Augmented and Virtual Reality

CSCI 3907/6907
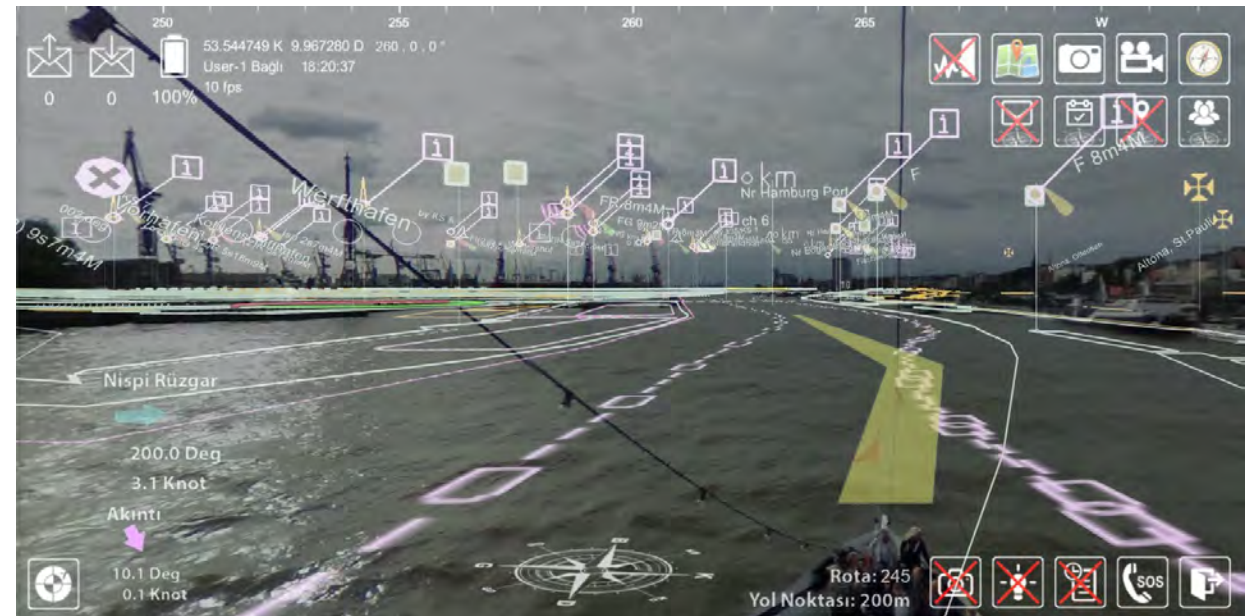
Spring 2022

3:30 PM - 6:00 PM, Thursdays

Lecture 3

Dr. Hurriyet Ok

hurriyetok@gwu.edu

Extended Reality (XR) User Interface (UI)

Guest Lecture by Joshua Gleason
Gelman Library - CREATE Digital Studio

- What is UI? Why is it important? What is UX?

- How is XR UI different from standard UI? What benefits and considerations are there?

- How is this applied in Unity? Some things to know about work with the Unity Canvas system.

- What is experiment UI?

- Best tools to quickly design a great looking UI?

Presentation Slides will be provided later on Black Board
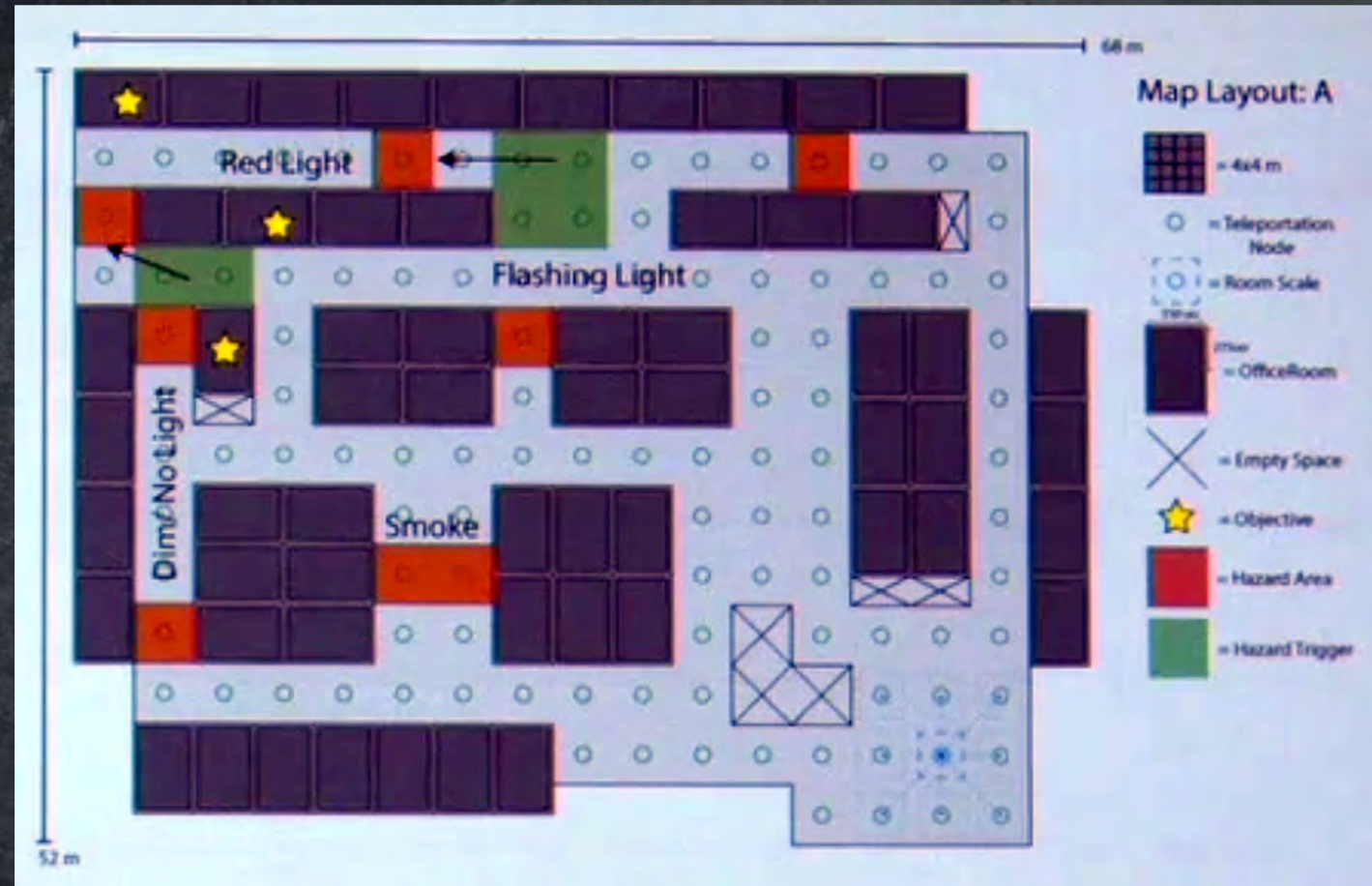
ANNOUNCEMENT: New Classroom!

