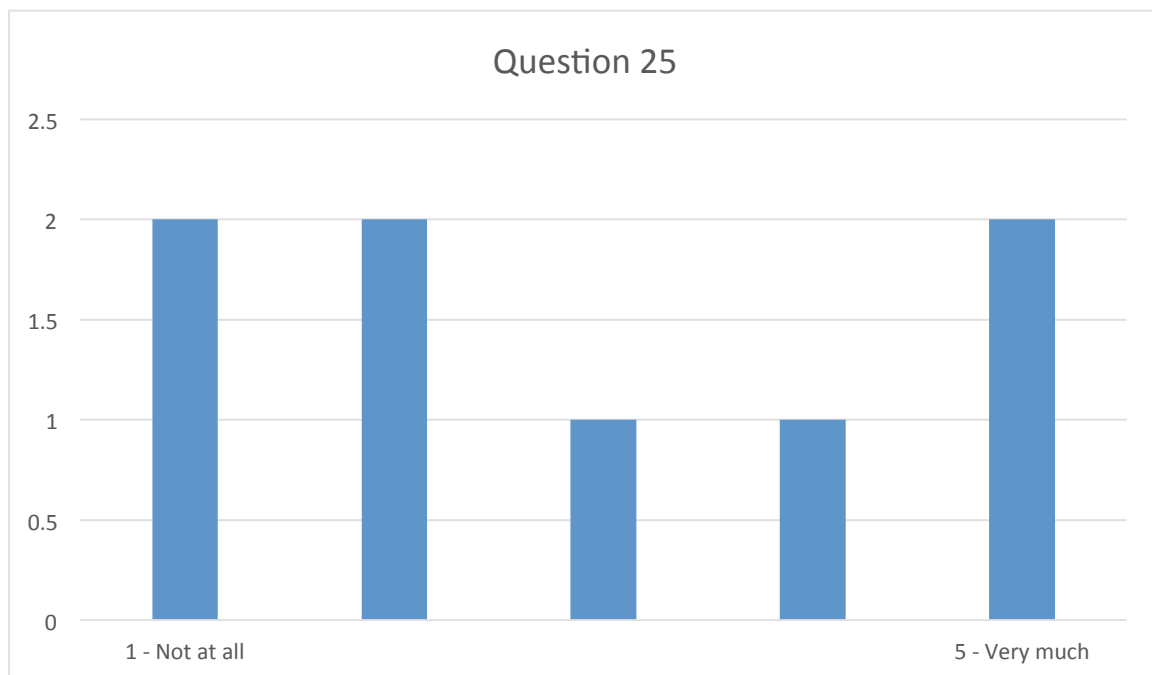
**Question 21 (General):** How do you find the overall quality of the textual descriptions?



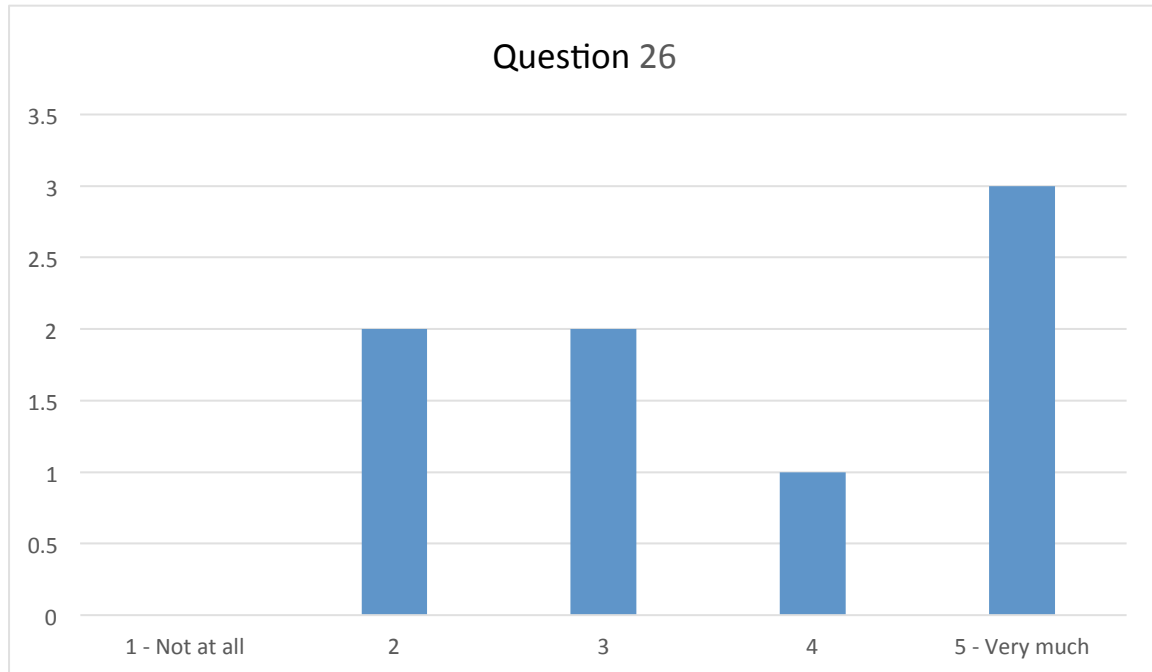
**Question 22 (General):** Do you find the descriptions that accompany each asset useful?



**Question 25 (General):** Do you think that extracting and reusing visual assets can reduce your workload?



**Question 26 (General):** Do you think that extracting and reusing visual assets such as the ones you evaluated can reduce the costs of your project?



## 5 EVALUATION OF THE VR AUTHORIZING TOOL

The goal of this study is to evaluate and report on the 1st prototype version of the V4Design platform and its components. It shall collect feedback from potential users on the platforms value proposition, usability and user satisfaction. The basic steps of the evaluation process are as follows:

1. Basic introduction into the platform, capabilities and tools; demographic survey (GDPR)
2. Walk-through (without recording) interview; Noting questions (specific per task or work flow step, summative at the end)
3. System Usability Scale survey/ Post-exercise questionnaire

The participants were able to experience, test and evaluate it while their responses and feedback are supposed to be integrated into the next development cycles. The workshop also functioned as a dissemination and exploitation event and was expected to help extend the group of people interested in the project. The demonstration and evaluation sessions were organized and conducted by DW and supported by Nurogames on Monday, the 26th of August 2019 at DW premises in Bonn, Germany.



Figure 21: Participants of DW evaluating the VR Authoring Tool being guided by R. Kratz of Nurogames.

DW invited colleagues from the editorial department, design and (VR-experienced) technical project manager to the demonstration session. In total 8 testers participated (3 female, 5 male). 4 of the 8 participants have a design background, three are (IT/Innovation) project managers, and one is a software engineer. The group consisted of five German, one Dutch and one Swedish participants. All participants have experienced VR before, some of them only on private occasions, other in work-related context.

Additionally, the VR authoring tool was presented by Nurogames at the Gamescom convention in Cologne, August 20 to August 24. It was presented to a wide range of people with an estimated average age of 20 years. The focus group was clearly game interested and the main occupation were students. There was a considerable gender gap of 80% males and 20% females, which can be attributed to the target audience of the Gamescom that is still heavily focused on young males.

## **5.1 Test executive summary**

The current production process of development on VUS includes three major steps:

- Data Collection
- 3D Modelling
- Presentation

The pilot targets all the steps of the production process and how V4Design can help transform the production process with better and faster results. In order to ensure a high quality of feedback we invited each participant for a private session of a minimum of 30 minutes. This allowed us to focus on each participant's experience and observe their actions carefully. The participants were instructed by Robin Kratz (Nurogames) and Eva Lopez (DW). At the beginning of each session each participant received an introduction about the project and the design of the evaluation. The evaluation set-up was two-fold: first, while testing the instructors observed the participants carefully, R. Kratz guided them through the experience and explained the functionality whereas E. Lopez talked with them about their experiences, the pros and cons of such a tool and its current status. Second, the participants filled out a questionnaire derived from previous testing (e.g. demonstration session of V4Design architectural tool at McNeel in Barcelona). As a result, the evaluation covers a qualitative and quantitative approach.



Figure 22: A user is preparing to test the VR Authoring Tool at the Nurogames booth at Gamescom 2019

The setup at the Gamescom convention was quite similar. It consisted of a

- Laptop capable of supporting VR
- Oculus Rift 2 Headset. The players would wear the headset and control the camera using their head.
- 2 Controllers. The controllers were used to move around the map and add/remove/move/scale/rotate the objects, questions and interact with the world
- 2 Sensors tracking the position and movement of the controllers. The sensors had to be kept 2 meters apart to get the best tracking results.

Users would enter the VR experience and try to add various 3D Objects in different scenes of the VR environment and change the VR environments.





Figure 23: A user is testing the VR Authoring Tool at the Nurogames booth at Gamescom 2019

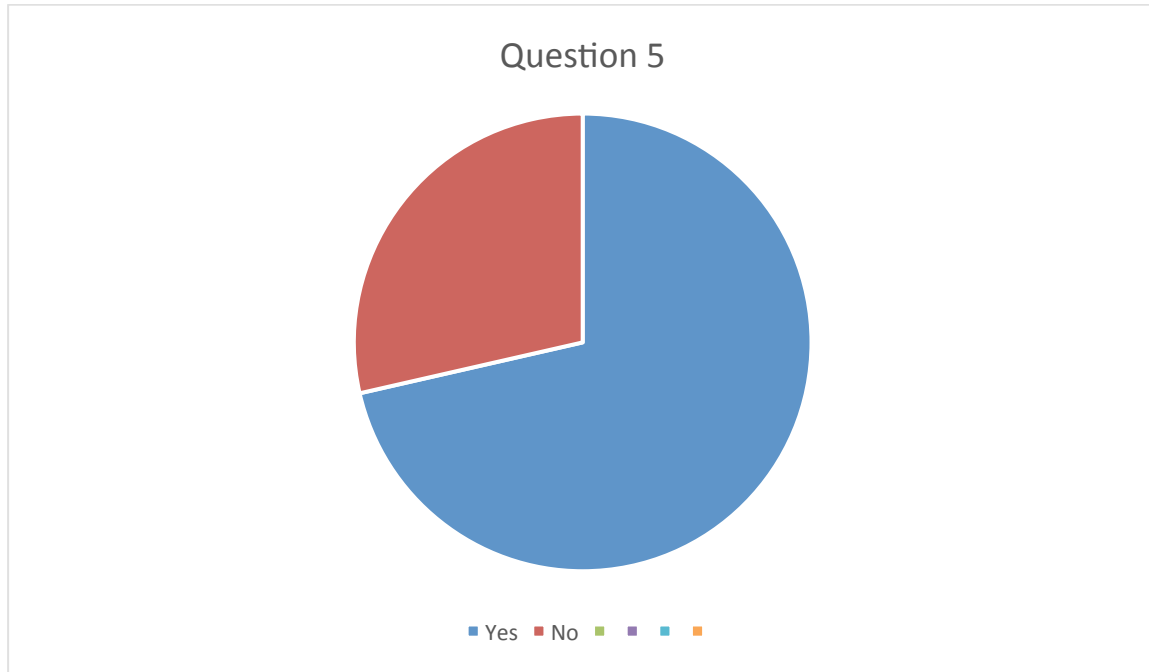
## 5.2 Quantitative Results

**Test Scenario 1 and 2:** After the walk-through, a follow-up interview has been conducted using a feedback questionnaire evaluating the exercises and additional questions with a combination of open-ended questions and Likert-scale questions to obtain a System Usability Scale (SUS). The SUS provides a score between 0-100% to assess the user friendliness of the 1<sup>st</sup> prototype version of the V4Design platform. The full questionnaire can be found in Annex B. All 8 participants filled out the questionnaire, which was sent to them via email, within 24 hours.

### 5.2.1 Binary and open-ended questions

Missing points or answers to the total number of participants indicate no answer given.

**Question 5:** Have you ever worked with 3D objects?



**Question 6:** In your projects, do you use pre-made assets, such as those sold on online marketplaces and repositories?



