

TR500014

XR-based decision making in Automotive

Tillmann Dorsch
Autodesk

Learning Objectives

- Get an overview about XR
- What are the benefits of XR in Automotive Development
- Different use cases of XR in Automotive Development
- Cloud based workflows with XR

Description

In this class I will give you an overview about what XR is, explain different use cases of XR in Automotive Development and highlight the benefits of 3d visualization and XR.

Speaker

Tillmann Dorsch is a Product Owner for Visualization (VRED) in the Product Management team at Autodesk. He has a background in 3d visualization and was working over the past 10 years as a 3d Artist, Visualization Expert and Consultant, mostly in Automotive to create visuals, secure virtual processes and manage car configurators.

He was working for different customers and in different companies before he joined Autodesk this year. Tillmann studied Virtual Design and has an MBA in International Management.

Agenda

- What is XR
 - VR, AR and MR
- Benefits of XR in Automotive
 - General benefits of 3d visualization
 - XR vs. conventional 3d
- Use Cases of XR in Automotive
 - Evaluation in VR
 - Evaluation in MR – Interior
 - Evaluation in MR – Exterior
 - Virtual collaboration
 - Cloud based workflows
- Related Links
 - Some articles and videos to deepen the topic:
 - Other related AU classes

What is XR

XR is an umbrella term for Virtual, Augmented and Mixed Reality. The “X” can be considered as a variable representing any current or future spatial computing technology.

VR is full immersive, it’s all virtual and there is no connection to the real world. An example can be an application where you wear an HMD (Head Mounted Display) or sit in a chair while experiencing the VR application. In addition to industrial solutions, games are also a very popular example of how VR is used.

AR is an overlay to the real world. It can be a Smartphone Display where a 3d image in front of a 2-dimensional catalogue pops out. The most famous example of an AR application is probably Pokémon GO. A game where you collect virtual Pokemons, captured in real life.

Another example of AR are Head-up-Displays that are used for navigation in cars, in cockpits of planes or are integrated into a helmet.

MR is the combination of the real and the virtual world. It can be a seating buck where you see the virtual car but get haptic feedback from a real steering wheel. It can be also your own hands visible in VR in front of your HMD such as the Varjo XR-3 device. Or simply a virtual car next to a real car, seen through a tablet.

Benefits of XR in Automotive

General Benefits of 3d visualization

The general benefits of 3d visualization are a cost reduction, increased speed, and more flexibility.

Reduce of costs

In virtual design validation process, you can reduce the amount of clay and cubing models by using virtual prototypes instead. Clay models are required to secure the design process but are very expensive. Cubing models are necessary to secure the engineering process but are even more expensive. Generally, you need less Prototypes and Hardware if you rely on 3d visualization.

Increase Speed

You don't have to wait for the hardware to be built, you can decide based on your 3d visualization. The data is created with 3d software anyway and is already available.

More flexibility

It's possible to visualize all possible product variants in one single file, as well as different proposed design and engineer solutions during the development process. You can simulate the front and rear light of the exterior, the ambient light in the interior and complex light animations such as welcome scenarios when unlocking a door. Designs can be compared in different environments such as landscapes and Interiors. It can be also lit in a photo studio scenario to explore marketing potentials. 3d visualization can be accessed by anyone via real-time applications or rendered images.

Benefits of XR compared to conventional 3d

Thanks to a true three-dimensional representation of a product in XR, more realism is achieved. You can better judge surfaces and joints and get a realistic idea of how the product will look. As a user, you are more involved and get a better emotional understanding of the product.

Thanks to fully immersive tracking technology you can conduct realistic ergonomic studies.

Compared to a traditional CAVE, for example, XR is more cost-effective, requires less space and can be used more flexibly, e.g. at trade fairs to gather important feedback from visitors or to present new designs.

During a virtual collaboration you have improved decision making.

You can combine the real world with the virtual and take advantage of both.

Use Cases of XR in Automotive

Evaluation in VR

The setup is a head-mounted display (HMD) connected to a high-end PC with a good graphics card, allowing easy tracking of body position and head movements. It can be inside-out tracking technology, which takes up less space and can be set up more flexibly, or outside-in tracking with additional external trackers like the HTC Vive with the Lighthouse base station.

VR controllers that track hand position and display hands in VR are optional. But this leads to an even better immersion.

Possible use cases include the evaluation of surfaces, materials, and lights in daytime and nighttime scenarios.

Evaluating in MR - Interior

Starting with MR in Interior Design, the setup is a HMD, complex tracking of body, head movements, hands, and a seating buck. A seating buck is a frame to which a steering wheel and a seat are attached. Additional 3d printed parts of the vehicle, such as a dashboard, center console and doors can be mounted on the seating buck. This enables a haptic representation of the surfaces in MR, so that the user can touch and feel the design.

Use cases are the evaluation of materials and surfaces, HMI concepts, ambient lighting, and ergonomic studies.