Starting next week, Thursday, February 3, 2022

we will meet in Room Tompkins 402

VR HUD Navigation Challenge – A Case Study

Objective: Search & Rescue Mission

- Virtual Environment
- Complex Office Space
- Hazards Blocking Routes
  - Fires
  - Smoke
  - Wall Collapse

VR HUD Navigation Challenge – A Case Study

UX/UI Evaluation Criteria

- Navigation Elements
- Time to Complete Mission
- Varying Lighting

VR HUD Navigation Challenge – A Case Study

Judges & SMEs

- NIST PSCR
- First Responders
- Usability Experts

VR HUD Navigation Challenge – A Case Study Design

- Streamlined – No Fumbling Through Menus

- Easy and Comfortable To Use – Floating UI

- Voice Activated or Manual Commands

- Display Only Critical Info To Save Lives

  - Oxygen, Temp, Compass

# VR Navigation Project – Suggestions

Simplify Your Design and Implementation Approach

- Start with three different routes with varying distances.

- Establish equal-distance pre-fixed teleportation points.

- Have a routing table to represent all paths (min. three).

- Create at least one obstacle to recalculate the new shortest route.

- Avoid complexity in order to complete the project on time.

- Expand your virtual realm only if you satisfactorily finished the minimum project requirements.

Chapter 11: Navigation

Augmented Reality – Principles and Practice

http://www.augmentedrealitybook.org
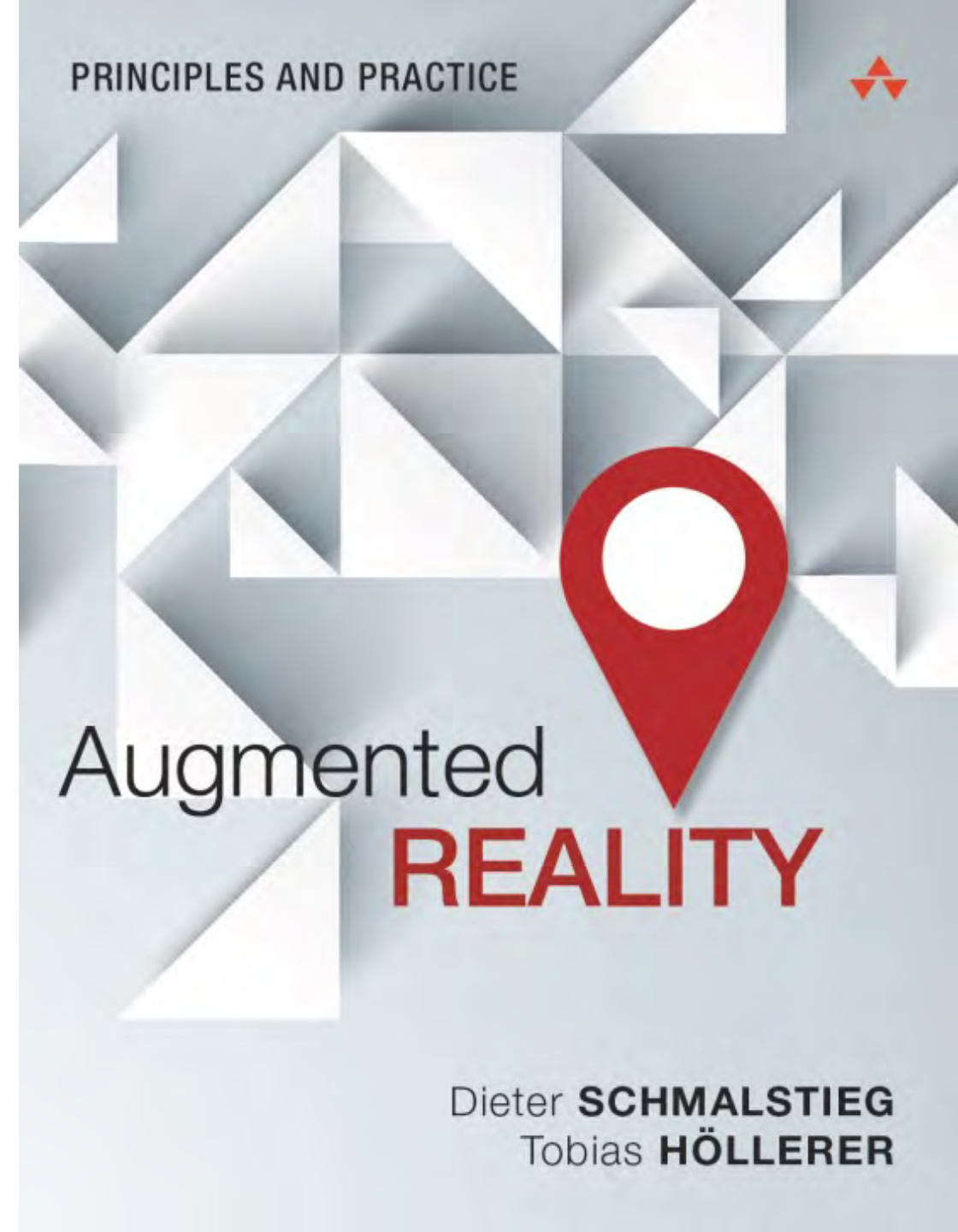
Outdoor Navigation

