



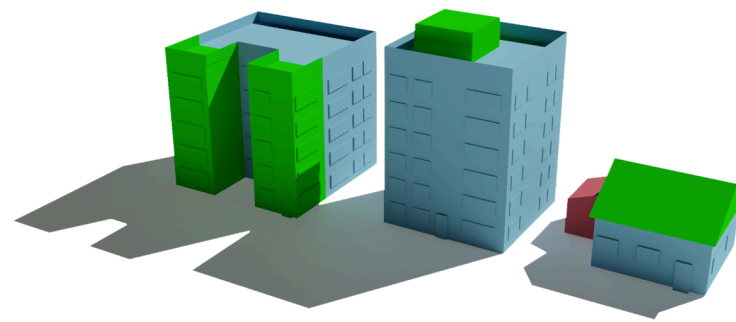
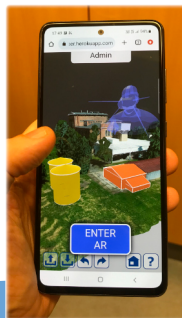
# VIRTUAL REALITY ON THE WEB

WebXR is a new web API for developing Virtual- and Augmented Reality web applications. These applications can be played on dedicated VR headsets and on smartphones. A major benefit of using WebXR is the ease of deployment, as no native app needs to be downloaded and installed. This allows for rapid sharing of Mixed Reality (XR) experiences to customers or the general public.

### Three.js



While WebXR takes care of the communication with VR devices and controllers, the API does not handle rendering of 3D graphics by itself. This is where the open-source framework Three.js fills the gap by providing a feature-complete toolset for 3D model rendering and animations in Javascript. The popular framework is used in a large number of online games, demos and 3D viewers.



# WHAT IS MASSING?

The architectural design process begins by studying massing. Massing is the study of the general shape, form and size of a project, and how it impacts the surrounding environment aesthetically.

In massing buildings are treated as compositions of basic shapes such as boxes, pyramids and gables. A complex shape is a composition of multiple simple shapes added or subtracted together.

### The problem

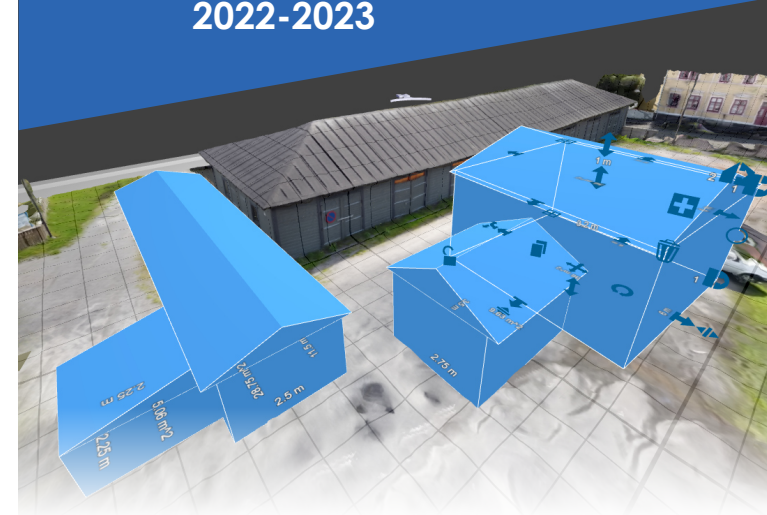
The customer correspondence during the massing phase can be a long and complex process. The architects apply incremental changes to to the design which are then shown to the customer, who in turn may suggest even more changes to add.

The solution could be to use a tool which enables quick and immediate collaboration between the architects and the customer. Something like an online meeting for massing, in which the architect could edit the design in real-time together with the customer and other architects. A "Massing" app.



# PROJECT DIGI-MODE MASSER

2022-2023



The architectural Masser is a collaborative massing tool for planning construction projects at existing locations. The browser-based tool is based on the new WebXR framework and is fully VR-compatible.

The Masser was developed in collaboration with professional architects from NAC Arkkitehdit as part of the Project DIGI-MODE research project.



European Union  
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# STARTING POINT

The use case selection took place over a number of online meetings with NAC Arkkitechdit, over which the Novia and Åbo Akademi workers gained an insight into massing and the possibilities of developing a digital massing solution.

## Photogrammetry



One of the initial concepts for the masser app was the usage of drone photogrammetry for scanning and importing real-world places and existing buildings into a digital environment. New digital content could later be added to the model, and parts of the original model could be removed. For example shrinking a building.

## Framework selection

After the initial concept was laid out it was time to select either a game engine or software framework for the masser. The main candidates were: **Unreal Engine**, **Unity** and **Three.js**. After weighing the advantages and disadvantages three.js was selected due to several important aspects:

- The developer had extensive experience with three.js from previous projects.
- Unlike the proprietary contenders, three.js is free, open source and is licensed under MIT.
- three.js is fully cross-platform as it is built on top of WebGL, WebXR and other web technologies
- Enables cross-platform collaboration between smartphones, PC and VR clients.

# WORK PROCESS



## Agile software development

In agile software development the work is broken up into short sprints in which the developers are committed to a certain task. At the end of each sprint a retrospective meeting is held to review the work done.

The masser app was developed over the course of months in short two week sprints. At the end of each sprint we scheduled a meeting with NAC Arkkitechdit. During the meeting we demonstrated and reviewed the last sprint's progress and planned improvements and new features to be developed during the next sprint.

## Modern Javascript



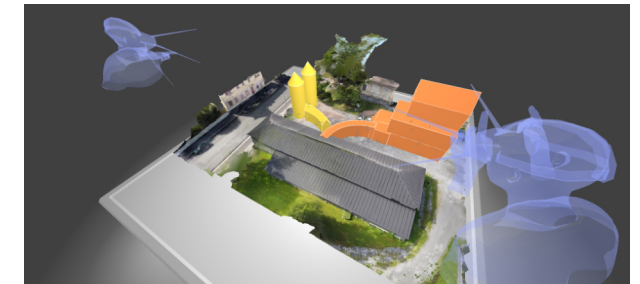
The masser app was developed in Javascript ES6. The code is object-oriented and modular, allowing for easy extension with new types objects, as demonstrated with the PV Planner extension. The app was built on top of a lightweight entity framework developed by Dennis Bengs.

Javascript has grown a lot over the last decade. ECMAScript 2015 (ES6) introduced a lot of modern programming features to JavaScript, such as the native classes, maps, sets and other high-level concepts. This modernization of an old language is why Javascript remains so popular.

# END RESULT

The Masser app has a large number of features:

- Compatible with most platform, including Oculus Quest, Smartphones and PC/Mac with Steam VR.
- Node.js multiplayer server allows for an infinite number of collaborators.
- Highly customizable massing system allows for complex building creation.
- First-person ground view to visual inspection.
- Quick link sharing for online collaboration.



## Reception and feedback

Quotes go here.