For HMI design you can test a Click-Dummy programmed with HTML 5 or QT Designer directly in your VRED scene. With hand tracking enabled and a physical representation of your vehicle, such as 3D-printed dashboard and door surfaces, you can explore the entire interior, including display content.

Also, the ambient light and illuminated icons of buttons can be viewed in MR if there is a night scenario of your design prepared in VRED. You can also calculate realistic light simulation as well as animated welcome scenarios. It is possible to test the accessibility of gearshifts, sun visors and storage compartments, all virtually and with realistic materials.

Evaluating in MR - Exterior

The setup of an Evaluation in Exterior looks similar with the difference that you don't need a seating buck. The need of a physical representation depends on your use case. Hands are less important in exterior and the hand-tracking can be done by VR controllers.

Use cases include comparing a real car with a virtual one. You can view and evaluate virtual facelift parts on a real, existing vehicle before the design changes go into production.

A virtual vehicle can be viewed in a real environment, or you can evaluate virtual materials on a physical representation of the car such as a clay model

With advanced hand tracking methods enabled by Varjo and Ultra Leap you can also view your real hands in VR.

Virtual collaboration

For a virtual collaboration you need a High-End PC or Laptop, additionally an HMD for joining the collaboration in VR and of course a stable Internet connection.

The benefits are:

- easy access for any persona: Even non-visualization experts can access a virtual collaboration with a prepared data set
- Participants can access from anywhere no matter where they are located. It is possible to collaborate with your team in United States, Europe and Asia and discuss your ideas anywhere.
- Several experts from different departments can work on the same data set at the same time. It is possible to take another's point of view and explore the product together. This enables closer collaboration.

Cloud based workflows

Apart from the hardware used, a fast wireless Internet connection, such as a 5G mobile network, is the most important aspect to join the cloud. The main advantage is that expensive local hardware is no longer needed. Users can access from multiple devices such as tablets, cell phones, HMDs or laptops.

With untethered devices there is no need for annoying cables anymore. The content can be streamed directly to a wireless HMD.

- No stumble over cables
- No complex setup with external trackers and a special mounting on the ceiling to deal with the cables
- No limit of space, the user don't get pulled back by the cabled attached to his HMD on the head.

Cloud based workflows enable a broad participation. Users can access from anywhere, where they have highspeed WiFi, and are enabled to participate from home office. Your vision can be shared with anyone such as customers, colleagues, or other stakeholders. The possibilities of sharing your designs are endless.

Render Power can be scaled on demand. If you want to evaluate your VRED scene in with realistic reflections, lighting and shading you just need to unlock more render nodes and you can evaluate your design in Realtime GPU Raytracing. Or if you have a important presentation you can render an offline animation overnight and present it the next day.

Related Links

Some articles and videos to deepen the topic

- XR with the VARJO XR-3 and Nvidia CloudXR in Autodesk VRED
<https://blogs.autodesk.com/design-studio/2021/07/29/xr-with-the-varjo-xr-3-and-nvidia-cloudxr-in-autodesk-vred/>
- Collaborative Design: The Next Phase of VR for Kia Europe's Design Team:
https://blogs.autodesk.com/design-studio/2021/06/10/kia_vr_collaboration/
- Ford Design Review & VR Collaboration in VRED:
<https://www.youtube.com/watch?v=Y4FnquBBW-g>
- NVIDIA CloudXR 3.0 in VRED:
<https://www.youtube.com/watch?v=agQc84QTiiU>
- How Varjo and VRED are pushing the boundaries of virtual car design:
<https://varjo.com/blog/how-varjo-and-autodesk-vred-are-pushing-the-boundaries-of-virtual-car-design/>
- Driving the Future with XR Collaboration in Car Design – KIA_
<https://varjo.com/case-kia-autodesk-vred-driving-the-future-with-xr-collaboration-in-car-design/>

Other related AU classes

- The Breathtaking Future of Car Visualization
<https://www.autodesk.com/autodesk-university/class/Breathtaking-Future-Car-Visualization-2015>
- Light Simulation in VRED
<https://www.autodesk.com/autodesk-university/class/Light-Simulation-VRED-2015>
- Rendering Freedom - One Data Set to Serve Offline and Real-Time Rendering, XR, and Mobile
<https://www.autodesk.com/autodesk-university/class/Rendering-Freedom-One-Data-Set-Serve-Offline-and-Real-Time-Rendering-XR-and-Mobile-2019>
- HMI in VRED - UX and UI Validation on a 3D Model During the Product Development Lifecycle
<https://www.autodesk.com/autodesk-university/class/HMI-VRED-UX-and-UI-Validation-3D-Model-During-Product-Development-Lifecycle-2017>
- The next big step in designing in Virtual Reality
<https://www.autodesk.com/autodesk-university/class/Next-Big-Step-Designing-Virtual-Reality-2017>