The Signpost system lets an outdoor AR user follow a route consisting of waypoints

Image: Gerhard Reitmayr

Indoor Navigation

The Indoor Signpost system highlights the next doorway along a path and shows a 3D arrow pointing in the direction of the final destination
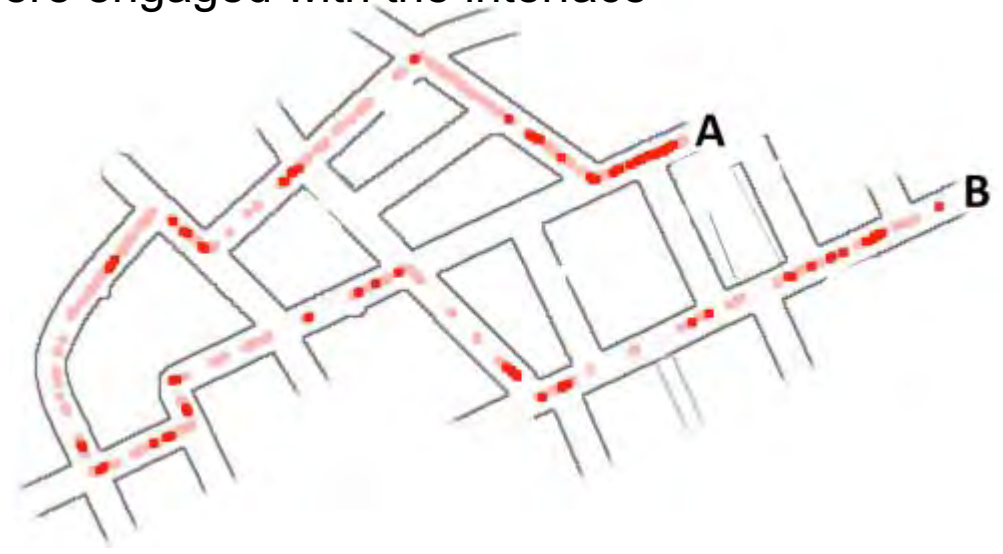
Image: Daniel Wagner

Outdoor Navigation Decisions

The plots show the number of users employing the navigation interface for every point along a route
Darker colors mean that more users were engaged with the interface
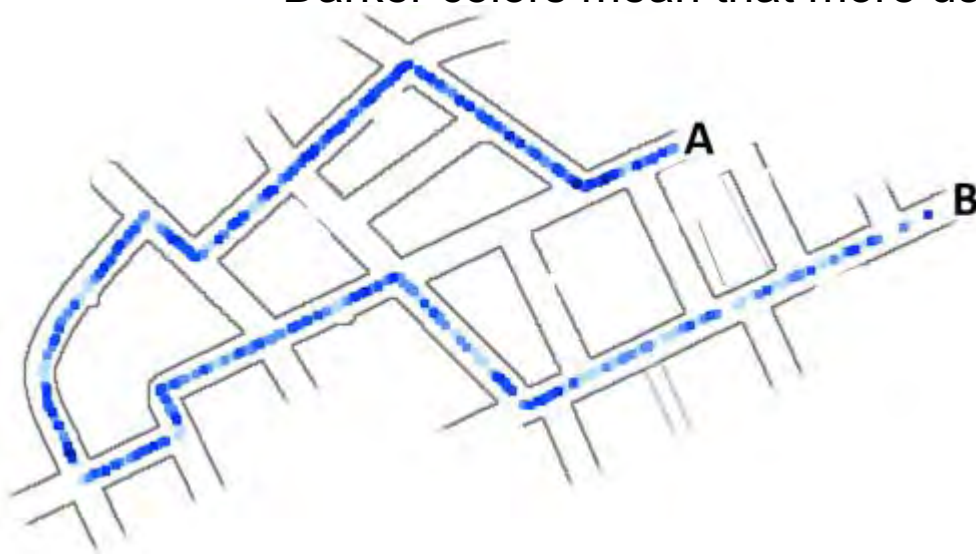
With a conventional map interface, the usage is uniformly high along the entire path

The AR interface was mostly used at nodes, when a decision needed to be made

Image: Alessandro Mulloni

Indoor Decision Making

While the user walks, the route is visualized in VR

Upon reaching a decision node, the whole path is shown aligned with the environment in AR

After departing from the node, the display switches back to VR

Image: Alessandro Mulloni

Class Exercise: Article Review

Indoor Navigation with Mixed Reality World-in-Miniature Views and Sparse Localization on Mobile Devices

Alessandro Mulloni, Hartmut Seichter, Dieter Schmalstieg

Read the paper and post your answer on Blackboard.

- What is the novel aspect of their approach?
- What are the key requirements for indoor navigation system and what are the possible solutions?
- Which mobile device sensors were utilized and how?
- Why their design is sufficiently effective in supporting indoor navigation?