**Question 7:** If yes, please indicate from where you usually obtain or buy these assets.

- *I tried out Google SketchUp , they have a library for famous buildings and more*
- *I really rarely use 3D assets, because I'm mainly working 2D.*
- *My own team*

**Question 19:** What kind of textures would you prefer to have?

- *A set of textures representing different styles of painting would be nice, I guess.*
- *Dependent on each project and its general design*
- *I like the world in 'art view' but also the historical versions are great although this might not be limited to texture, right?*

**Question 21:** Are you missing features? Suggestions?

- *I found it difficult to deal with the controllers.*
- *I would find it helpful to switch to another view mode - e.g. bird's eye view to place objects or to get an overview of a situation.*
- *A desktop authoring/editing feature would be nice.*
- *A help-feature to guide me in order to find the menus (e.g. briefly show the necessary buttons to click in VR)*
- *Where obvious, one should be able to manipulate objects with the virtual hands instead of using the joystick and button. Example: scaling, rotating.*
- *Immersion, interaction with others possibly? Maybe a timescale instead of a time-switch, but that is interaction design which is a different baustelle :)*

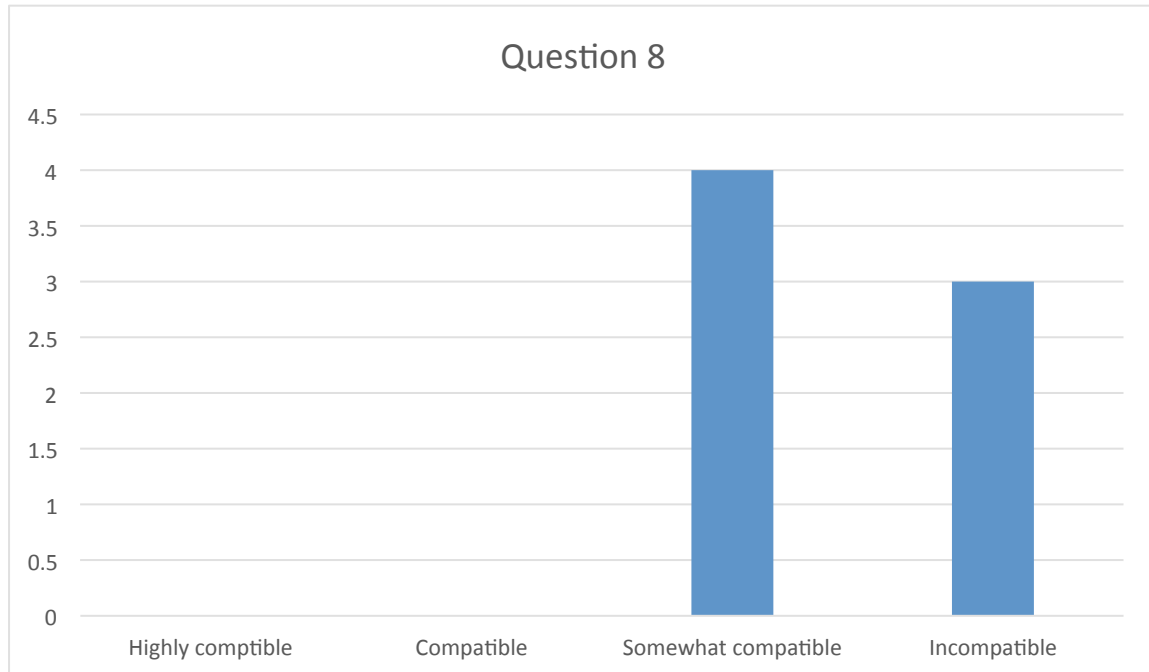
**Question 22:** What is your overall impression of the VR Authoring Tool?

- *It is at the beginning and I am looking forward to the further development.*
- *It is an interesting experience which might help to develop new ideas.*
- *Very interesting!*
- *Interesting, but flawed. Editing in a virtual 6DOF environment is already tricky. Latency issues, a less than ideal display resolution and a subpar GUI interface design will make things even more difficult.*
- *It's cool and I'd like to use it more often. But I do think there need to be some improvements to both the materials available as well as the UX of the handling itself. It's sometimes a bit clunky*
- *Too brief to give a valid answer. Would also need more background info before testing.*
- *Good starting point, but needs to evolve to make it better than modelling a scene on a 2D monitor.*
- *Great start, good proof of concept. What I would find interesting is templating of certain things like a question game, a history travel, witnessing an event or so. Like PowerPoint gives users hints on what they can do with their tool via templates...*

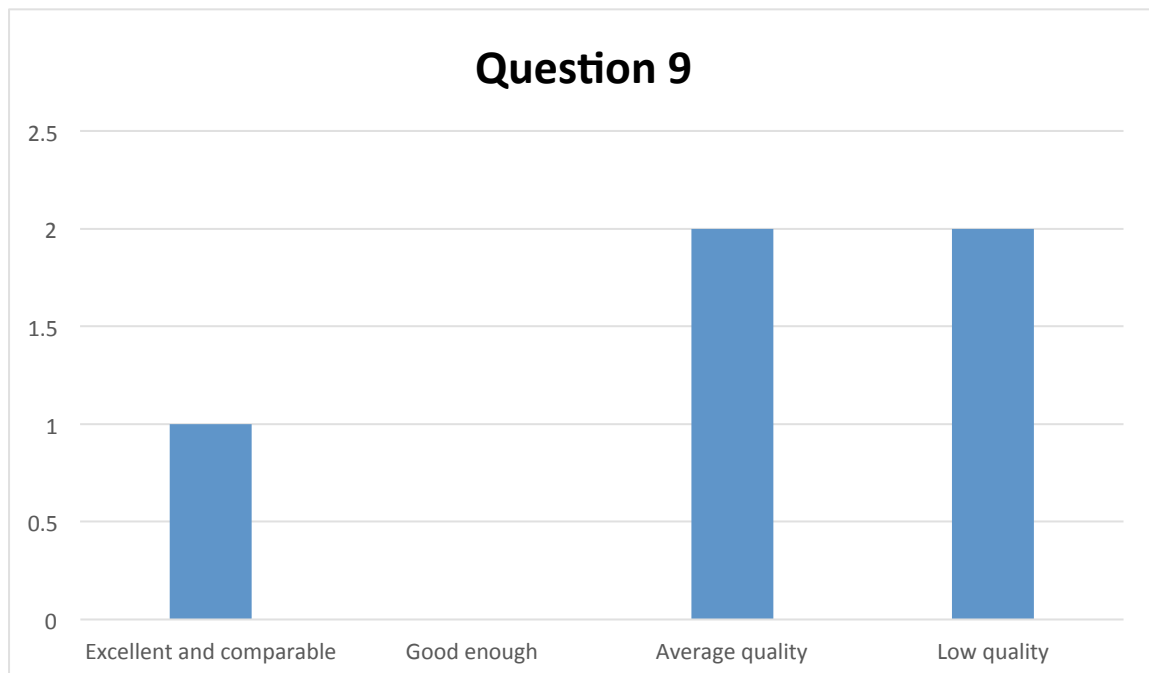
### 5.2.2 Rated questions

Missing points to the total number of participants indicate no answer given.

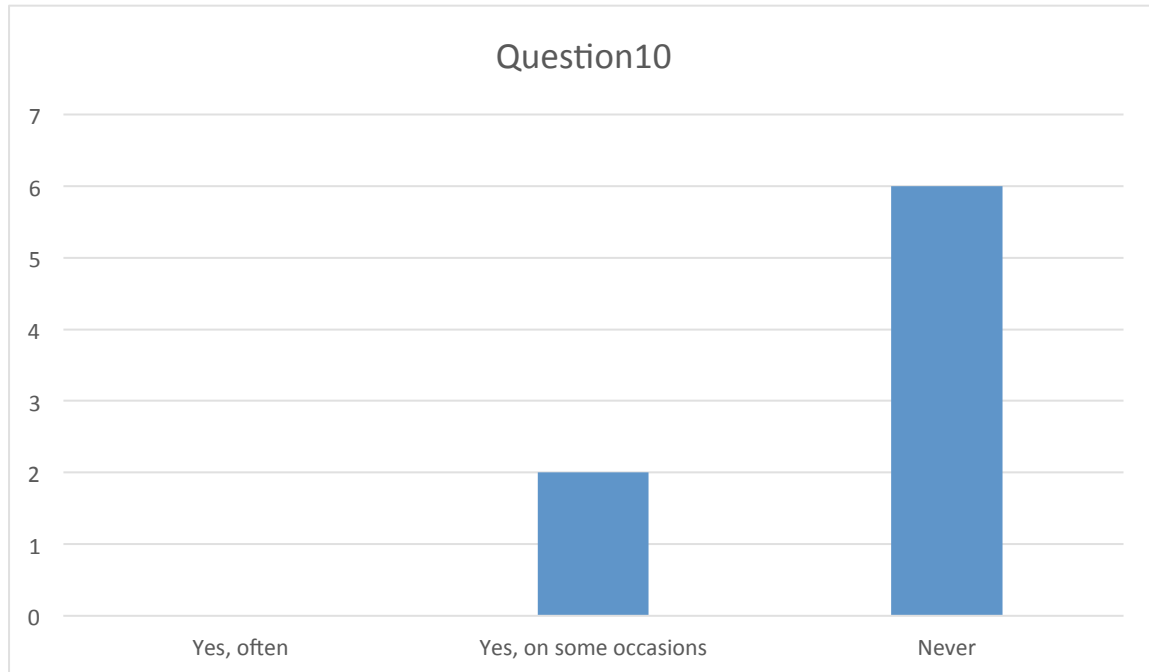
**Question 8:** How would you describe the compatibility of these assets with your projects?



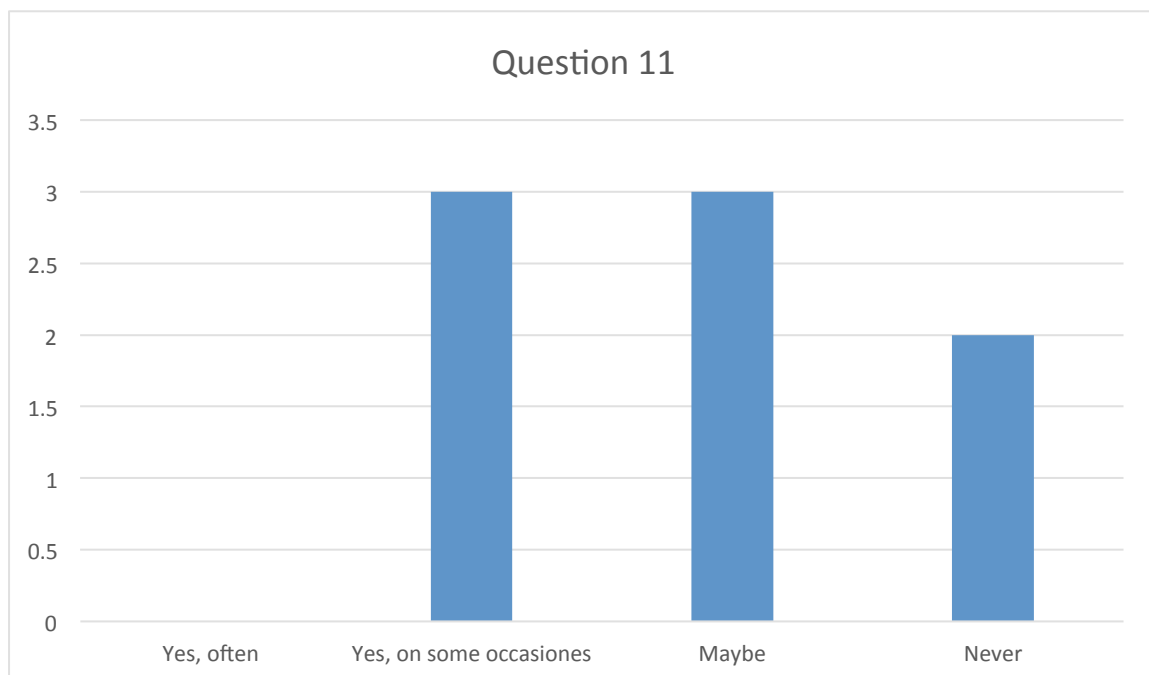
**Question 9:** How would you describe the quality of these assets on average?



