

Augmented Reality

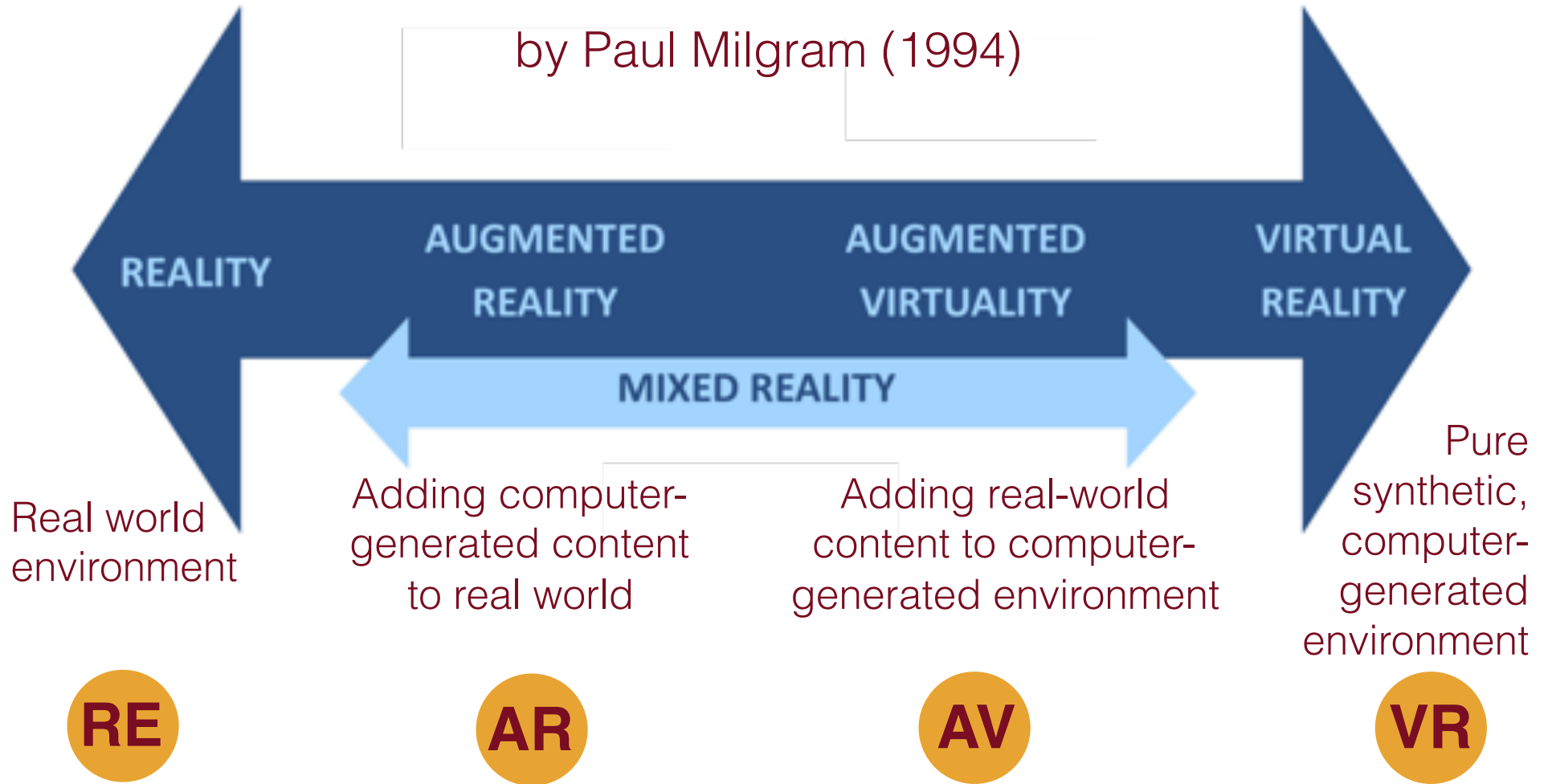


ARchi VR

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The Reality-Virtuality Continuum

by Paul Milgram (1994)



