MFG501322

Visualizing digital prototypes in context with Autodesk VRED

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Learning Objectives

- Using Autodesk VRED for visualizing Digital Prototypes in Design and Manufacturing
- Building holistic visualization scenes based on Revit, Inventor, Fusion 360, Maya and other data sources
- Building Experiences for XR and mobile devices leveraging Autodesk VRED
- Streaming high-end visualizations from the Cloud to any device

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Description

In this session we will share insights in how to review, evaluate and showcase digital prototypes in context, holistically. Using the example of a kitchen, we are showing how Revit, Inventor and Fusion 360 Data can be used in Autodesk VRED to influence and inform the design and layout process.
You will learn on how to import and setup the data, prepare it for real-time and XR review and collaborate with colleagues remotely to take an educated decision. Join us and understand the value of advanced visualization and digital prototyping with Autodesk VRED for your product development process. Learn how to involve all stakeholders by delivering the same high-quality visualization on any device from anywhere at any time.

Speaker(s)

Pascal Seifert is the Tech. Product Manager on the Automotive and Conceptual Design Team at Autodesk. He has been working in the automotive-design visualization and virtual-reality domain for the last 12 years. With his Design Consultant background, he possesses expert knowledge in database handling & file conversion, data preparation, as well as real-time computer graphics. Currently, he works on Autodesk VRED and is based in Munich, Germany.

Lukas Fäth joined Autodesk, in 2012 with the acquisition of PI-VR. After graduating in digital media Lukas drove the visual and conceptual development of VRED, a high-end virtual prototyping software. Lukas was responsible for quality assurance, support, and consulting, and is a professional VRED software trainer for the automotive industry and computer-generated imagery agencies with a strong artistic knowledge base. Since 2014 he is in charge of product management for the VRED software products

VRED Introduction

Combined Value Proposition

For the beginning let's take a look at VRED`s combined value proposition, which consist out of 3 main pillars:

Data Complexity

The first aspect which is a unique value to the VRED product Family is the capability to prepare and handle extremely complex data if needed. Setting up and running datasets with billions of polygons or millions of possible configurations is not a problem for VRED as it has its origin in the Automotive industry where this is the norm.

Rendering Flexibility

VRED has 3 integrated rendering engines that can be easily switched with just a push of a button allowing to flexibly chose the required rendering accuracy or performance needed for a given use-case. Even the less accurate OpenGL mode already produces photorealistic experiences in real-time but has a focus on high framerates for fluent experiences on any device – including XR devices. The two Raytracing modes allow the user to choose which hardware they want to compute the image, GPU or CPU. Both can be adjusted as well to serve different use-cases and are able to generate close to simulation grade accuracy results if desired. You can even connect several computation units to combine their power and thus speed up rendering in real-time or image production.

Collaboration for anywhere

The last element which contributes to VRED`s combined value is a deeply integrated collaboration capabilities that allow people to join virtual collaboration session remotely from anywhere on any device. Users around the world can connect via the VRED collaboration platform and be in the same virtual space reviewing the same data. This works with all supported output devices and display types like e.g., Desktop, Mobile or even XR. The objective is that everybody can freely choose their preferred device to join from anywhere in the world.

The combination of those 3 elements makes Autodesk VRED a perfect solution for visual communication, digital prototyping and decision making.

VRED Product Portfolio

VRED Design and Professional

VRED Design and VRED Professional are the Desktop authoring tools of the product line. VRED Design has a feature set focused on solving the tasks designer face daily while VRED Professional is the most capable version of VRED expanding capabilities in many other areas like advanced light simulation, engineering evaluation and scalable rendering for the most challenging tasks.
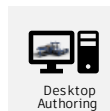
VRED Presenter

VRED Presenter, as the name already indicates, is a desktop viewer application that can open native VRED files and review them. While is does not have the authoring interface of Pro or Design it allows reviews in all render modes and even supports XR reviews and collaboration. Perfect to involve stakeholders that do not have the need to setup or change datasets.
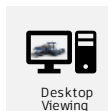
VRED Render Node and Core

Render Node and Core are the cloud or server-based products which run headless and can be used as the base to build custom tools and services running remotely and being access through custom interfaces that can be tailored to any persona`s needs. Through VRED Cores streaming capabilities the high-quality results can reach any device and be integrated into any custom frontend while the computation happens in the cloud or on a remote server.
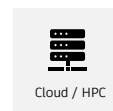
VRED Solution