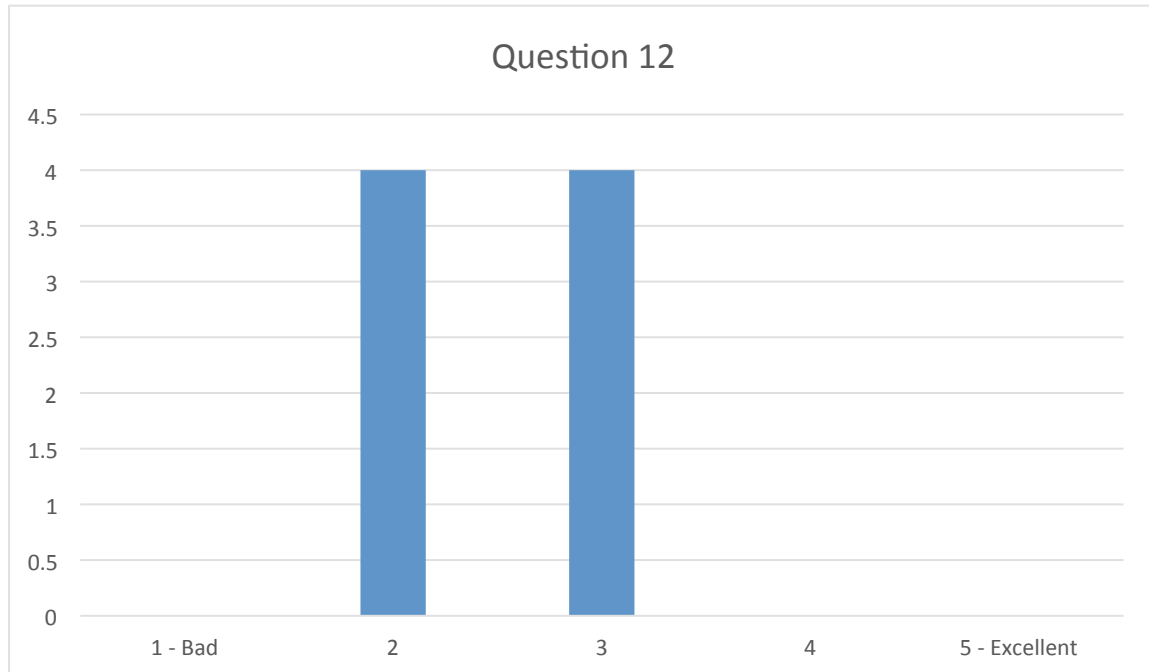
**Question 10:** Have you ever attempted to extract assets from existing media (images, videos, webpages, etc..) and transform them into assets for your project?



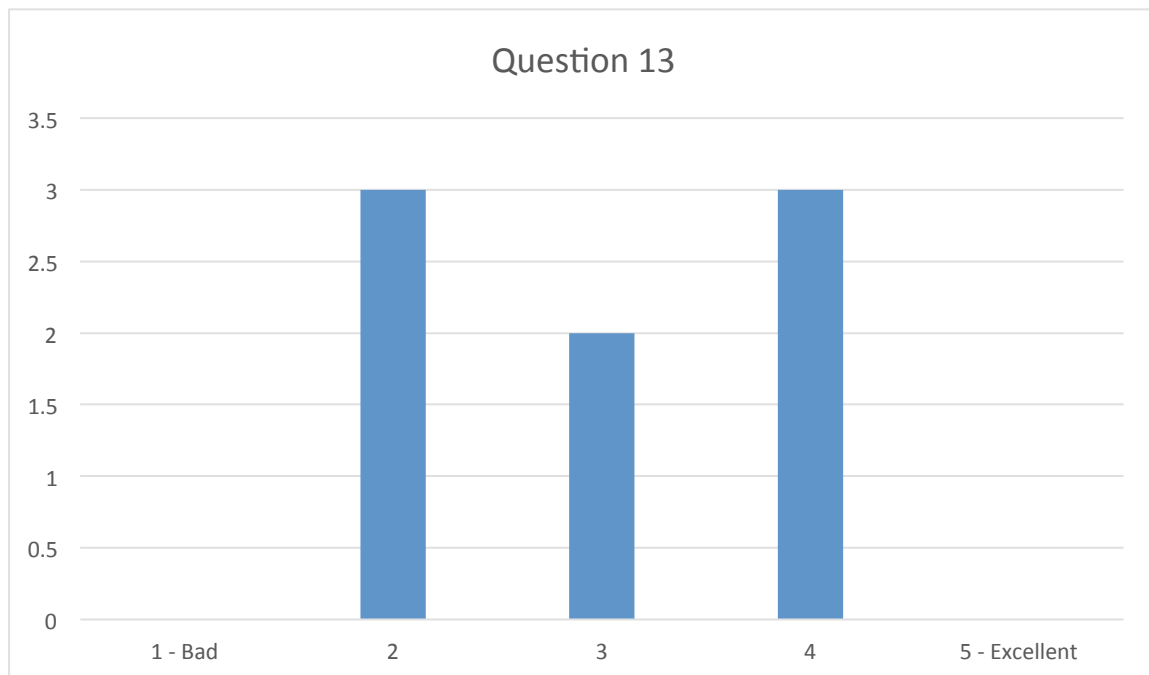
**Question 11:** Have you ever identified items in films, documentaries, videos, or image collections, that could be relevant for your projects?



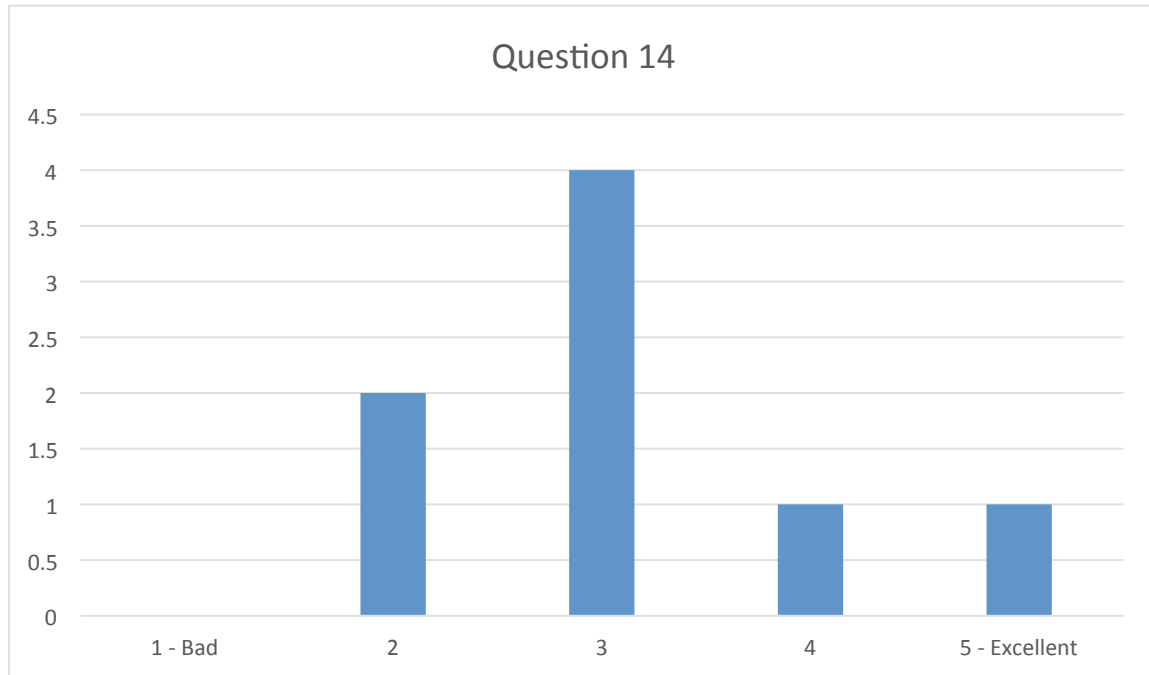
**Question 12:** How do you find the overall quality of the V4Design assets?



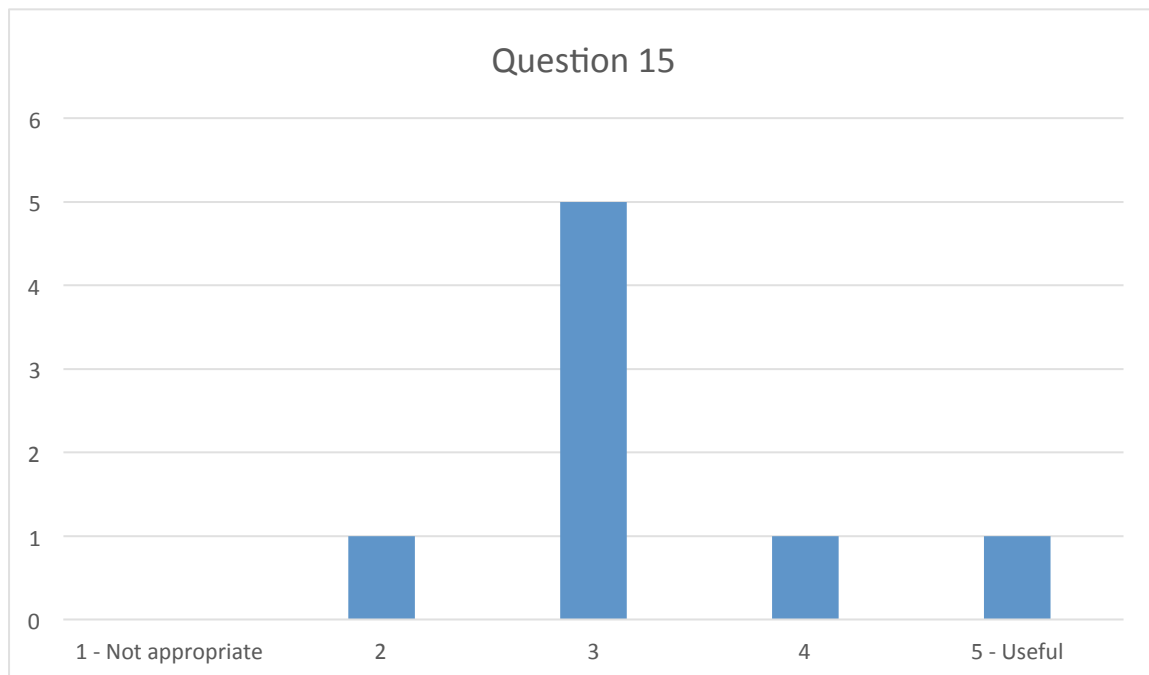
**Question 13:** How do you find the overall quality of the 3D models?



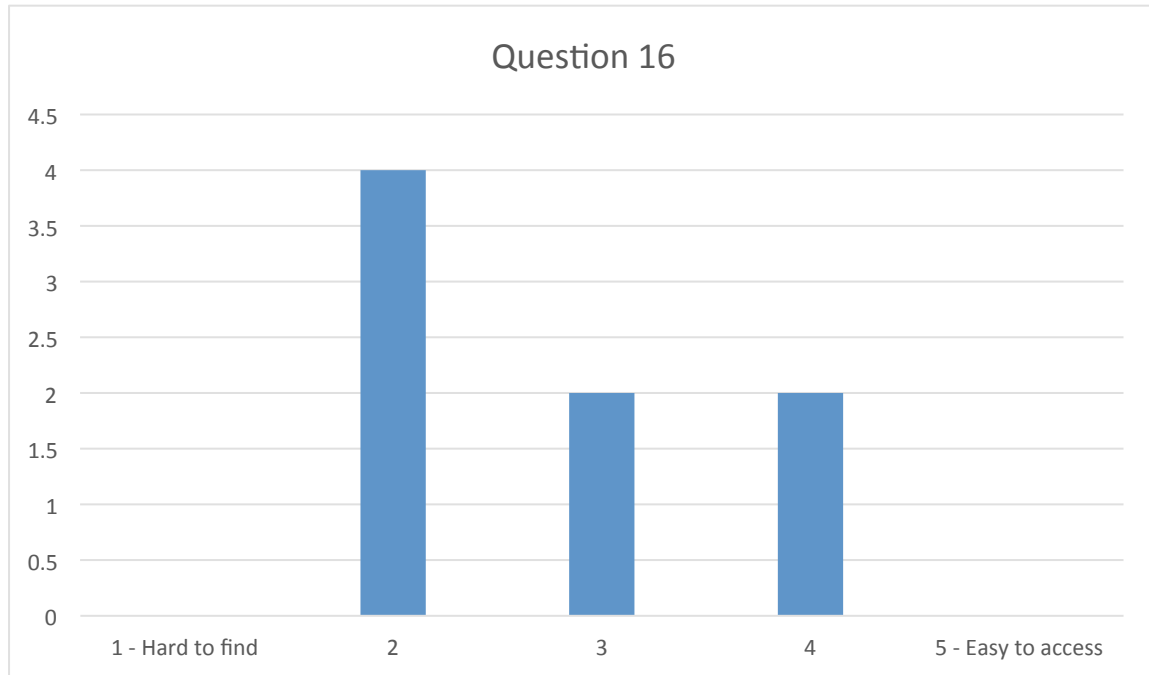
**Question 14:** How do you find the overall quality of the textures?