Use Cases of Augmented Reality

- Entertainment / Games
- Marketing & Sales
- Education / Training
- Maintenance & Repair



Pokémon GO

Augmented Commerce

- Do we go from E-Commerce to A-Commerce?
- Reasons for Augmented Commerce
 - Design & style options
 - Spatial context
 - Geometric constraints
 - Dimensioning of options
 - Visual explanations

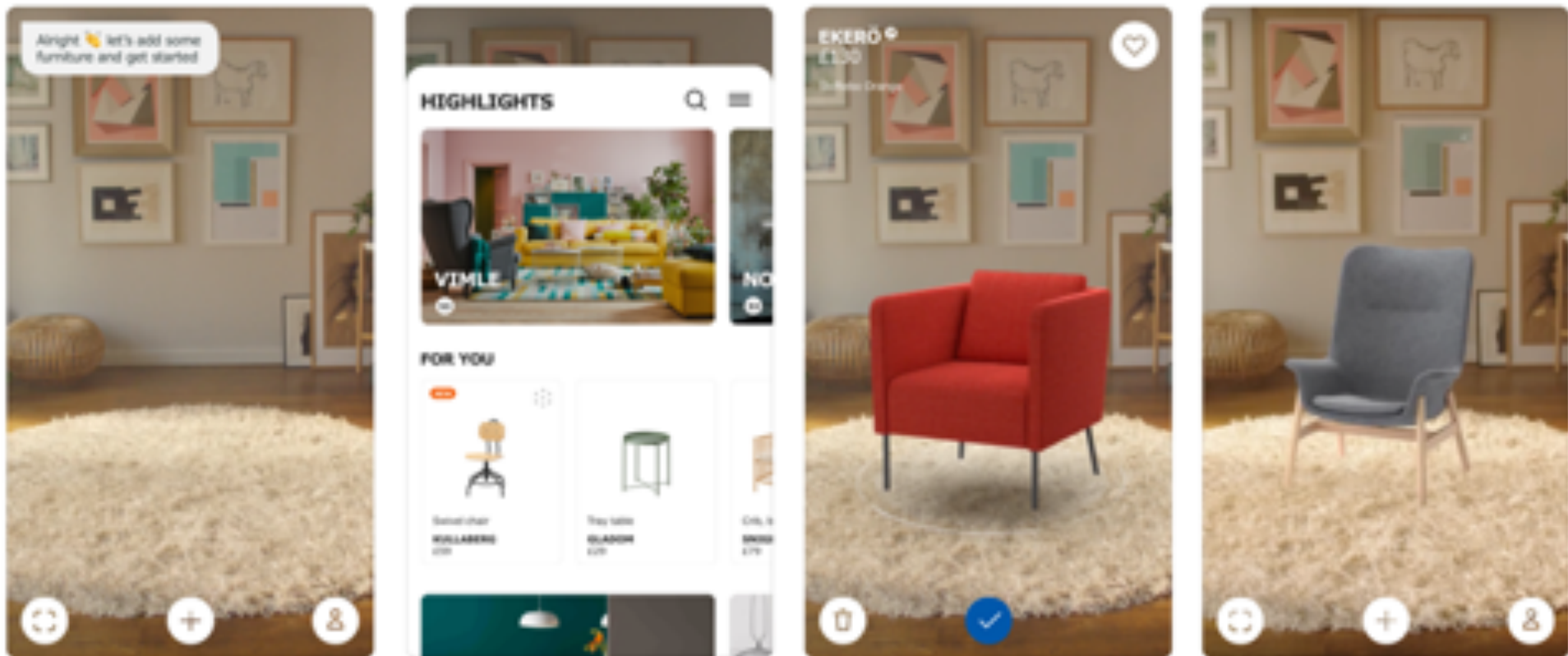


Ray-Ban Virtual Try-On



Ikea Place

Augmented Commerce



Ikea Place

3D Objects in AR Get Smart

- Physical simulation
- Configuration logic
- Product functionality
- Animation of complex tasks
- Problem-based help
- Real-world sensor data