Halo

A halo is an arc with a curvature proportional to the distance of an object outside the screen
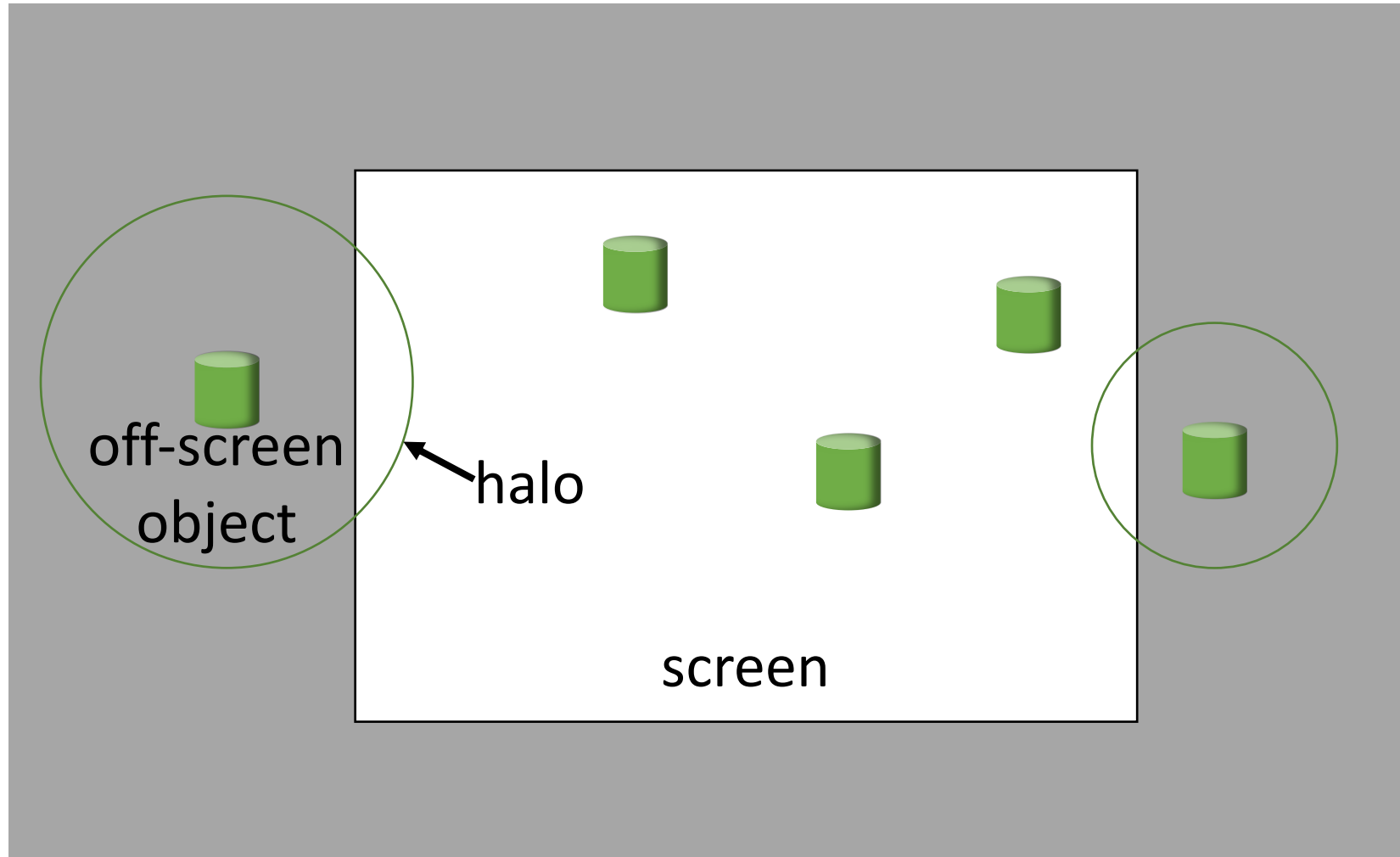
Context Compass

A context compass is a band at the bottom of the screen representing the possible directions
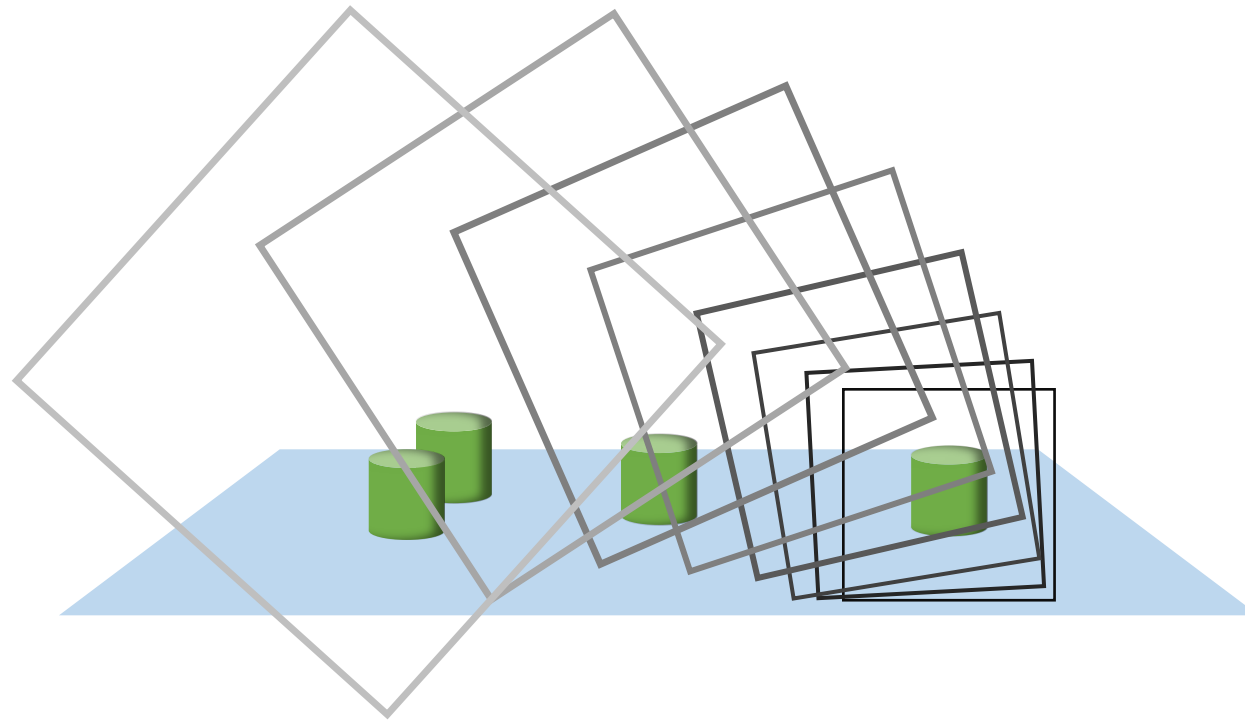
An arrow overlay is visible