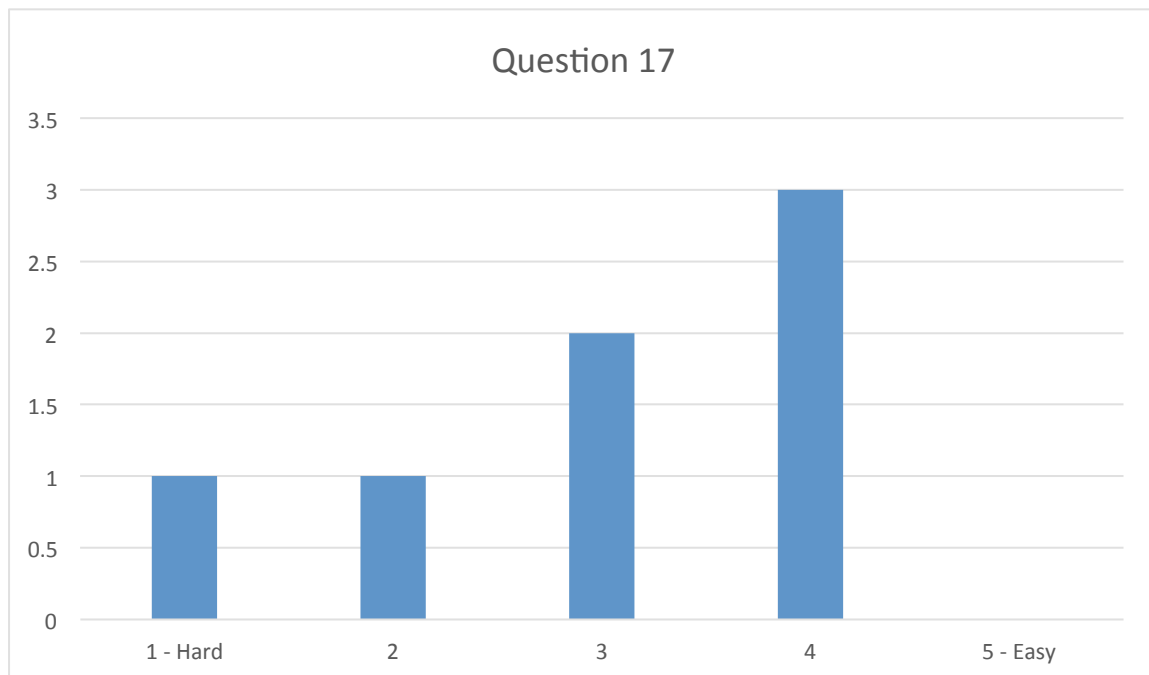
**Question 15:** Is the texture proposal appropriate for texturing 3D models?



**Question 16:** How would you rate access to V4Design assets using the tool?

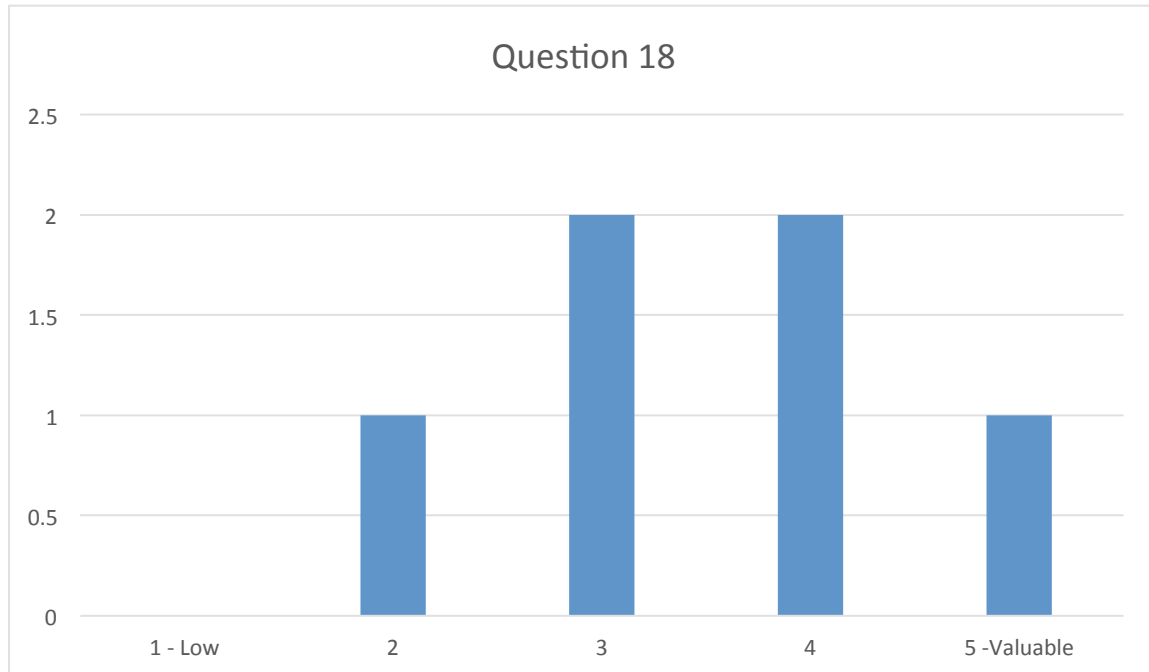


**Question 17:** How would you rate selecting, placing and removing assets from the scene?

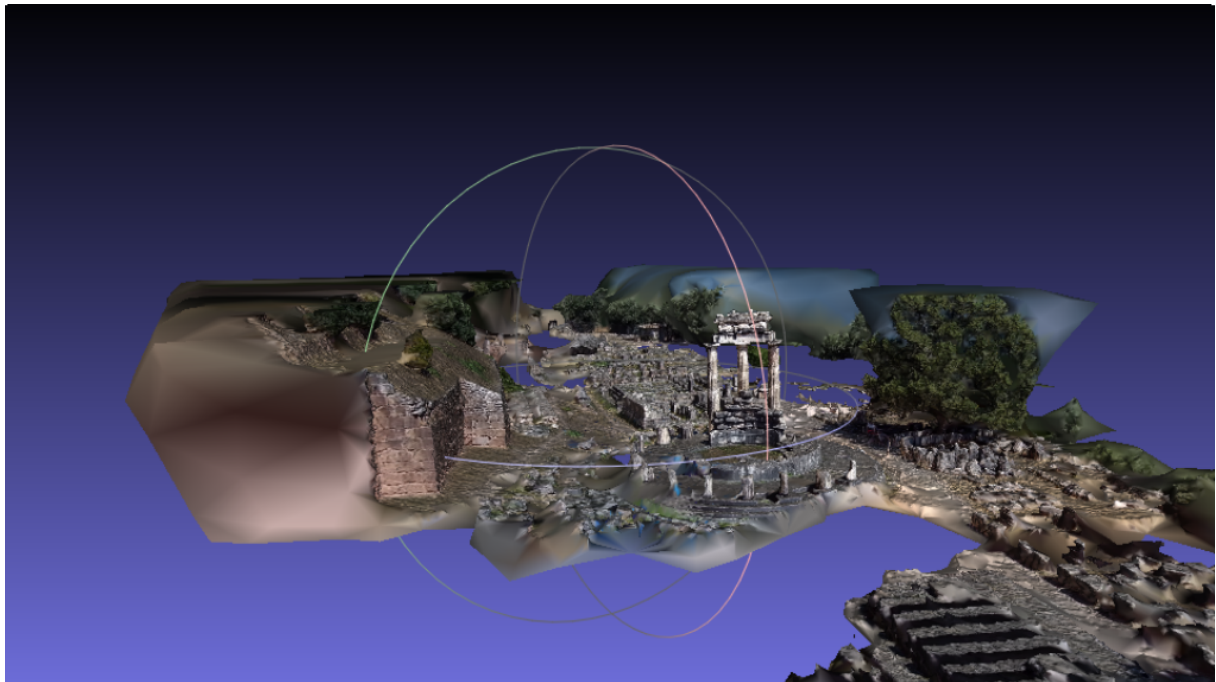


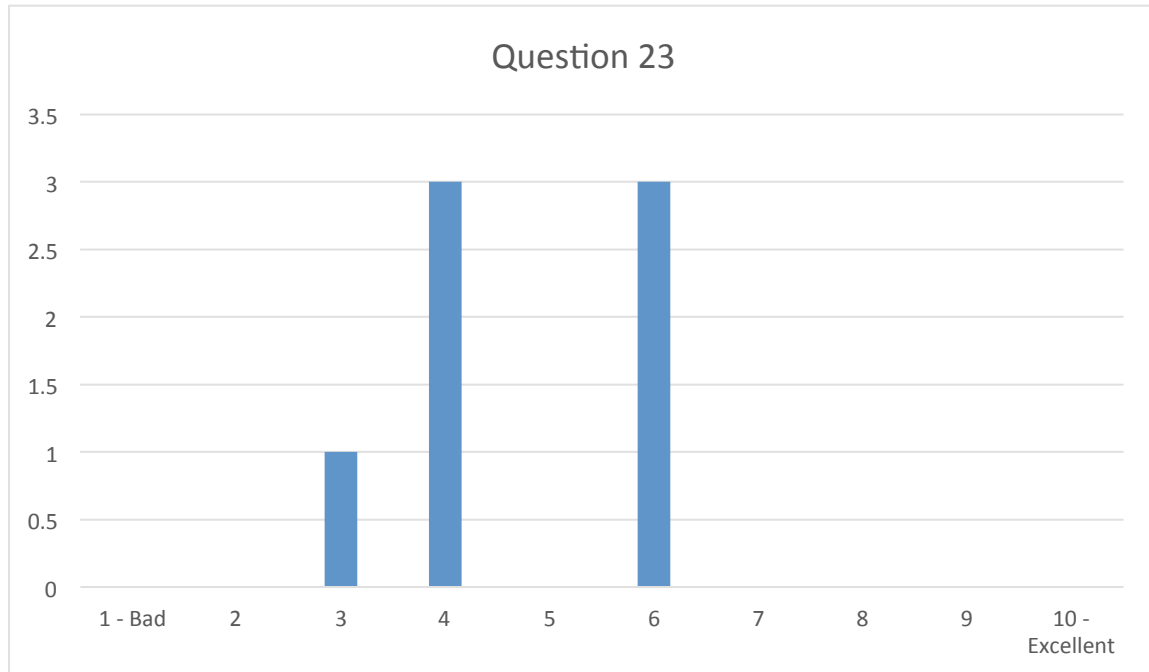
**Question 18:** How would you rate the value of changing the texture?