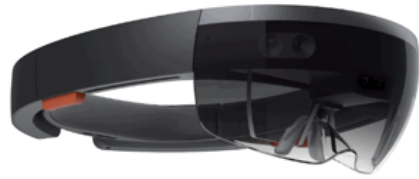
Video by Jelmer Verhoog

Outdoor & Indoor AR Merge

- Example: SBB AR Preview
 - Android App with Google Map + AR Technology
 - Indoor currently only Zürich HB



Spectrum of Immersion



VR/AR Glasses

Mobile VR/AR

Desktop VR

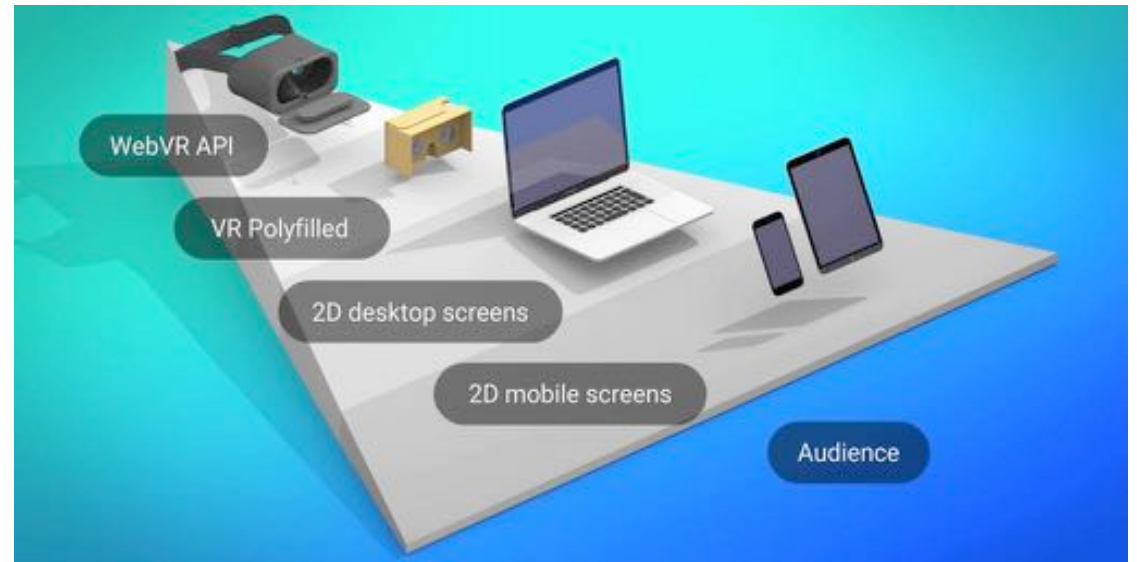
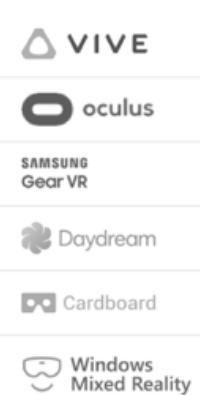


Image by [Arturo Paracuellos](#)