Portfolio
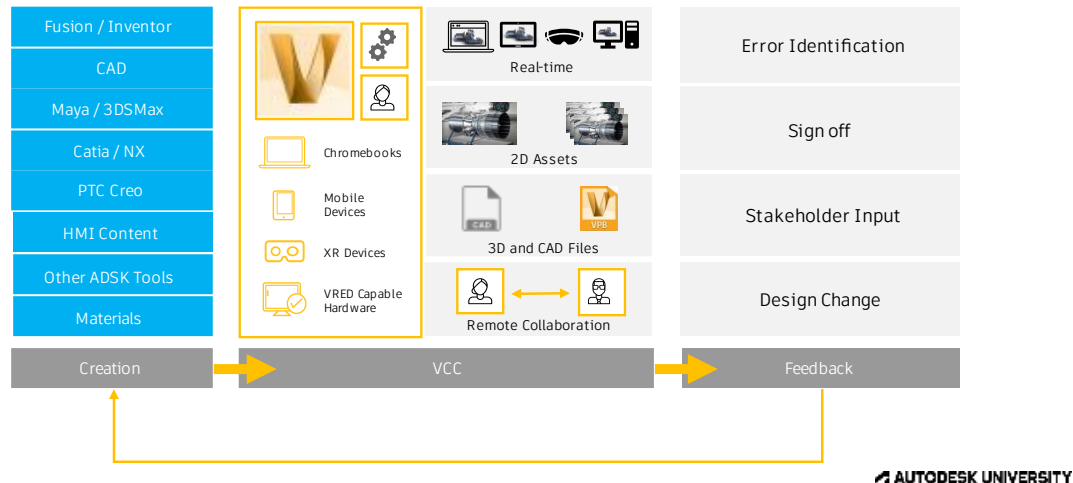

Desktop Authoring

Desktop Viewing

Cloud / HPC

VRED Solution Overview and Value Cycle
The typical workflow or value cycle of Autodesk VRED solutions looks as follows:

Solution Overview
Value Cycle

It all starts with the import and preparation of created data. VRED support a huge variety of CAD and other formats from products like Inventor, Maya, 3DSMax, Catia or NX. As well as many other generic exchange formats for geometry and materials.

Once the data is in VRED there are easy to use and quick tools to organize and prepare the data. The great thing is that afterwards it can be used for many different use-cases and workflows without having to adapt the data again. You can create simple renderings like images, videos or 360° experiences. But also use the real-time graphics on different output devices like HMDs, displays including 3D Stereo or stream the results to lightweight mobile devices and of course all that works in collaboration as well.

The findings and feedback that is gathered during or based on any of those usage modes can be documented and fed back into the creation process to support a holistic and closed value cycle that speeds up decision making and time to market by connecting all stakeholders in the process to take informed decision based on the same digital twin. Allowing to design and build better products faster.

The Project

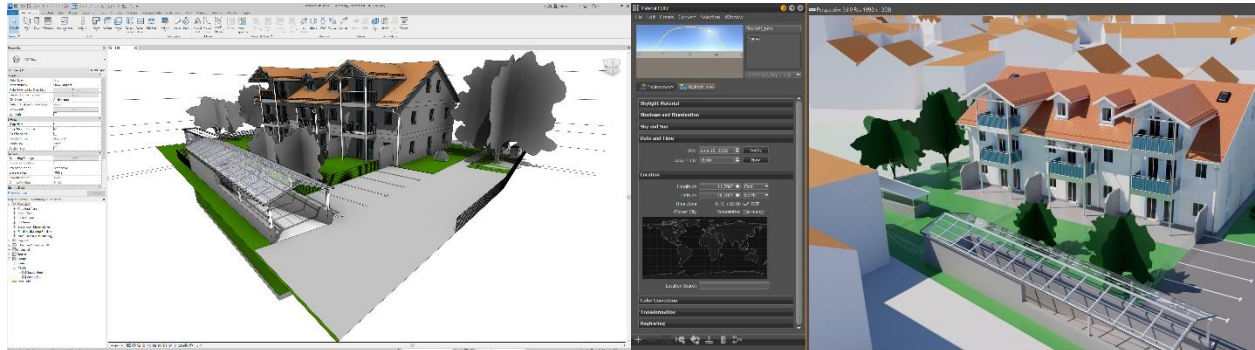**The Project: Designing a Kitchen in Context**

The project we want to talk about today is all about designing and configuring a kitchen with the support of VRED and its capabilities considering the context and space it will be built into.