The user can use the compass context to find the off-screen arrow

Image: Alessandro Mulloni

Attention Funnel

A tunnel visualization directs a user's attention toward a specific object at the tunnel's end

Hologram Inspection

The appearance of a hologram varies with the incident viewing direction

The yellow circle directs the user toward a specific viewing direction, encoded as the angle and distance to the center of the pie slice visualization

Image: Andreas Hartl

View Frustum Visualization

Yellow pyramids reveal the camera frusta corresponding to an image sequence

Image: Clemens Arth

Indoor Map

Overlaying a transparent layer combines two visualizations in one image: 3D AR overlaid on the video and a 2D map

Image: Daniel Wagner

Bird's Eye View

With a top-down map, users can precisely determine the distance to various palm trees, also encoded in this experiment as the sizes of the virtual spheres in the ego-centric AR scene
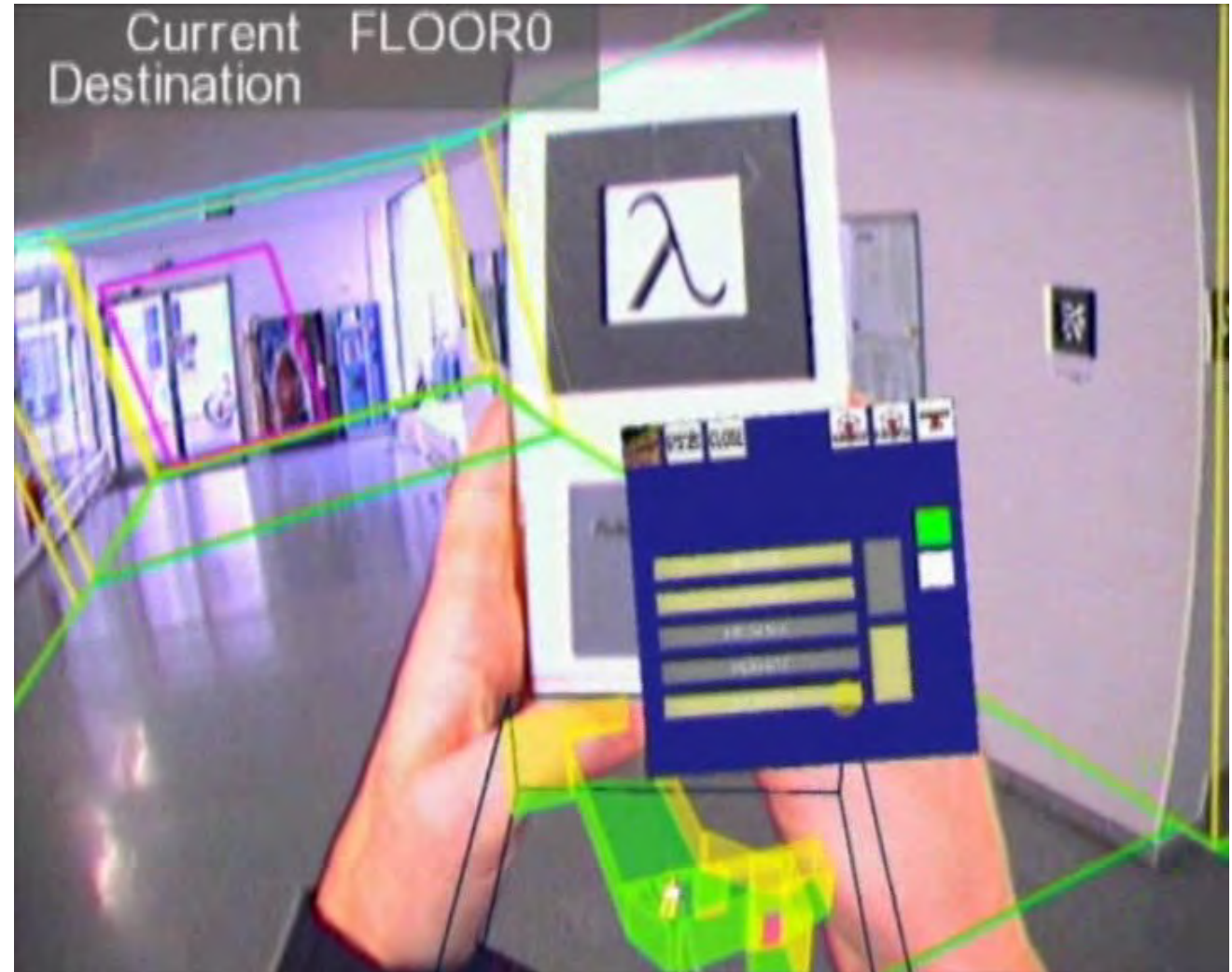
Image: Jason Wither