The New Wave of WebVR & Mobile AR

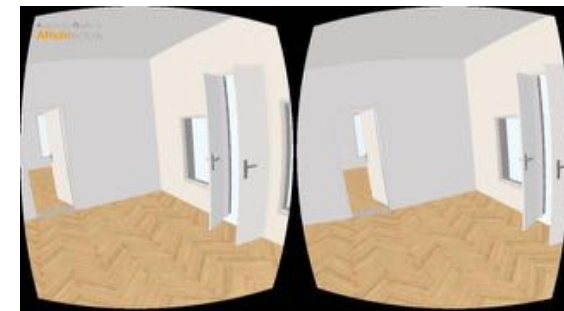
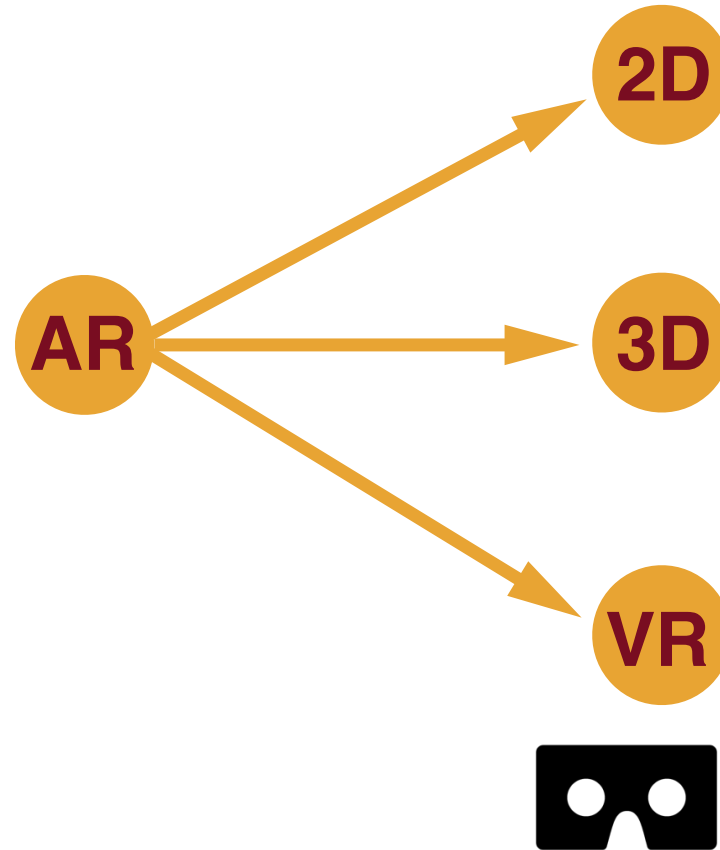
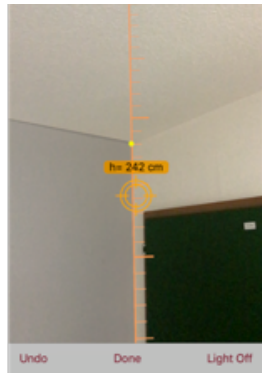
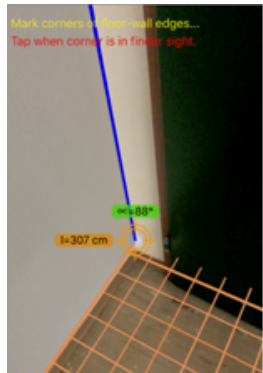
- Experience VR
 - in any Web browser
 - on any device
- Declarative VR content
- JavaScript libraries

- AR on Smartphones & Tablets
 - No special device required
- The Pokémon GO showcase
- New dev tools for mobile AR
 - ARKit by Apple
 - ARCore by Google