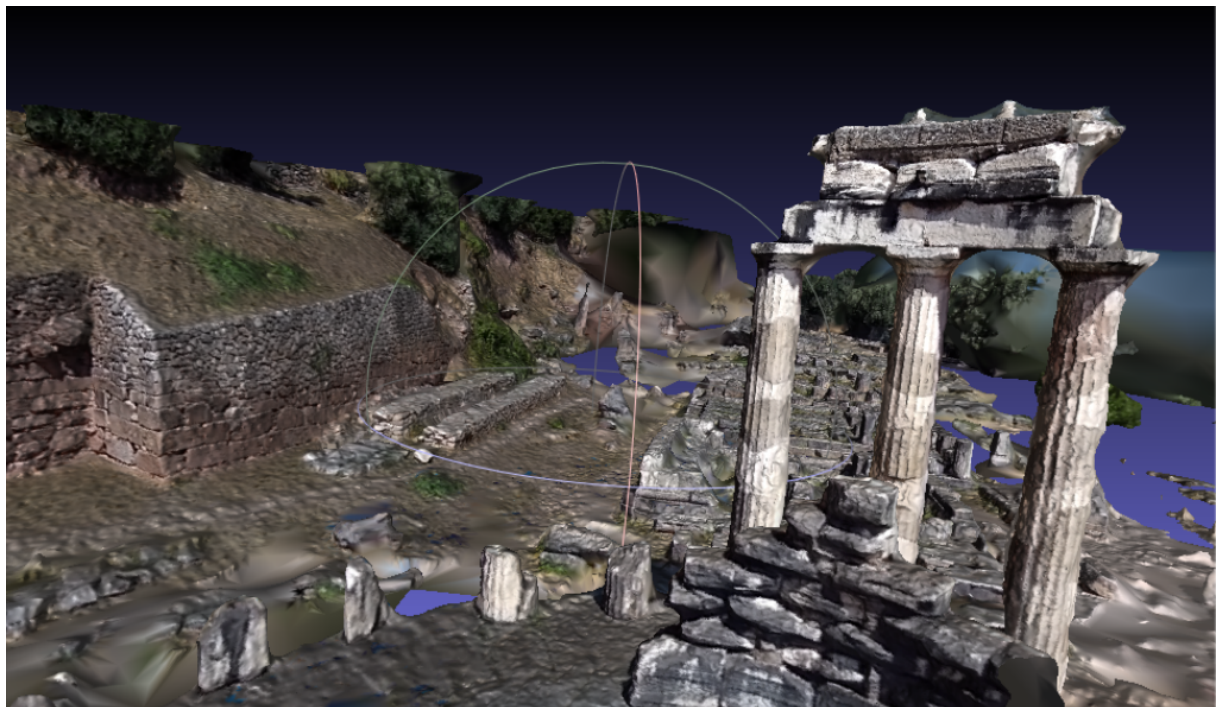


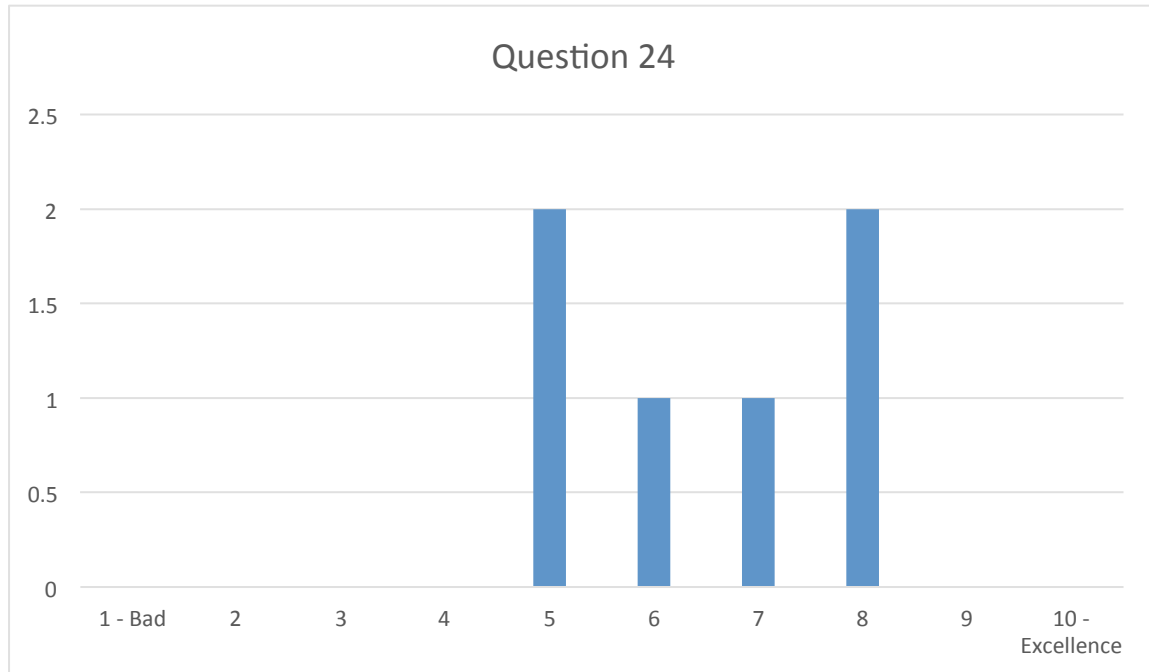
**Question 23:** If you were to review the quality of the results that were retrieved what score would you give it out of 10?





**Question 24:** If you were to review the quality of the results that were retrieved what score would you give it out of 10?





The applied survey was derived from the questionnaire designed for the Barcelona demonstration workshop which targeted architects (see 2.2 Evaluation of the architecture authoring tool). The instructors modified it in order to retain a comparability. Since DW has no dedicated game designers but interdisciplinary working content creators, the survey did not fit perfectly the participant's background. Thus, we chose to conduct also a qualitative evaluation which complements the overall results.

### 5.3 Qualitative Results

The instructors made several observations and received verbal feedback value for further developing:

- Participants familiar with VR have more sophisticated demands than rather inexperienced participants: all of the participants have actively experienced VR in the past and are familiar with the concept. Still there was a difference between people being rather experienced with VR as a concept and the ones who were not. Later group was overwhelmed by what they experienced but they also tended to be over-challenged with the functionalities and its possibilities. The more time they spent in the VR, the more valuable was the feedback. Its value increased with the time the participants spent in the VR. Especially the non-experienced group first needed to overcome the obstacle of overstimulation before going into depth feedback.
- Acknowledgement: All participants acknowledged the status as something interesting, exciting and promising
- Participants described their experience as fun and took very actively part on demonstration. Some stayed even longer in the VR in order to experience it more. The tool stirred up curiosity.

- Usability: Even though the instructors stressed that this is a first prototype and the main focus lied on technical infrastructure, almost all participants addressed usability as a key function that could be improved. They specifically asked for more intuitive usability.
- Quality of 3D objects: whereas the quality of the environment (e.g. Bauhaus) was perceived as objects worth working with, some 3D objects were perceived critically. Again, participants more familiar with VR and the concept of research and design saw potential whereas the less experienced group was more surprised about the fact that the 3D objects were not perfect.

The observations from the evaluation at Gamescom were promising as well. Users liked

- the concept of V4Design and the processes involved in making 3D assets out of 2D media,
- the idea of experiencing cities and how they looked a long time ago. Some of the players suggested that virtual tours of cities when they were old or cities that they cannot visit could be a potential application, and
- they enjoyed being able to interact with the world and place objects and create their own level and the intuitiveness of doing it.

Users noted that

- they needed more information and explanation when during testing regarding the controls (Usability)
- they could go through the buildings and fall off the map, since they were mainly interested in walking around and looking at the virtual world
- the objects selected from the placement menu were upside down and small in scale, making it difficult for some users to properly understand what they had placed.

## 5.4 Conclusion

The participants draw a rather homogeneous picture: all of them acknowledged potential and none of them were disappointed. Nevertheless, some critical points were raised frequently: almost all participants criticized the usability of the functionalities and some criticized the quality of 3D assets. On the other hand, the texture- and time travelling-functionalities were very well received. In general, the participants attested the tool to be promising (“Great start, good proof of concept”) but remarked that is still noticeable that the development is in its early stage and research driven. The results of the demonstration and evaluation workshop will be communicated with the V4Design consortium. Suggestions, like the improvement of usability, is reflected in the requirements.

## 6 UPDATES ON USER REQUIREMENTS

In general, the evaluation of the 1<sup>st</sup> prototype of the V4Design platform reveals that only minor updates to the user requirements are necessary. Most of the issues are of qualitative nature with regards to the assets (model quality, texture quality) or usability (finding and managing assets, access and handling in the authoring environments).

### 6.1 Design Review

With regards to the design review and heuristic evaluation, there have been no changes to the high-level user requirements. The recommendations rather focus on the usefulness and usability of particular modules of the V4Design platform that might in any form get exposed through the frontends (Rhino Plugin and VR Authoring tool). Both frontend implementations have been tested in separate workshops and are documented under 3 and Section 4, respectively.

### 6.2 Architecture and design industry

This section reflects on updates to the user requirements that have been elicited based on the use case and requirements as a result from the user test. All high-level user requirements (HLUR) 1.1 through 1.8 stated in D7.2 are still valid as of the results of the 1st prototype test of the V4Design platform. The qualitative evaluation highlights the importance of

- providing easy access to models,
- having the ability to manage and sort 3D models, textures and assets,
- and being provided with high quality assets.

In general, our formative test shows the validity of the V4Design concept for the focus group. It also highlights, that users are very interested to provide own visual material and that should be contained in the progress of developing towards the 2<sup>nd</sup> prototype and the final version. PUC2 was not exclusively tested because it's development is based on PUC1.

Updates to the HLUR of the architecture and design industry are given in the following table. Updates are given as numbered sub-items of a previous HLUR, e.g. HLUR\_#. # is extended to HLUR\_#.#.1ff.

Table 8: Updates on industrial requirements for architecture and design.

HLUR	HLUR Title	HLUR Description
HLUR_1.9	Personalization and Feedback	Manage assets in personalized structure (folders, personal tagging, notes or ratings) Rating assets might as well be available publicly

HLUR_6.1	Retrieval and integration	Easy retrieval and integration of additional multimedia content in the design process
HLUR_6.1.1	Personal library management	Being able to persist and manage a personal library of assets including
HLUR_6.2	Semantically enriched 3D models	Availability of large libraries of semantically enriched 3D and multimedia objects that can be used for design
HLUR_6.2.1	Additional metadata for 3D models	Provide additional technical metadata for the provided models including: <ul style="list-style-type: none"> <li>• Size</li> <li>• Faces</li> <li>• Vertices</li> <li>• MB</li> <li>• Mesh count</li> </ul>
HLUR_6.6	3D model reconstruction	Automatic or semi-automatic generation of 3D models for design purposes using existing multimedia content
HLUR_6.6.1	Adjusted scale and orientation	Provision of a raw estimate of scale and rotation to facilitate better integration of 3D models into new scenes based on metadata, e.g. natural scale of a building or statue.
HLUR_6.6.2	Light-neutral textures	Provision of textures that don't contain the lighting properties of the captured state of an object to minimize shadows and allow for better use in a new scene.

### 6.3 3D and VR game industry

The content provision for PUC3 was not prioritized for the evaluation of the 1<sup>st</sup> prototype. Thus, a re-evaluation of requirements was not performed during the reported project phase. The qualitative evaluation reveals that all high-level user requirements elicited before (HLUR 3.1-3.6) are still relevant to the PUC.

The questionnaire and interview feedback of PUC4 reveals that the previously elicited high-level user requirements are in general still valid. The interviews and the direct feedback from the walk-throughs reveal that a strong focus should be on usability and convenience. A new

aspect introduced was to add a standard 2D option to game and experience design, as POV editing in a 6DoF environment might be challenging for some users, even though it provides a near WYSIWYG-environment.

Updates to the HLUR of the 3D and VR game industry focus mainly on usability aspects.

Table 9: Updates on industrial requirements for 3D and VR game industry

HLUR	HLUR Title	HLUR Description
HLUR_4.2	User interaction and control	Game developers will be able to access the 3D assets (3D models, point clouds, Meshes) in an 3D environment and they will be able to edit and manipulate <b>them in a user-friendly manner.</b>
HLUR_4.5	Multiple environments	Ability to develop multiple environments for the same scene and change them <b>using scrollbar.</b>

## 7 OUTLOOK ON FURTHER EVALUATION

The user-oriented evaluation within V4Design is based on structured feedback derived from usability reviews and testing. An emphasis is put on directly addressing the focus groups. The initial evaluation plan was introduced in “**D7.1 Initial use case scenarios and user requirements**” and updated in “**D7.2 Use cases, requirements and evaluation plan**”. This section provides a review of the evaluation activities planned.

### 7.1 General approaches

The current evaluation phase for the 1<sup>st</sup> prototype version consisted of 3 major elements:

- a modular design review,
- regular focus group interaction within academic courses, and
- dedicated focus group workshops that employed a sequence of project and prototype introduction, a user walk-through for observation of tasks, and a questionnaire or interview section to obtain qualitative and quantitative insights.

It is expected to follow this process for the 2<sup>nd</sup> prototype evaluation as well and is in line with the envisioned evaluation methodology outlined in deliverable D7.2.

#### 7.1.1 Outline of continued formative usability testing (2<sup>nd</sup> prototype)

Formative testing is carried out during the development phase and focuses on identifying and fixing problems. Formative testing aims at providing developers with insight on how users evaluate a specific status of the prototype within the development cycle. It is not (or less) about metrics or statistics, but about finding out what works best for users (Barnum, 2010). The findings from formative testing will feed directly into the development process and might also – to some extent – modify the understanding of the use case scenarios and the user requirements.

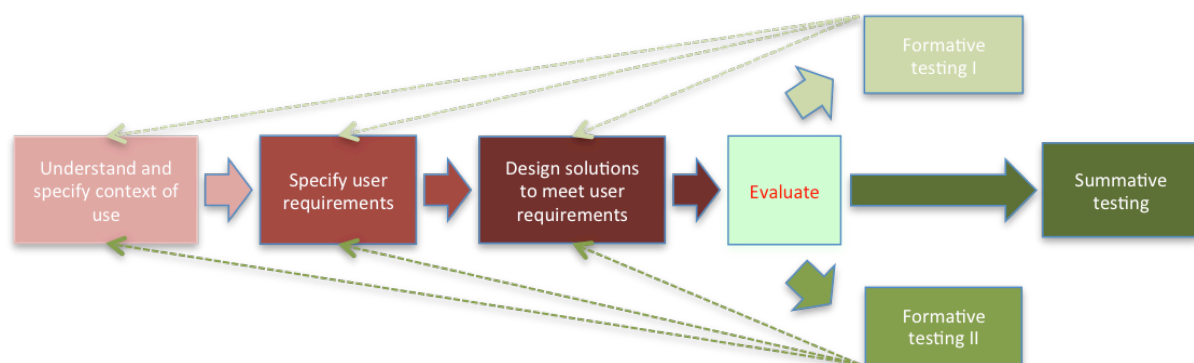


Figure 24: Current evaluation stage (Formative Testing)

### 7.2 Updated Timeline

The evaluation timeline with regard to the 4 PUCs will pursue the following steps:

Table 10: Updated evaluation timeline



What?	When?	Who?	How?	Status
Evaluation of the operational prototype	M13-M18	Focus groups	The operational prototype and the initial mock-ups for (i) architecture and design application and (ii) video game application will be evaluated by the two focus groups. The constant feedback and interaction with technical partner will feed the development of the two applications.	Done
Evaluation of 1st prototype	M19-26	Focus groups	The 1 <sup>st</sup> V4Design prototype will be presented to the two focus groups that are familiar and passionate users of Rhino platform and Unity software. They will be asked to validate the overall impression of the first prototype, its main goals, interface and usability as well as specific functionalities that are already available. The focus group will also be asked to assess the performance of the first V4Design prototype in comparison with other already existing tools and the improvement that it brought in Rhino platform or in Unity platform. The received feedback will be incorporated in the development process of the 2 <sup>nd</sup> prototype.	Done
Evaluation of 2nd prototype	M27-M34	User group	The 2 <sup>nd</sup> V4Design prototype will be presented to the user group (consisting of focus group members and externals) and similar feedback with the 1 <sup>st</sup> prototype will be requested. The received feedback will be incorporated in the development process of the final system.	Planned
Evaluation of 3rd prototype	M34-M36	User group	The final system will be presented to the user group and the open public and similar feedback with the 2 <sup>nd</sup> prototype will be requested.	Planned

### 7.3 Updates to demonstration workshops and open days

- **2nd Demonstration workshop:** The 2<sup>nd</sup> demonstration workshop will take place in the AUTH facilities in Thessaloniki, Greece after the 2<sup>nd</sup> prototype deployment (M28). The main goal of this workshop is to present the status quo of the V4Design to academic groups (students, staff, etc.) of various levels (undergraduate,

postgraduate). The workshop will include training seminars, lectures, design studios and actual fabrication of selected designed prototypes. End users will be able to experience, test and evaluate the fabricated prototypes and provide important feedback for the development of the V4Design prototype and its tools. The workshop will also function as dissemination and exploitation event that helps to inform broader groups of people interested in the project and communicate its capability and potential.