Arm-Mounted World in Miniature

A world-in-miniature can be attached to a handheld or arm-mounted prop
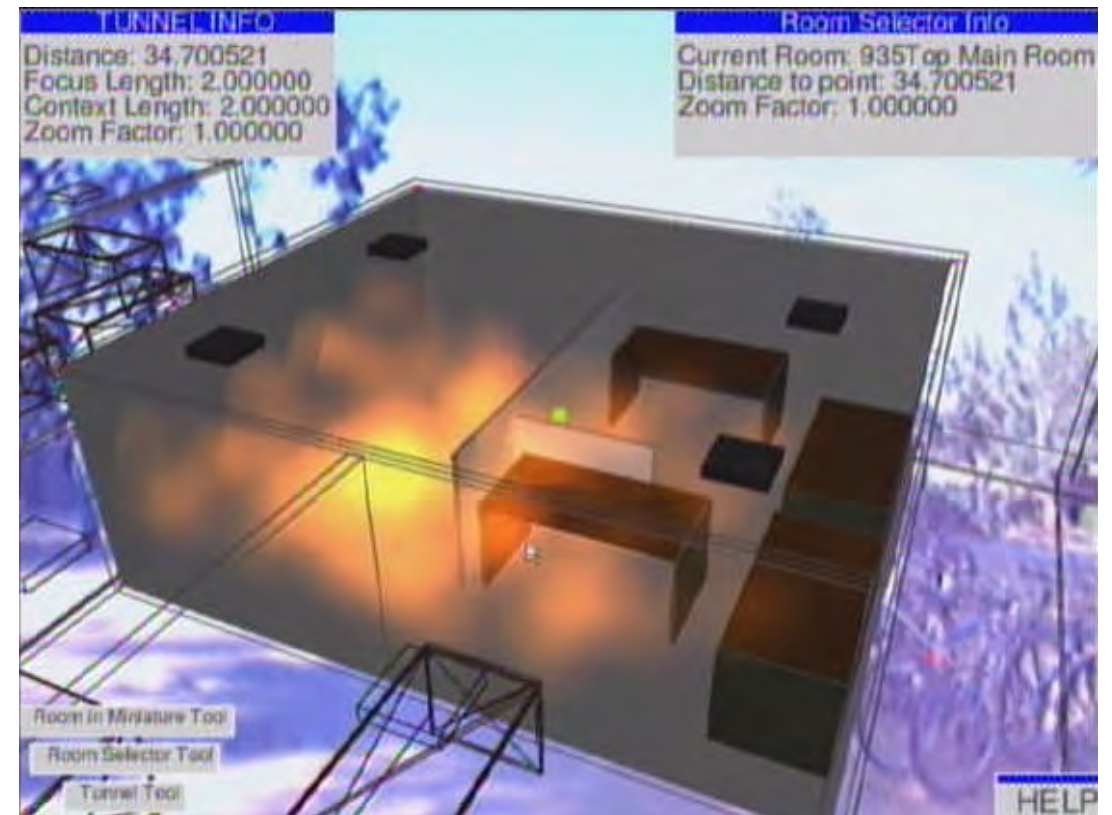
Image: Gerhard Reitmayr

Room in Miniature

The user selects a room in a building in an egocentric perspective

The room is magnified and shown in an exo-centric perspective

Magic Book

- Use planar tracking
  - ARToolkit
  - Natural features

- Simple interaction

- Mostly passive viewing
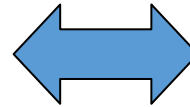

Image: Mark Billinghurst

Image: Vincent Lepetit
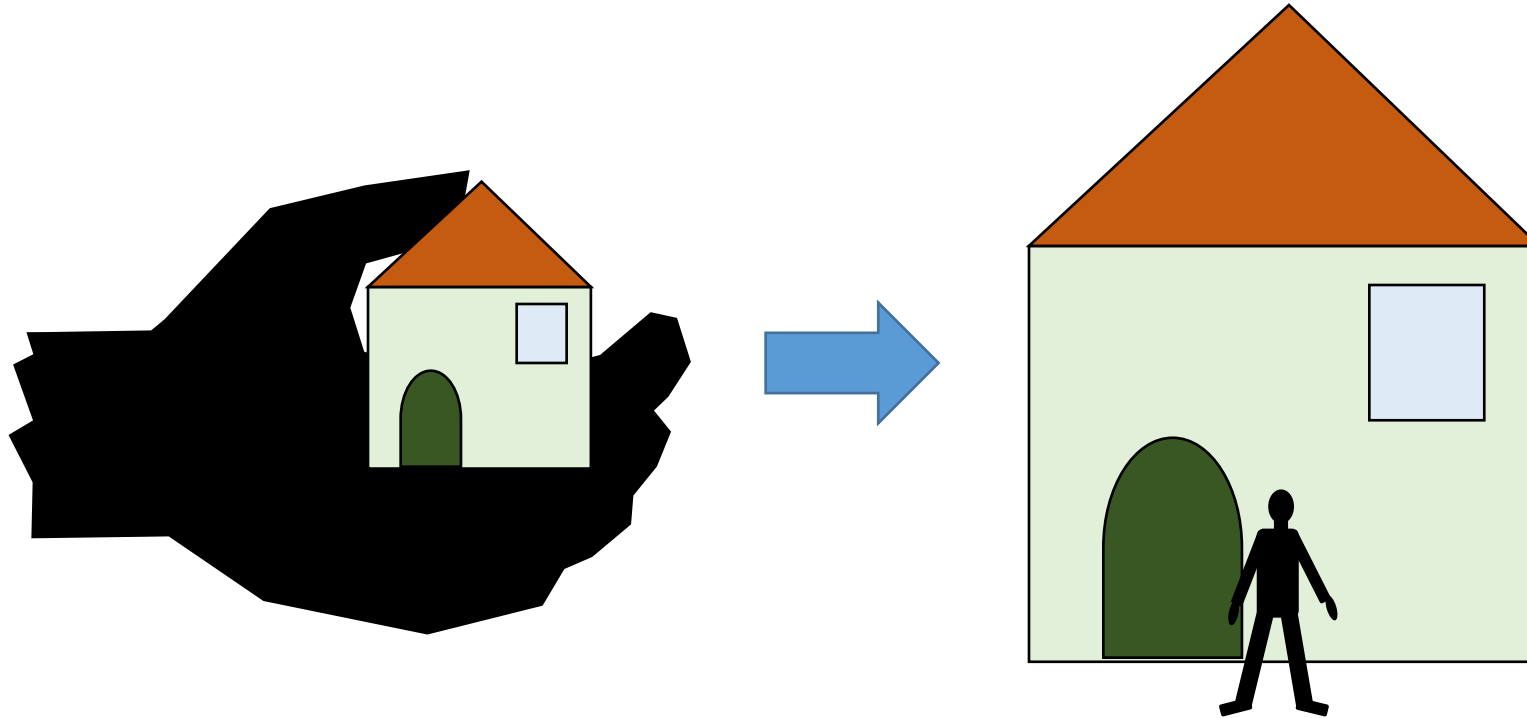
Multi-scale Collaboration