AR for Reality Capturing

Room Capturing with Augmented Reality



Augmented Reality for
ARchitecture

ARchi VR



Main features of ARchi VR

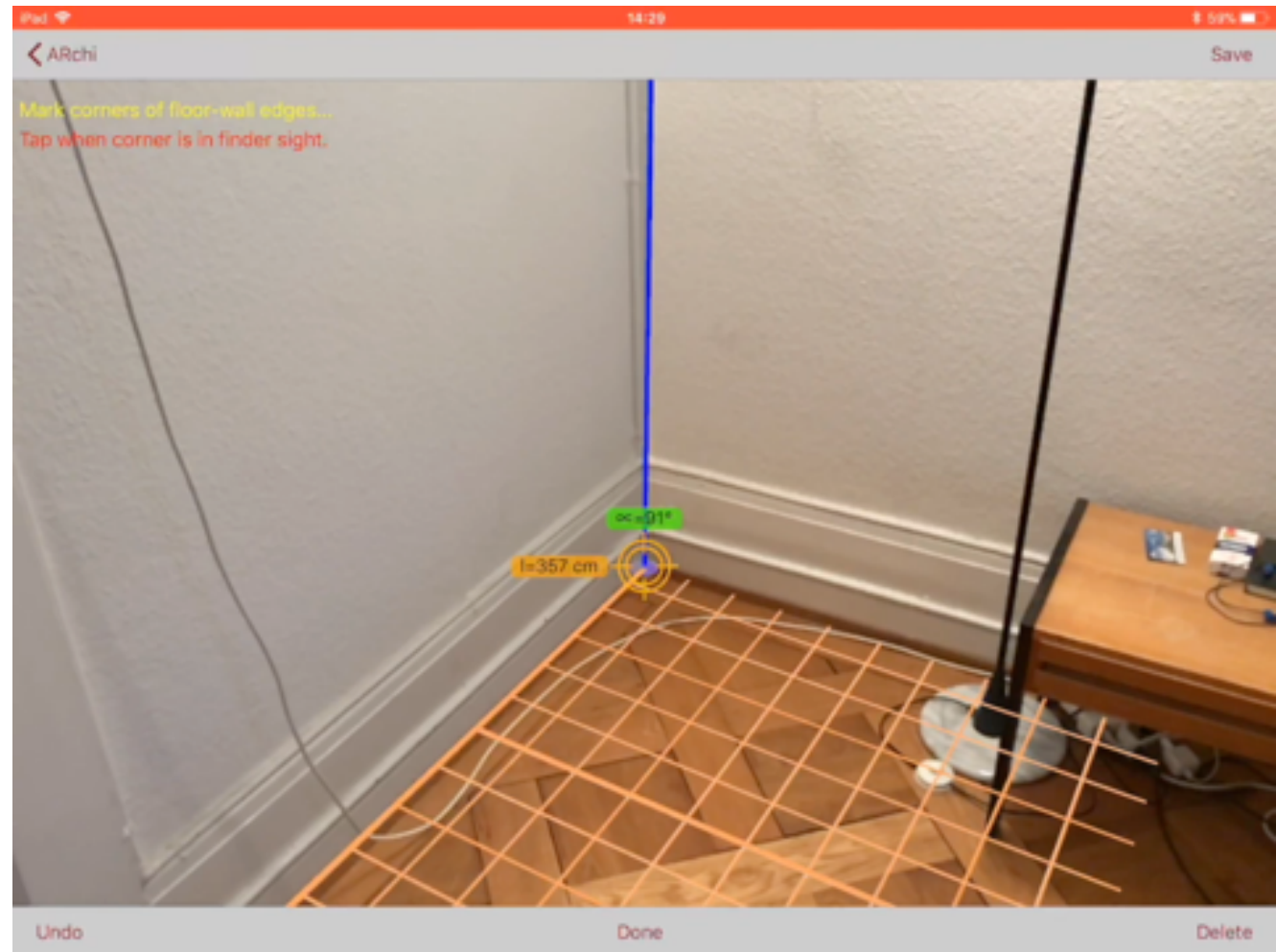
- Scanning of a room using Augmented Reality
 - Floor, walls, doors, & windows
 - Auto-align to length grid and perpendicular angles
- Merging of multiple rooms to one plan
- Share 2D & 3D models via email

AR for Reality Capturing

Capture rooms with floor, walls, windows and doors.



ARchi VR



Results of AR Capturing

Spatial Data of Captured Room

- Measured 3D points of walls, doors, & windows
- Aligned points: grid alignment, angular alignment
- Doors & walls as sub-elements of wall
- Subtypes estimated by geometric rules
- Material type estimated using computer vision

Results of AR Capturing

Meta Data of Captured Room

- Geolocation: longitude & latitude
- North direction
- Address: street, town, country
- Floor area, outer & inner wall area
- Cubature of room