- **1<sup>st</sup> Open Day:** The 1<sup>st</sup> Open Day will be held by HdM after the deployment of the 2<sup>nd</sup> prototype (M31), aiming to perform testing and evaluation of the V4Design system. The workshop will demonstrate the V4Design prototype and tools in a broader audience consisting of academic and market representatives. The event's location will be decided later.
- **2<sup>nd</sup> Open Day / Final Demonstration Workshop:** This event will be organised by McNeel, after the release of the final system (M35), to fully demonstrate the V4Design solution to a broader group of potential customers, including architecture offices, video game companies, design industry leaders, governmental members, investors and societal organisations. The event might be collocated with a Rhino User Meeting organized by McNeel several times during the year. The event's location will be decided later.

## 8 CONCLUSIONS

Within this deliverable, the consortium outlined its efforts to validate the current state of implementation and get direct feedback from the target groups that V4Design aims at. It successfully showed that the relevant groups from academia, semi- and full professional users in the fields of architecture and design as well as journalists and game creators were addressed and their feedback will be included in the progression towards the 2<sup>nd</sup> prototype and the final version of the V4Design platform.

The activities were performed in tight collaboration between the user partners and the technical partners to provide a stable platform of mutual exchange and feedback to foster the iterative development of the V4Design platform and strengthen the user centric approach that is a prerequisite towards a successful productization of the V4Design research results. The early design review led by DW and HdM allowed for the early detection of issues within the demonstrators. These issues have been documented in the tables of section 2 and are available to the technical partners as recommendations for further reference. These recommendations guide the integration work and building of user interfaces and are a topic of discussion in the regular technical teleconferences and the upcoming technical meeting in Barcelona, October 2019. The results of this deliverable and the discussed evaluation process provide the foundation for further improvements of the V4Design platform in the upcoming months.

The long-term efforts of AUTH during their curriculum provided a strong foundation on aesthetics aspects and usability for creative processes and design. Four community events and workshops helped directly address the focus groups from journalism, architecture and gaming and get valuable feedback. These events were:

- Global Media Forum, Bonn, June 2019
- V4Design user training and evaluation workshop at McNeel, Barcelona, July 2019
- Gamescom Exhibition, Cologne, August 2019, and
- V4Design user training and evaluation workshop at DW, Bonn, August 2019

The qualitative evaluation highlights the importance of usability and quality and raised expectations in the subsequent capabilities in the platform that were given in detail in sections 3 and 4. In general, our formative test shows the validity of the V4Design concept for the focus group and highlights the usefulness of the research and development activities within the frame of the project.

# Appendix A: Prototype walk-through and follow-up questionnaire for architecture and design industry

## V4Design 1st Prototype User Evaluation

July 16th , Barcelona



### Introduction

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Welcome to the V4Design Demo Workshop where you can test and evaluate the current stage of a novel photogrammetry plugin for Rhino, McNeel develops for a European H2020 research project called V4Design.

Please find our brief workshop schedule below:

10:00 Welcome and introduction V4D and team (Ayman, Luis, Verena)  
10:20 Plugin demo, UI and plugin features  
11:00 Guided exercises  
11:30 Coffee break  
12:00 10 min test exercise  
12:30 Discussion and questionnaire under guidance of Florian and Martin from Herzog de Meuron Architects, Basel  
13:30 Lunch at La Triunfal with workshop participants and V4D team from Greece

This is the questionnaire for the V4Design user evaluation taking place July 16 at the McNeel Europe office

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Roger de Flor, 32-34 bajos  
08018 - Barcelona; Spain  
[www.mcneel.com](http://www.mcneel.com)  
[www.rhino3d.com](http://www.rhino3d.com)

### Equipment

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Remember you would need to bring your own laptop. The plugin is currently compiled for the Rhino 6 for Windows and Rhino WIP for Win (Work in Progress). If possible, please install both Rhino versions.

- <https://www.rhino3d.com/download/rhino-for-windows/6/latest>
- <https://www.rhino3d.com/download/rhino/wip>

Make sure you have the Rhino photogrammetry plugin and a free trial version of Camtasia for Win installed:

- <https://drive.google.com/file/d/1tliINUvSQGW700vNCiDUBsco7rDtBy50/view>
- <https://www.techsmith.com/download-camtasia-win-thankyou.html>

## Partners



HERZOG & DE MEURON



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement

## Participants information

You will be part of our first user group to test the plugin.

Test group members need to be familiar with Rhino 6 and the workflow in design and architecture practices and have basic 3D modelling knowledge using Rhino 6

Please provide some information about yourself.

Your user contacts will only be used, if you consent, to provide you with follow up information.

### 1. Gender

As we look for a diverse community of testers, we record gender and profession for statistics purposes.

*Mark only one oval.*

- ☐ Male
- ☐ Female
- ☐ Diverse

### 2. User contact details (email / mobile phone / etc.)

*\*optional*

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### 3. I agree that my responses to this questionnaire will be used for the elicitation and refinement of the user requirements of the V4Design project. My contact details will only be stored so that I can receive information about the project's progress.

*Mark only one oval.*

- ☐ Yes
- ☐ No

## Background Experience Architect

As an architect, you design projects in CAD-based software like Rhino3D. These projects are built in virtual 3D environments, and each is composed of a series of integrated assets, namely 3D models, textures, aesthetics, styles, etc...

**4. Profession of the user (80-100 words)**

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**5. In your architecture projects, do you use pre-made assets, such as those sold on online marketplaces and repositories?**

*Mark only one oval.*

- ☐ Yes
- ☐ No

**6. If yes, please indicate from where you usually obtain or buy these assets.**

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**7. How would you describe the compatibility of these assets with your projects?**

*Mark only one oval.*

- ☐ Highly compatible, virtually no adaptation work required
- ☐ Compatible, with occasional small-scale adaptations
- ☐ Somewhat compatible, I need to transform several aspects (e.g. resolution, format, scale, etc...)
- ☐ Not compatible, I just use them for reference

**8. How would you describe the quality of these assets on average?**

*Mark only one oval.*

- ☐ Excellent and comparable with those developed by professional designers and asset creators
- ☐ Quality is good enough for my projects
- ☐ Average quality, it is good for prototyping and low affinity projects
- ☐ Low quality in general

**9. Have you ever attempted to extract assets from existing media (images, videos, webpages, etc..) and transform them into assets for your project?**

*Mark only one oval.*

- ☐ Yes, I often do
- ☐ Yes, I did so on some occasions
- ☐ No, I never attempted to do so

10. Have you ever identified items in films, documentaries, videos, or image collections, that could be relevant for your projects?

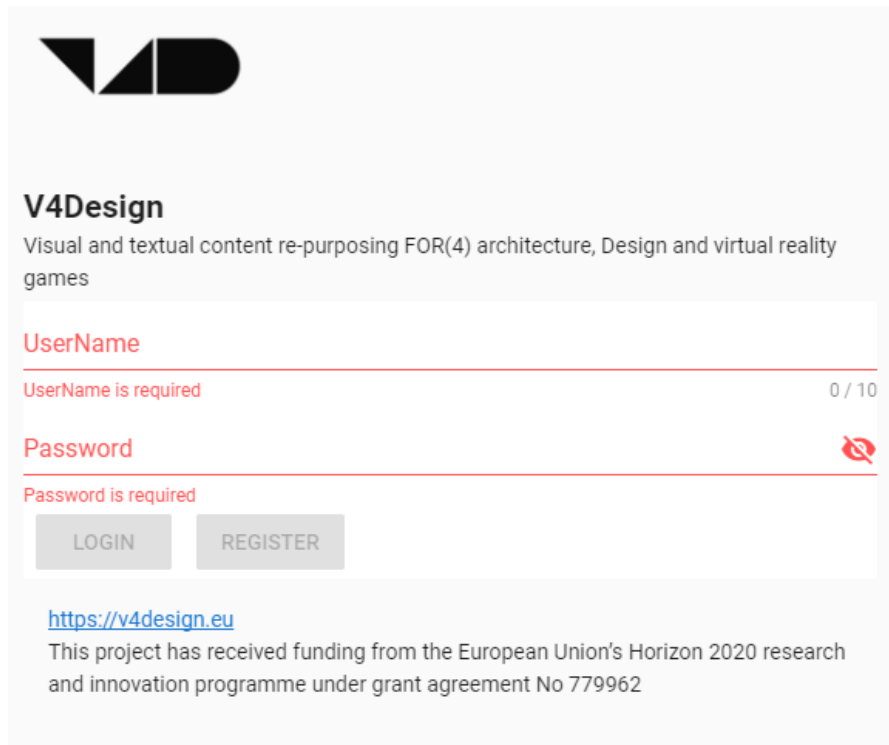
Mark only one oval.

- ☐ Yes, I often do
- ☐ Yes, I did so on some occasions
- ☐ Maybe
- ☐ No, I never did

## Login or Register

Before working on the three tasks, please login or register

In Rhino



The image shows a login and registration form for V4Design. At the top is the V4Design logo, which consists of a stylized 'V' and 'D' in black. Below the logo is the text 'V4Design' and a description: 'Visual and textual content re-purposing FOR(4) architecture, Design and virtual reality games'. The form has two input fields: 'UserName' and 'Password'. The 'UserName' field has a red error message 'UserName is required' and a character count '0 / 10'. The 'Password' field has a red error message 'Password is required' and a red eye icon to toggle visibility. Below the input fields are two buttons: 'LOGIN' and 'REGISTER'. At the bottom of the form is a link to 'https://v4design.eu' and a paragraph of text: 'This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 779962'.

## User Evaluation Task 01

### Navigate the V4Design Window

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Steps

01

Search for the tag "London"

02

Open the window to display more details about the item "Figure Emerging"

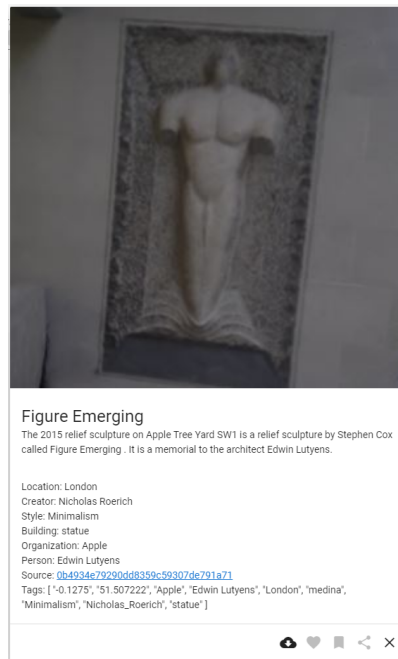
03

Close the window

04

clear the search field to display the entire data set

## Window with additional information



**11. Did you encounter any workflows or behaviour which were unexpected or counter intuitive?**

e.g : search syntax, use of right mouse button, use of icons, keyboard input, more...

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## User Evaluation Task 02

### Place an object in to the 3D scene

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Narrative:

You have to design a multi-storey book store in an existing heritage building in the city centre.

To visualise your design it is important to create a 3D model of the context.

One important urban feature is a replica of a monument of the German writer Friedrich Schiller, which is located in the centre of the square in front of your building.