Egocentric

Exocentric

Image: Mark Billinghurst

Magic Book Transition

A transitional interface can take a user from an AR model into a life-size VR environment

Zooming Interface

Seamless transition from an AR ego-perspective view to a panoramic view of the surroundings or to a map
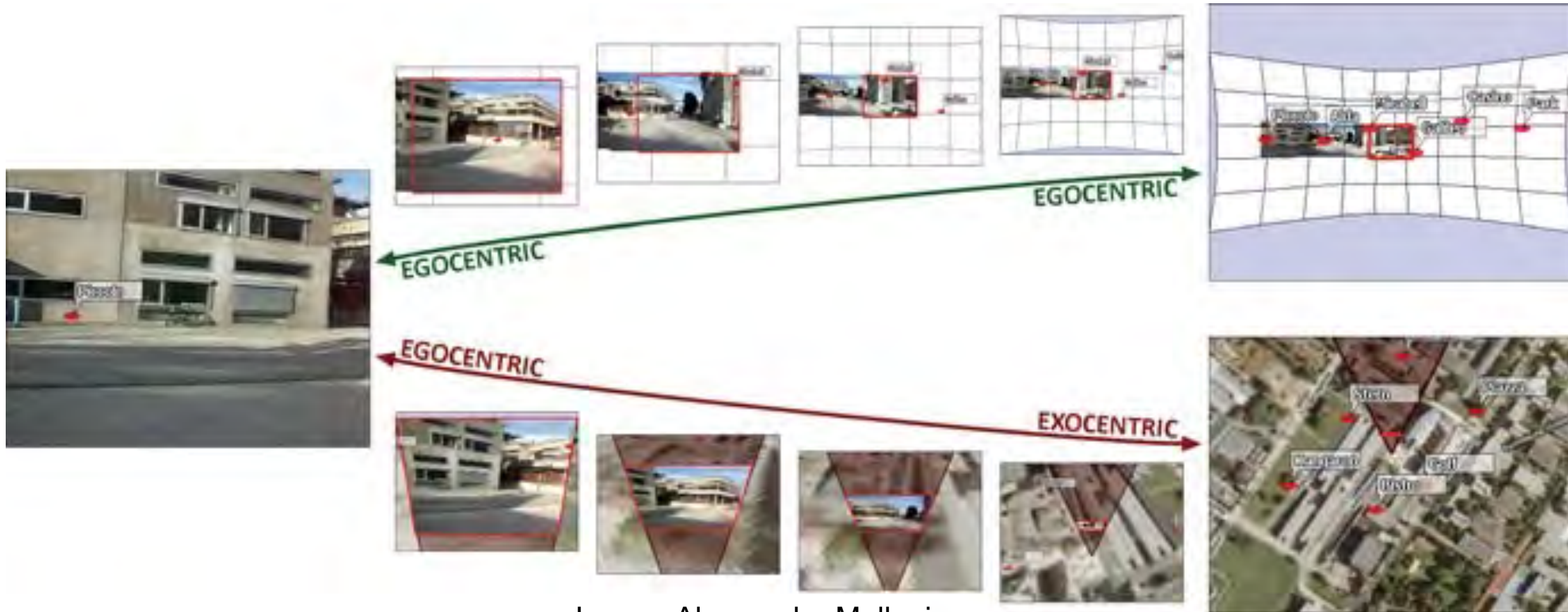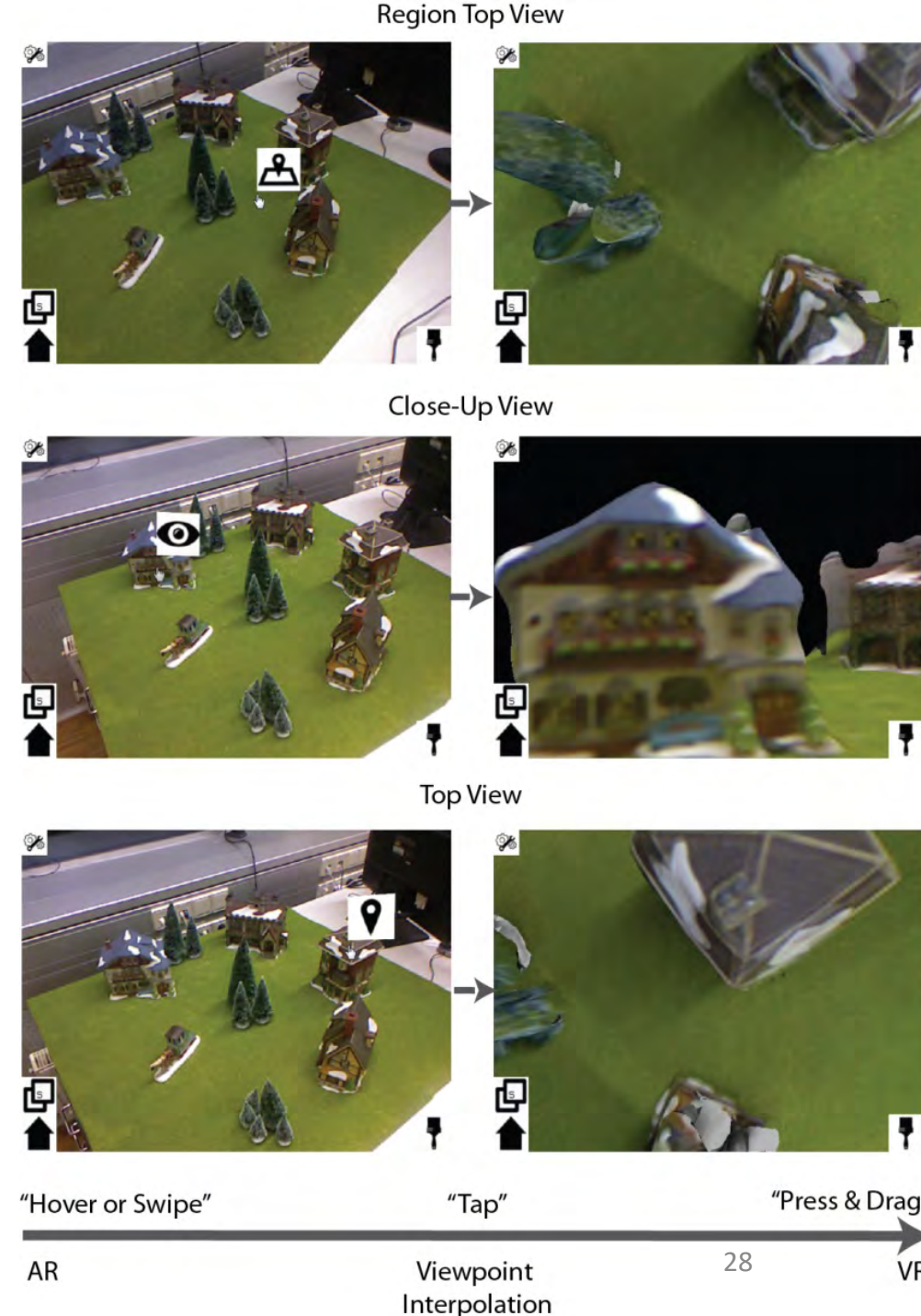