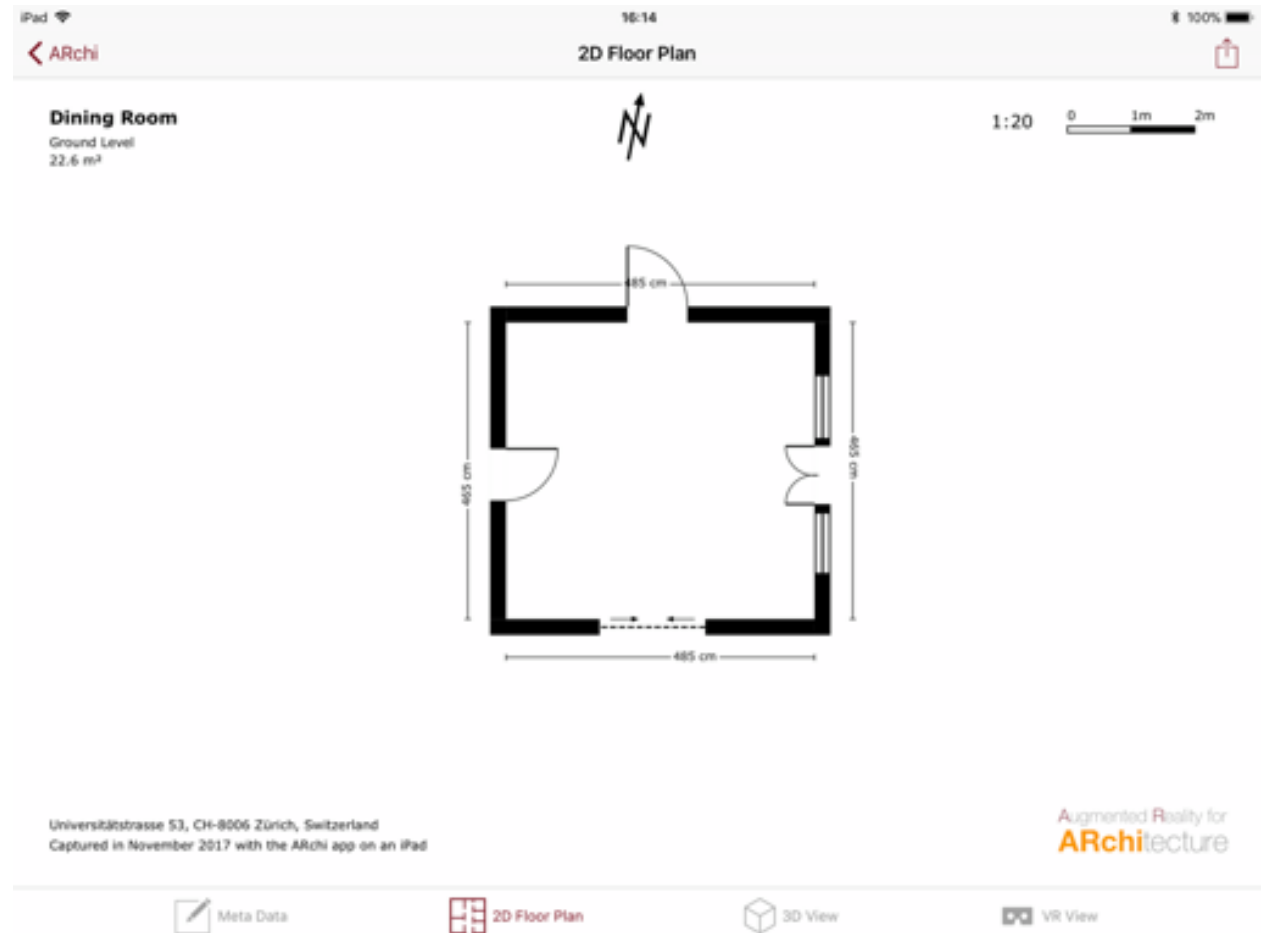
Meta Data	
Name	INT
Building	10
Level	1 - +
Remark	Remark/Description
Floor Area	104.98 m ²
Ceiling Height (m-cm)	280.0
Wall Material	Stone >
Outer Wall Surface	Plaster Rough >
Area of Outer Walls	85.30 m ²
Area of Inner Walls	278.78 m ²
Auto-Align Measurements	<input checked="" type="checkbox"/>
Grid Raster	5 cm >
Perpendicular Angle	±10° >
LOCATION	
Place	Steinberggasse 10
	Steinberggasse 10
8400	Winterthur
Zürich	Switzerland
Location on Map	474884, 87297 >
CREATOR	
User Name	Philipp