Therefore, we are showing how to aggregate and prepare data from Revit, Inventor and Fusion 360 in VRED for a diverse set of review and evaluation purposes.
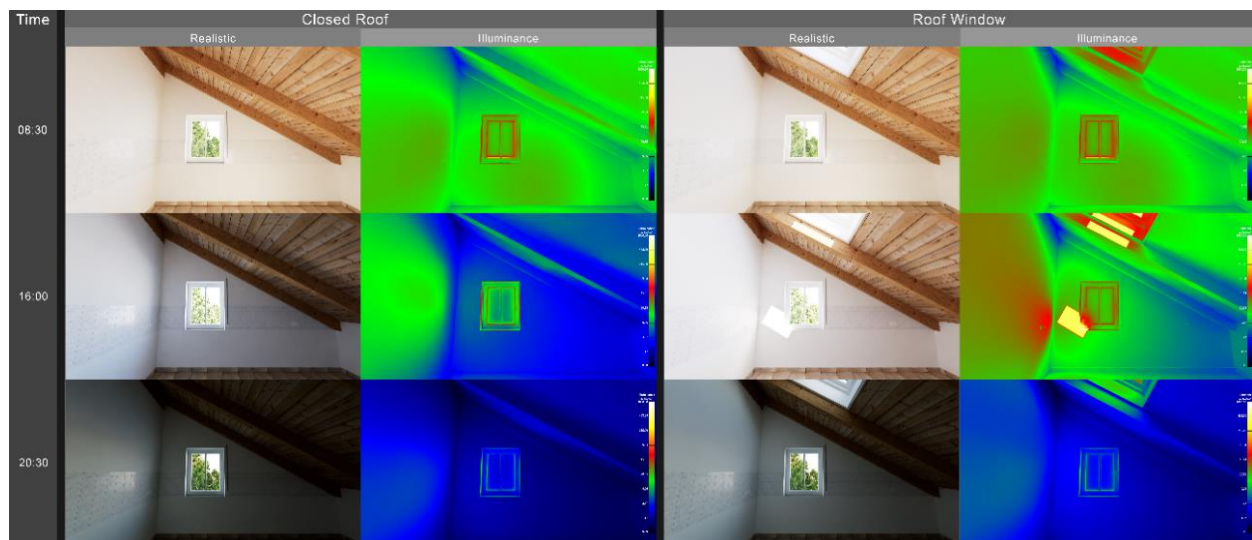
Autodesk VRED acts as a visual platform to aggregate all elements needed to take decision and present 2 main proposals to a potential customer. Besides obvious aspects like size of the room, layout, and appearance we also looked at lighting and functional ergonomics.

We are leveraging many different technologies like XR, advanced light computation and streaming to design the kitchen itself but also to include the customer into this process from the beginning, taking the decision in collaboration and keeping them up to date on the status quo at any time so the outcome is exactly what they expect, and the customer journey is more inclusive.

Pre-Visualization and Light Study

As a first step after importing the rough house and room layout from Autodesk Revit we want to make sure the room has enough natural light and conducted a light study with different times of the day leveraging VRED`s procedural skylight environment which allows to simulate different sunlight situations considering location and time.

The light distribution inside the building and intensity values in different areas of the room are interesting to know and important for any workplace as well in your kitchen. VRED offers several ways to visualize them from realist to analytic – all of them based on VRED`s highly accurate raytracing computation modes:

- Realistic Rendering: This mode shows a realistic view of the light distribution in the room
- Illuminance tone mapping: This mode shows a heat map which allows more precise evaluation of the light distribution