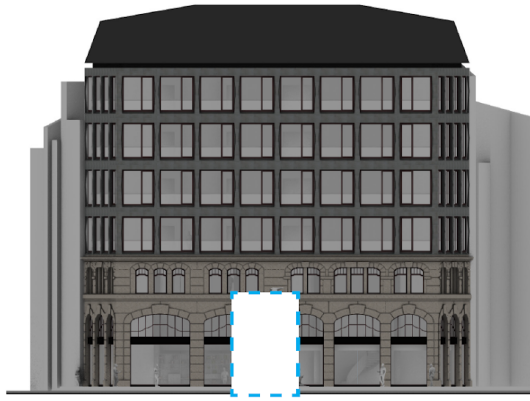


fig 1. elevation plaza

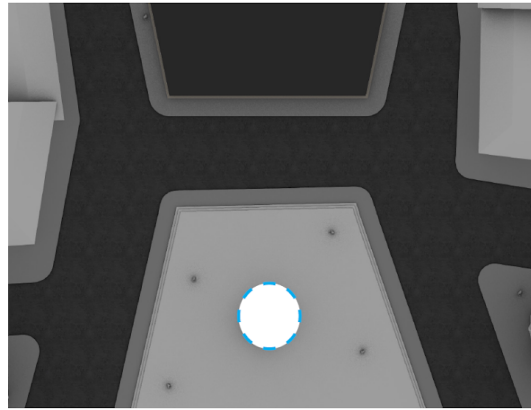


fig 2. plan plaza



## Steps:

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01.  
Open the context model  
file: V4Design\_BookStoreProject.3dm
02.  
Find a textured 3Dmodel of the monument.  
Use the V4Design Rhino Plugins search function.
03.  
Place the monument in the center of the plaza.
04.  
Try to match the position and size shown  
in the images above
05.  
Take a screenshot in rendered mode and save it to the same folder

**12. Describe your experience of using the search function. (step 02)**

in regards to : navigation, auto completion, display of search results, more....

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**13. Describe your experience when adding objects to the scene (step 03 & step 04)**

in regards to : mouse navigation, insertion point/ location , scale, quality, more....

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**14. Did you encounter any workflows or behaviour which were unexpected or counter intuitive?**

e.g : search syntax, use of right mouse button, drag & drop functionality, system feedback for each operation, more...

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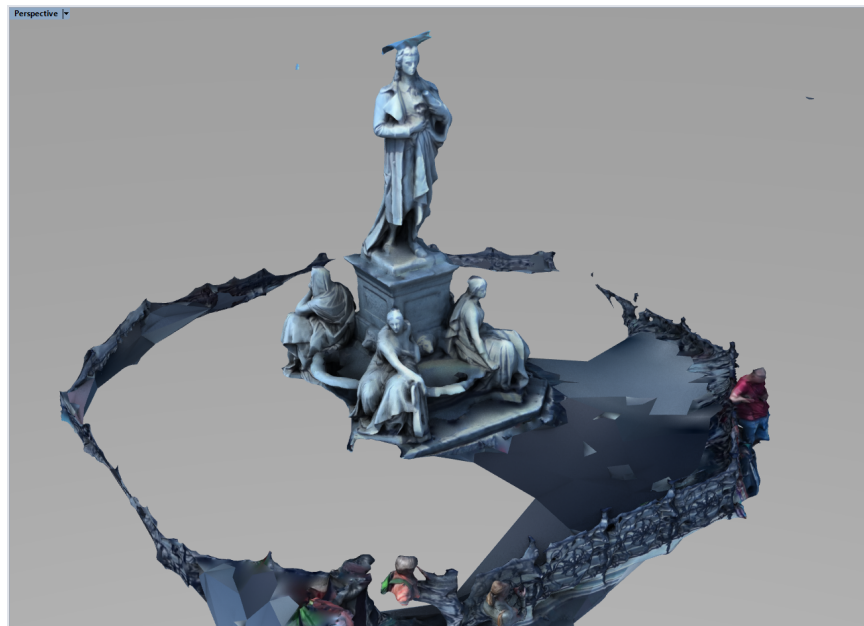
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**15. Rate the quality of the retrieved 3D model**



Mark only one oval.

1 2 3 4 5

Bad ☐ ☐ ☐ ☐ ☐ Excellent

# User Evaluation Task 03

## Add items to the Library

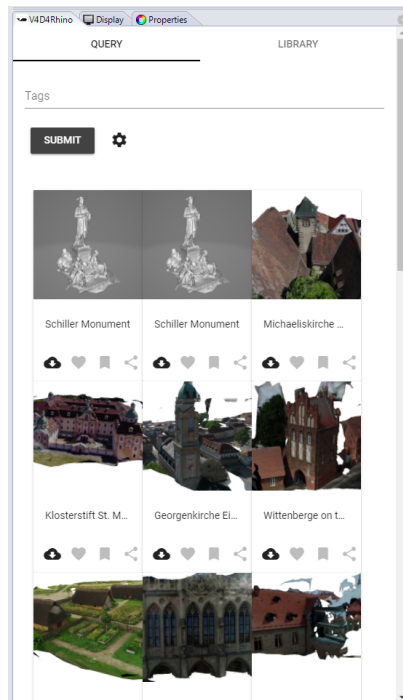
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Narrative:

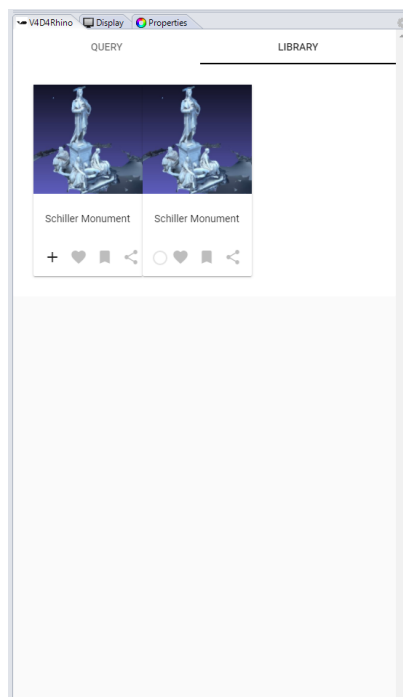
One of the most important aspects of your shops interior design are references to windows of different styles and shapes.

To start with your design you will have to look for inspiration in the V4Design Tool.

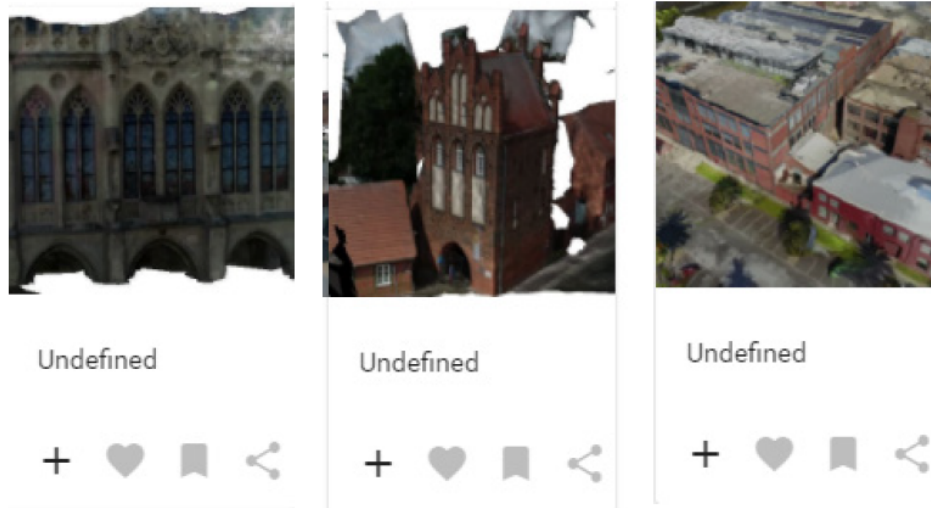
### Query Tab (left)



### Library Tab (right)



## Models to be added to library



## Window elements of interest



fig 3. gothic arch



fig 4. pointed arch



fig 5. industrial window

## Steps:

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01.

Search for models that contain the three windows shown above.  
Use the V4Design Rhino Plugins' query tool for the exercise.

02.

Add the models you find interesting to your Library tab

03.

Insert the models in to an empty scene and isolate the windows from the meshes

04.

Place the windows next to each other in the Rhino space.

05.

Take a screenshot in rendered mode  
and save it to the same folder

**16. Describe any difficulties encountered when adding items to the library (step 02)**

in respect to : mouse navigation, intuitiveness, hover texts, context menus, more...

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**17. To productively utilise your own custom library, what additional features would you need? (step 03)**

e.g.: organise, manage, structure, sort, filter and query the library

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**18. Did you encounter any workflows or behaviour which were unexpected or counter intuitive?**

e.g : search syntax, use of right mouse button, drag & drop functionality, sorting & filtering of content, managing more...

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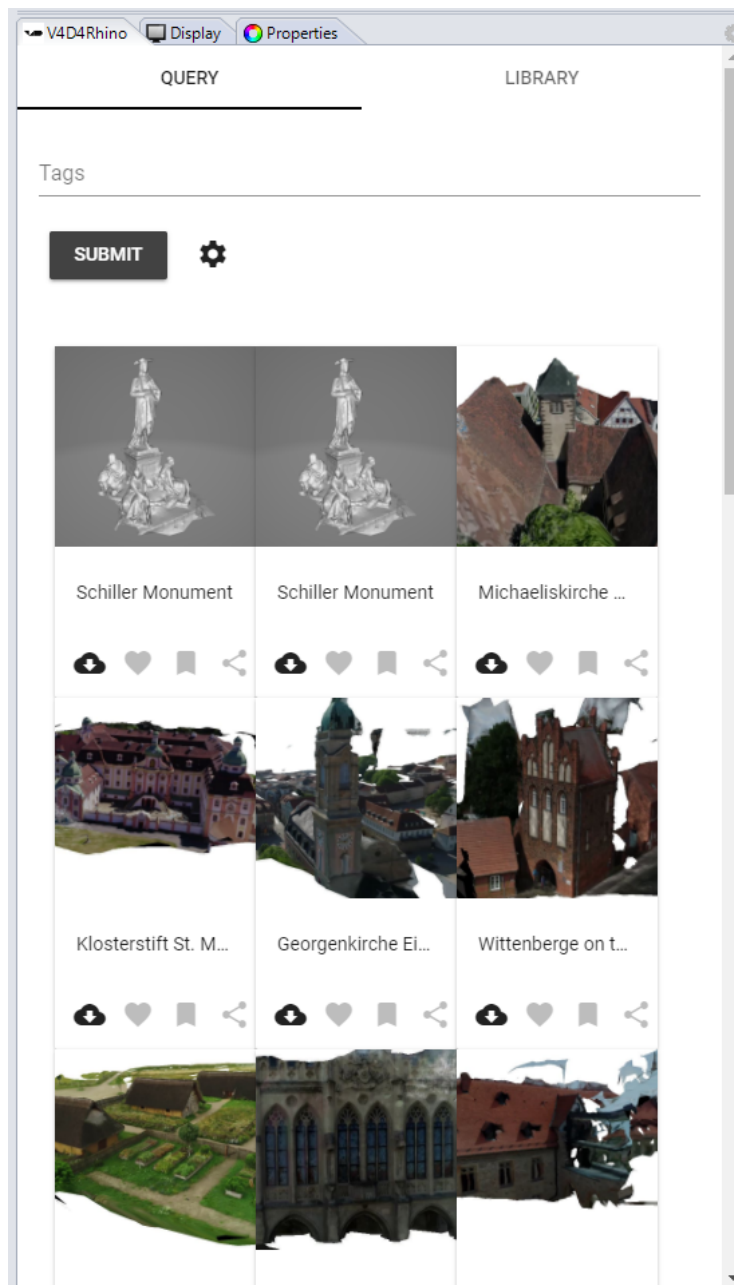
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## General Evaluation

### V4Design Tab



19. How do you find the overall quality of the 3D models?

*Mark only one oval.*

	1	2	3	4	5	
Bad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Excellent

20. How do you find the overall quality of the textures?

*Mark only one oval.*

	1	2	3	4	5	
Bad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Excellent



**27. How do you think this extraction and recycling process can be improved to better meet your expectations?**

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## Appendix B: Prototype walk-through and follow-up questionnaire for 3D and VR game industry

### V4DESIGN BONN QUESTIONNAIRE

This is the questionnaire for the V4Design user evaluation taking place August, 26th at DW in Bonn.

\* Required

#### PARTICIPANT'S INFO

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Please provide some information about yourself. As we look for a diverse community of testers, we record gender and profession for statistics purposes. Your user contacts will be only used, if you consent, to provide you with follow up information.