Meta Data 3D Floor Plan 3D View VR View

2D Floor Plan

SVG in WebView

- SVG generator
- SVG document in WebView
- Web interaction calls Swift code



3D Room Visualization

WebVR in WebView

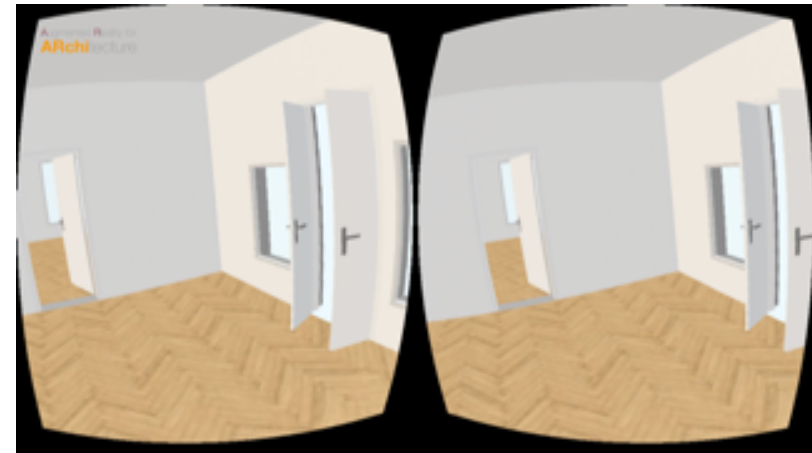
- A-Frame generator based on 3d.io
- WebVR document in WebView
- Web interaction calls JS and Swift code



3D VR Experience

WebVR in WebView

- Same A-Frame code with different controls
- WebVR document in WebView



ARchi VR

Try out and test by yourself

- Download on Apple App Store
- Use test devices (iPhone & iPad)
- Test the app with VR glasses
- Give feedback
- Please rate & review on App Store



archi.metason.net

ARchi VR App 2.0

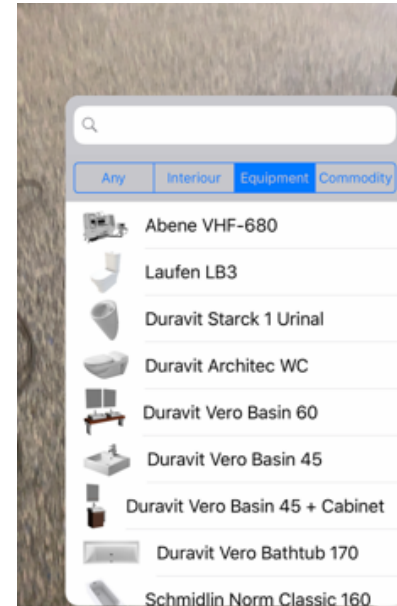
New Features (in development)



Object Detection
The detection and classification of objects within the AR view



Augmentation Items
User generated AR content like markers or measurements



3D Object Catalog
Placing of custom 3D objects in spatial context







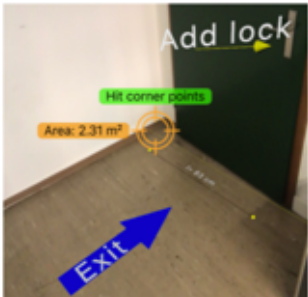
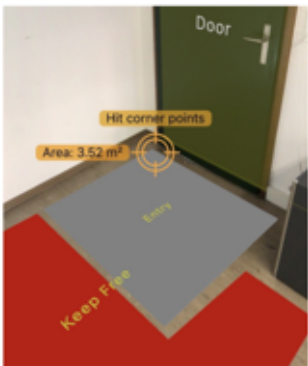
AR Cloud, Sharing
Sharing of user generated content

Capture & Augment Rooms

User-generated AR Content

- Real entities (bounding box)
- Virtual 3D catalog objects
- Image
- Spot
- Route
- Zone