After realizing the side windows will not allow enough natural light in the room, we took the decision to add an additional window in the roof of the house just above the main working place of the kitchen. This should allow to let enough natural light into the room and creates the perfect base so our assumption. As a location we have chosen Munich Germany and ran the study from 6 AM to 9PM on 1st of July. We will repeat the light study with the final kitchen layout to see if this has side effects like self-shadowing in the main working area from people or furniture and therefore should be enhanced with artificial lighting.
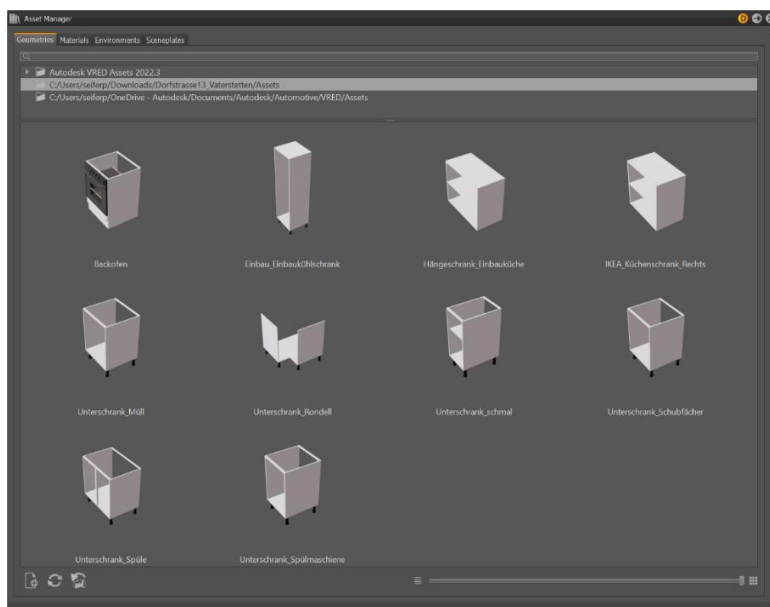
Layout

The next step is all about deciding the layout of the kitchen. This is where quick and less accurate rendering modes come in handy. We imported different very basic elements of the kitchen to see how the space can be used perfectly. Using real-time ambient occlusion to get a rough impression is totally fine to move objects around, measure and eventually place all kitchen elements at the right spot. As already mentioned, with VRED it is possible at any time to switch to a more realistic and physical based raytraced rendering mode if this gives a better understanding of space, size and small gaps that only appear through shadowing.

Besides functionality, technical pre-conditions like water connection or deduction possibilities and personal preferences - ergonomics and usability play an important role in this step of the process. There is nothing better than Virtual Reality to immerse yourself in the scene and experience this first-hand. We quickly realized that due to the sloping roof some parts of the room are not ideally usable while standing and might be better suited as a storage place.
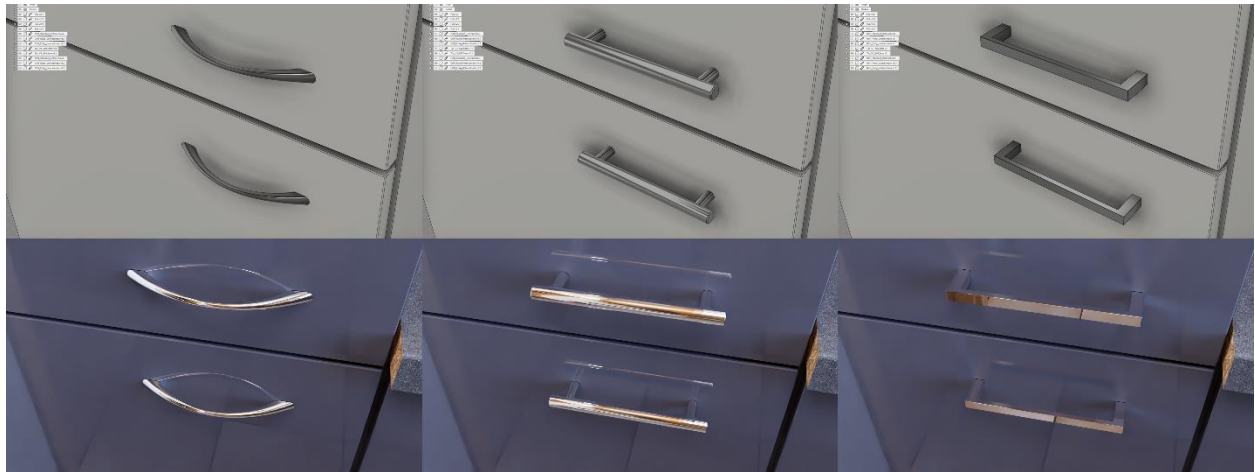

It is worth to mention that VRED comes with an Asset Manager to store the individual kitchen elements in a re-usable library or work with Smart References (aka. Assemblies in CAD). That means, no matter where the basic element is placed in the scene it is possible to work further on an assembly level, update or replace Reference with new CAD data in your main scene.

Color, Materials and Finishes

Once the layout is decided we looked at color, material, and finishes.
Starting with different options for the door panels and handles, which were designed in and imported from Fusion 360.

After reviewing all of the options we decided for two geometrical variants which will make it into our final configurations.