**1. Gender**

*Mark only one oval.*

- ☐ Male
- ☐ Female
- ☐ Diverse

**2. Profession of the user (80-100 words) \***

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**3. User contact details (email / mobile phone / etc.)**

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**4. I agree that my responses to this questionnaire will be used for the elicitation and refinement of the user requirements of the V4Design project. My contact details will only be stored so that I can receive information about the project's progress. \***

*Mark only one oval.*

- ☐ Yes
- ☐ No

#### Background Experience Designer/Content Creator

As a (game) designer or content creator, you might create projects in 3D software like Unity3D or Unreal Engine. These projects are built in virtual 3D environments, and each is composed of a series of integrated assets, namely 3D models, textures, aesthetics, styles, etc... In case you have never dealt with 3D objects, we would still like to know your more general opinion with regards to graphical (2D) assets.

**5. Have you ever worked with 3D objects?**

*Mark only one oval.*

- ☐ Yes
- ☐ No

**6. In your projects, do you use pre-made assets, such as those sold on online marketplaces and repositories?**

*Mark only one oval.*

- ☐ Yes
- ☐ No

**7. If yes, please indicate from where you usually obtain or buy these assets.**

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**8. How would you describe the compatibility of these assets with your projects?**

*Mark only one oval.*

- ☐ Highly compatible, virtually no adaptation work required
- ☐ Compatible, with occasional small-scale adaptations
- ☐ Somewhat compatible, I need to transform several aspects (e.g. resolution, format, scale, etc...)
- ☐ Not compatible, I just use them for reference

**9. How would you describe the quality of these assets on average?**

*Mark only one oval.*

- ☐ Excellent and comparable with those developed by professional designers and asset creators
- ☐ Quality is good enough for my projects
- ☐ Average quality, it is good for prototyping and low affinity projects
- ☐ Low quality in general

**10. Have you ever attempted to extract assets from existing media (images, videos, webpages, etc..) and transform them into assets for your project?**

*Mark only one oval.*

- ☐ Yes, I often do
- ☐ Yes, I did so on some occasions
- ☐ No, I never attempted to do so

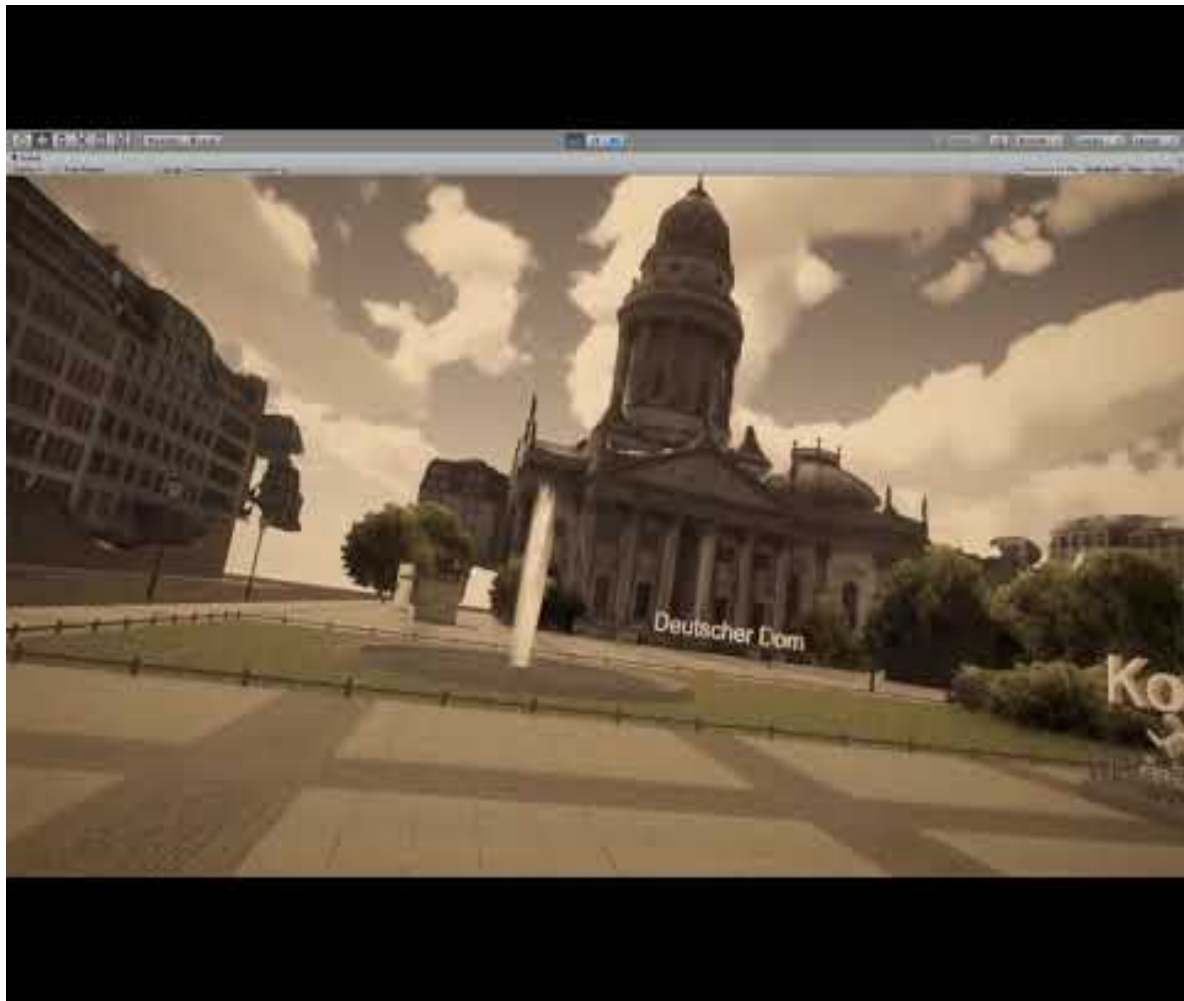
**11. Have you ever identified items in films, documentaries, videos, or image collections, that could be relevant for your projects?**

*Mark only one oval.*

- ☐ Yes, I often do
- ☐ Yes, I did so on some occasions
- ☐ Maybe
- ☐ No, I never did

## **VR authoring tool**

This tool allows you to create VR scenes directly in VR without programming.



<http://youtube.com/watch?v=iUA1hEMQFNM>

**12. 12. How do you find the overall quality of the V4Design assets?**

*Mark only one oval.*

	1	2	3	4	5	
Bad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Excellent

**13. 13. How do you find the overall quality of the 3D models?**

*Mark only one oval.*

	1	2	3	4	5	
Bad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Excellent

**14. 14. How do you find the overall quality of the textures?**

*Mark only one oval.*

	1	2	3	4	5	
Bad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Excellent

**15. 15. Is the texture proposal appropriate for texturing 3D models?**

Mark only one oval.

	1	2	3	4	5	
Not Appropriate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Useful

**16. 16. How would you rate access to V4Design assets using the tool?**

Mark only one oval.

	1	2	3	4	5	
Hard to find	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Easy to access

**17. 17. How would you rate selecting, placing and removing assets from the scene?**

Mark only one oval.

	1	2	3	4	5	
Hard	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Easy

**18. 18. How would you rate the value of changing the texture?**

Mark only one oval.

	1	2	3	4	5	
Low	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Valuable

**19. 19. What kind of textures would you prefer to have?**


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**20. 20. How would you rate the value of the time travel-feature?***Mark only one oval.*

	1	2	3	4	5	
Low	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Valuable

**21. 21. Are you missing features? Suggestions?**


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**22. 22. What is your overall impression of the VR Authoring Tool?**


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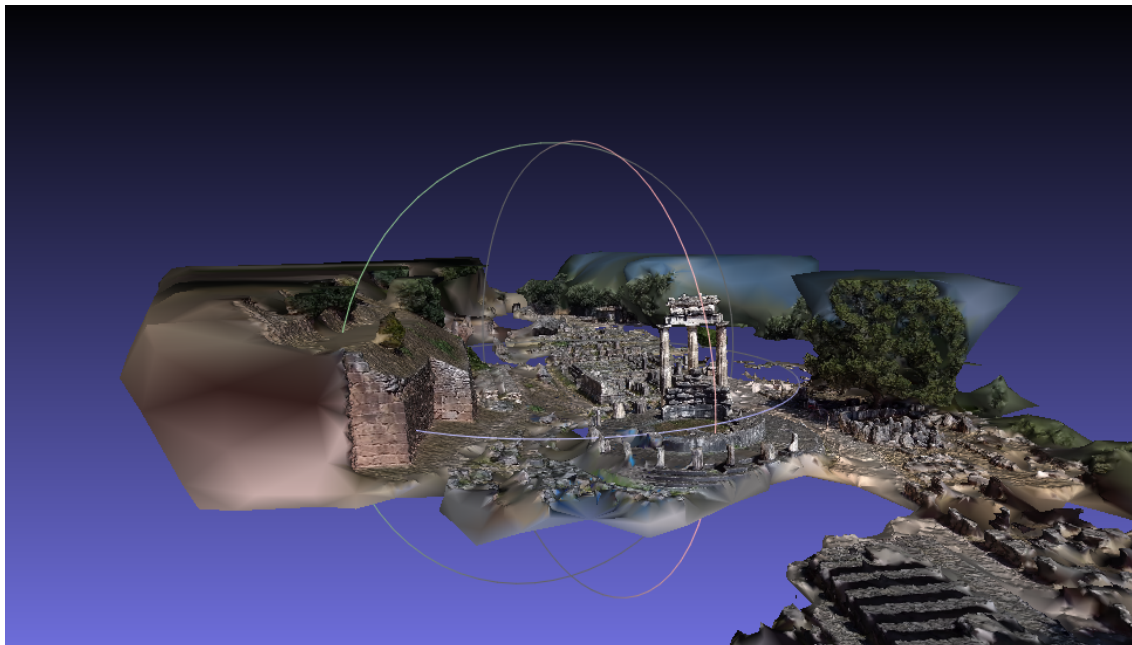
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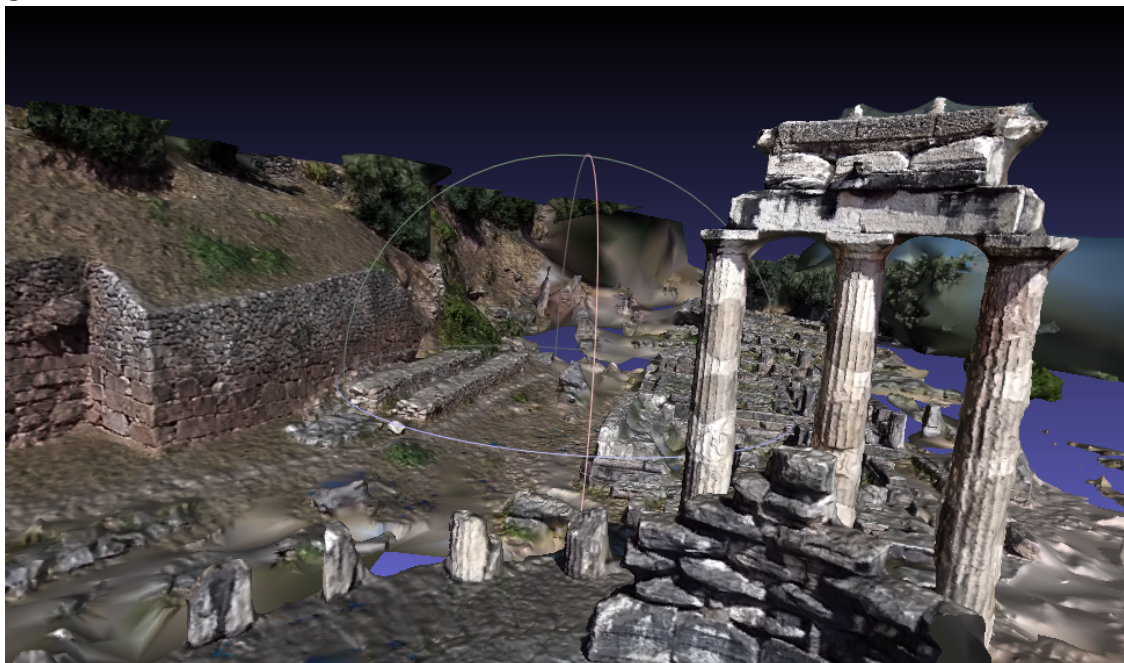
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**3D-reconstruction****23. 23. If you were to review the quality of the results that were retrieved what score would you give it out of 10?***Mark only one oval.*

1	2	3	4	5	6	7	8	9	10
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



24. 24. If you were to review the quality of the results that were retrieved what score would you give it out of 10?



Mark only one oval.

1	2	3	4	5	6	7	8	9	10
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>