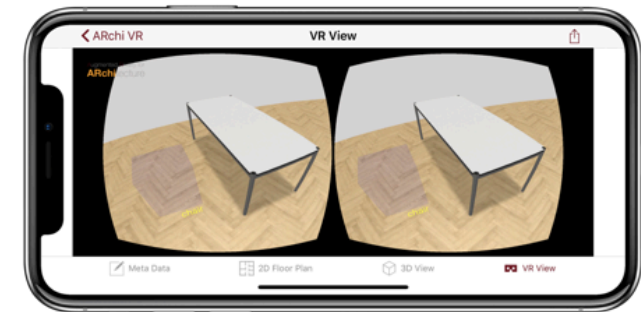
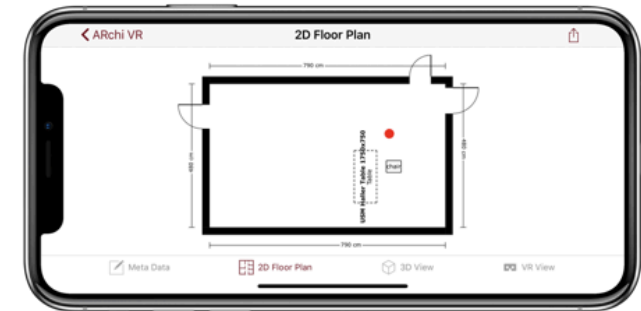
Type	Subtypes	Examples
Entity	Building, Equipment, Interior, Commodity (real objects)	
Object	(virtual 3D object, e.g., the red chair)	
Picture	(virtual image in vertical rectangle, e.g. the UCC18 poster)	

Type	Subtypes	Examples
Spot	Info, Warning, Question, Task, Open task, Done task	
Route	Distance, Pointer, Direction, Radius	
Zone	Keep free, Entry, Gangway, Carpet, Lane, Lawn, Pool, Parking	

Capture & Augment Rooms

Share Augmented Rooms

- 2D SVG
- 3D WebVR
- Share AR
—> „AR Cloud“



ARchi VR: Used Technologies

- Apple Libraries
 - ARKit with SceneKit
 - Core ML
- WebVR / A-Frame
- 3d.io toolkit



Archilogic

Challenges in AR ^{1/3}

Convincing User Experience

- Usability of Augmented Reality apps
- Benefit generation and storytelling adequate to AR

Challenges in AR ^{2/3}

Persistent augmentation for outdoor AND indoor environments

- Persistent point cloud
- Re-registerable object features
- Searchable and shareable augmented realities

Challenges in AR ^{3/3}

Social Mixed Realities

- How to manifest and share our own personal realities?
- Multi Realities /
Multi Existences /
Multiple Personalities?
- How can AR become NOT be driven by advertising?

Happy New Augmented Reality?



Fig. 1.7 Keiichi Matsuda vision of riding a busy while using a smartphone to play a game, get alerts, be inundated with advertisements, and get a phone call (Source: Keiichi Matsuda)

URL: <https://vimeo.com/166807261>

Outlook 1/3

Ideas for new features in ARchi VR

- Scanning of interior objects: furnitures, equipment
- More AI logic
 - Geometric classification rules
 - Computer Vision for feature recognition
 - Machine Learning for object classification
- and a lot of UI improvements ...

Outlook 2/3

Work in progress of new features in ARchi VR

- Persistent AR
 - Re-registration of spaces
 - AR markers (spot, route, zone, object)
- Sharing of AR content via Cloud
 - Sync of private AR content over user's several devices
 - Searchable, shared & public AR spaces and markers

Outlook 3/3

Ideas for business cases & app scenarios with ARchi VR

- Extensions or specialisations of ARchi VR for
 - Field Sales / Field Service / (buildings, equipment)
 - Facility Management (costs, investments, offerings)
 - AR for (public) Buildings (Schools, Museums, Hospitals, ...)
 - „Holiday Absence“ App (e.g., plant watering)
- Integration into business workflows (APIs, Web Services)

Happy New Augmented Reality?

YES, let's make it great!

- Any cool ideas for AR?
- Do you need help and expertise in AR?
- Ready for starting an R&D project using AR?
 - R&D collaboration, white labelling, ...
- Feel free to contact me ...

Contact

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Engineering**

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