So, let's move on to color and materials:
Levering the huge library of parametric materials from Adobe Substance, which is directly accessible from inside the VRED applications, we went through many options for each element and decided for 3 complete sets as our final pre-configurations that can still be customized further on customer whishes.
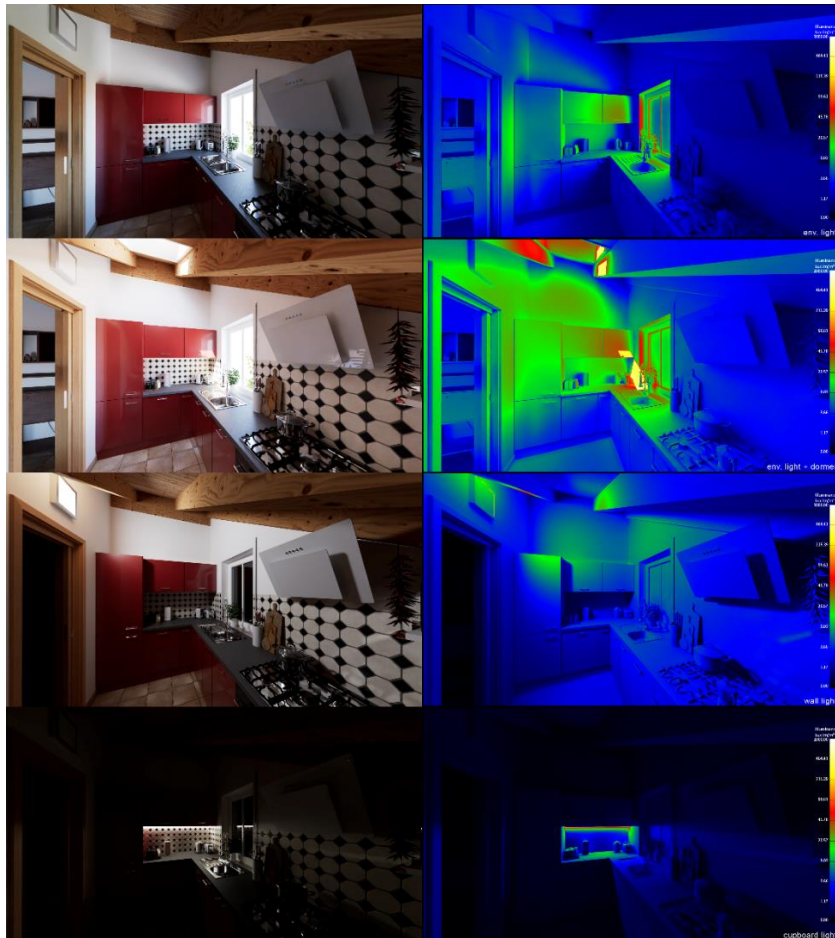

VRED`s Variant set module makes it very easy to build simple but also very complex configurations of a whole scene, like in this case the kitchen. As you remember, the product was originally built for the automotive industry. A car usually has thousands of possible configurations including objects, materials and functional elements that need to be accessible with one click.

Exactly for this case the Variant set module allows you to combine many different elements and scene states into one Variant set that can be activated with the click of one button. This feature came in very helpful when we were working towards 3 final kitchen configurations in this project.

As the last step, we included different electronic devices and kitchen appliances.
We made the 3 final configurations more relatable and life-like for the final customer decision by placing additional objects in and on the kitchen itself.

Taking all material, geometry and asset variations in account, the kitchen has in total 164.8888 possible configurations.

Artificial Light

Taking the natural light into consideration we now placed artificial light to ensure a properly lit working environment in every situation – may it be day or nighttime. You can use VRED`s own light types but also include many external light sources and profiles alike IES profiles or ray lights to really assure the digital twin has the exact same conditions as the kitchen once it will be built. As soon as that was done, it's time to properly calculate Light and Shadows for real-time use-cases and give the Kitchen its last touch.

Review and Decision Process

After we jointly designed the kitchen with our future customer in the surrounding it will eventually be used its time for some final reviews and decisions.

To present the 3 final configurations to the customer we have decided to offer several options, both interactive and traditional:

- **Collaborative review**

We leverage VRED`s streaming capabilities to directly stream the interactive experience to our customer`s tablet. Guiding them through the nuances and specialties of the two final options and making sure we capture their feedback.
All participants are free to use the device of their choice. So, while we will be presenting the result within XR the customer can also just join from their tabled while still being able to interact with the kitchen and switch configurations themselves. Or, in case they do have a XR headset they can join us for a joint XR collaboration session taking a more immersive look and experiencing their future kitchen firsthand.
Even if the customer does not have a XR capable PC at home, we can stream the content directly to their XR headset from the cloud.
After making sure the customers are happy with our 2 final configurations we can move to the next step.