Image: Alessandro Mulloni

Image-Based Transitional Interface

By touching an object in the live AR view, the user can trigger a transition to a magnified VR view from a top-down or frontal viewpoint
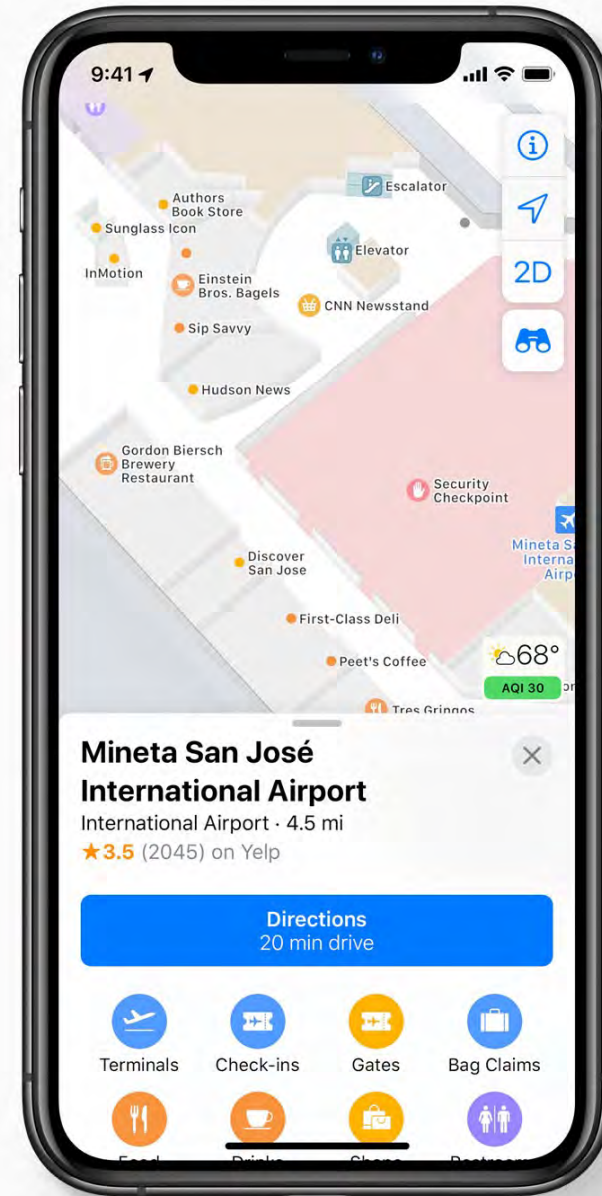
Image: Markus Tatzgern

Example: Apple Maps Flyover Feature

Example: Finding your way in airports & malls

Summary

- **Exploration** can benefit from AR via increased **situation awareness** and discovery of hidden targets.

- **Wayfinding** can be supported by directly superimposing routes in an ego-centric AR view or by helping users at decision points.

- AR can also be used to supply various cues to let the user adjust a **viewpoint** so that a target object is observed or that a certain given view is obtained.

- Multiple perspective interfaces can provide overview and detail, either by spatial combination in a **split screen** or **layered screen**, or by **transitioning** from one view to the next.