- **Interactive final validation**

To validate the whole project and get a final sign off its important to look at it interactively in high accuracy rendering modes. VRED has one of the most capable raytracing engines on the market which allow real-time Full Global Illumination to assure a final validation and sign of based on a reliable visualization. As mentioned, many customers, inside and outside the automotive and transportation industry rely on VRED`s accurate rendering for their final product sign offs since more than 10 years now. So, the application has a proven track record for representing digital twins properly for final sign off.

- **Tablet based Augmented Reality**

Something we did not use in our example but would have been a great help as well is using VRED`s XR streaming capabilities to allow the customer to place the kitchen in the empty room with the help of tablet based Augmented reality.
We have attached an example to provide a better understanding of this feature but as we did not have the empty room it was not possible to show it properly with our project.
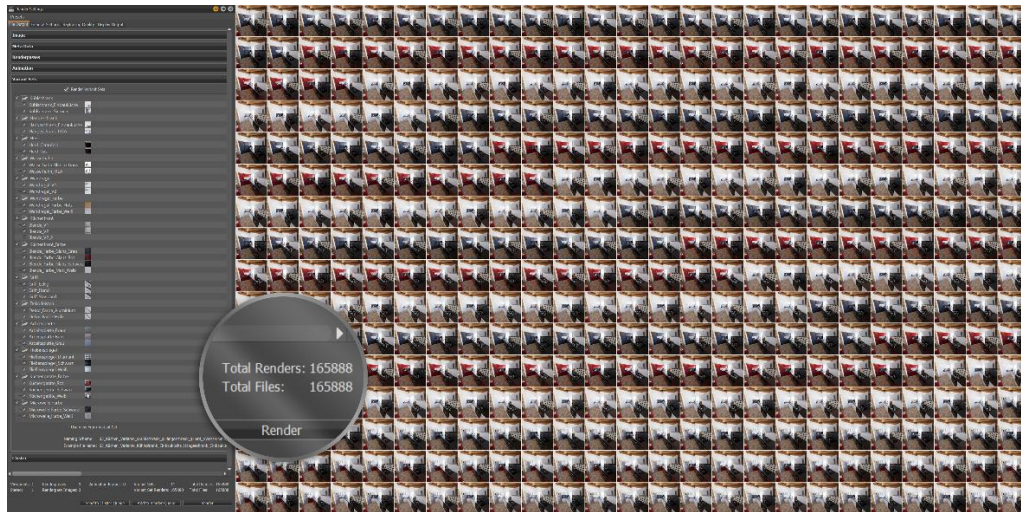

- **Image generation**

In case the customer needs more time to think about their decision, you can either offer to leave the collaboration session open so they can join at any time alone to check the options again or you can render out some images and movies that demonstrate the kitchen configurations nicely to support their informed decision or just increase their excitement waiting for the delivery.

Looking at all those options you can see we have many ways to collaboratively review the digital prototype, educate the customer and guide them in their customer journey to take a buying decision with confidence and comfort. And this does not even require them to meet us in person or leave their home.

Summary

Summary

Let`s take a look at the value VRED brought to this design and sales process:

- Inclusive Design: Involvement of all stakeholders throughout the process
- Customer Journey: Actively involve the customers to increase customer satisfaction and transparency
- Accurate Validation: Accurate Material representation and rendering modes to validate digital prototypes
- Light Study: Study and validate Light Situations with simulation grade accuracy
- Collaboration: Device agnostic collaboration from anywhere at any time based on the same data and visual quality – even on XR devices
- Remote Access: Leverage cloud streaming to ensure access from any device or location

VRED beyond Automotive

While Autodesk VRED has its origin in the Automotive Industry, we can see perfectly that it's a valuable tool for visual collaboration, communication, and digital prototyping for any industry. We wanted to clear up with the perception that Autodesk VRED is an automotive software. It is used by the biggest companies in industrial machinery, factory design and planning and consumer products and as we showed in this presentation it's perfectly suited to serve those industries as well. The origin of VRED is a great advantage indeed. The automotive industry has always been at the forefront of visualization technology and trailblazed the way in many areas. Other industries now have the chance to leverage a tool that already has solutions to the problems they might be facing in the future.