

# Augmented and Virtual Reality

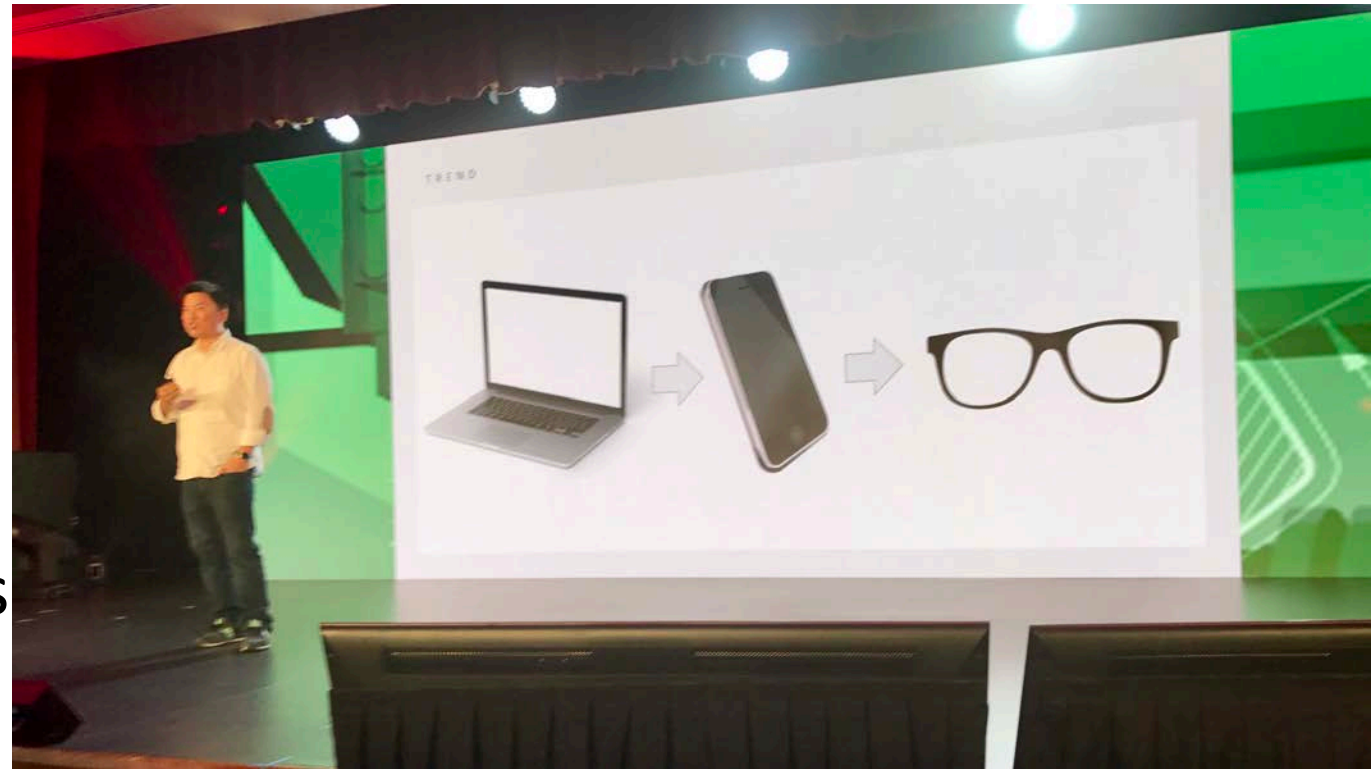
**CSCI 3907/6907**

**Spring 2022**

**3:30 PM - 6:00 PM, Thursdays**  
**Week 12**

**Dr. Hurriyet Ok**

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# PROJECT 2: Experimental AR App

## AR Project Part II: AR App

- Experimental AR Application

## AR App Proposal

- Concept

## AR Project Development Tool Guideline

- Apple's Native ARKit / Reality Kit: Development tool for AR app iOS, iPadOS
- Google's Native ARCore: Development tool for AR app on Android
- Unity ARFoundation: Cross platform support

# Experimental AR App Development

App for assembling and interacting with 3D objects:

- Do-it-yourself furniture or household device assembly, such as a chair, a mini table, or a cordless vacuum cleaner.
- Assembling and operating a virtual small vehicle (e.g., drone, mono-cycle, or a small space rover) in a restricted indoor location.
- Curatorial or animated content about artworks in a virtual exhibition.

# Experimental AR App Development

## AR App Features:

- Minimum three parts to assemble the 3D object.
- Step by step guidance for assembling the parts through informative texts and visual effects.
- Options to change the color/texture of the 3D object.
- Ability to remotely control and interact with the 3D object realistically, such as move, rearrange, or relocate.

# AR Project Deliverables

**Due by 6:00 PM TODAY, Thu., 3/31**

AR App Concept

**Due by 6:00 PM on Thu. 4/14**

AR Project Interim Report, after Lab Study (group collaboration)

# AR Project Deliverables

**Due by 3:30 PM on Thu. 4/21**

AR App Release including App, User Guide and Promo Video

AR Project Report

AR Project Presentation

**Due by 6:00 PM on Mon. 4/25**

Peer Review – Evaluation Classmate AR Apps

# Alternative Project 2 Assignment

Develop an AR App for **ThirdEye X2** Mixed-Reality Glass

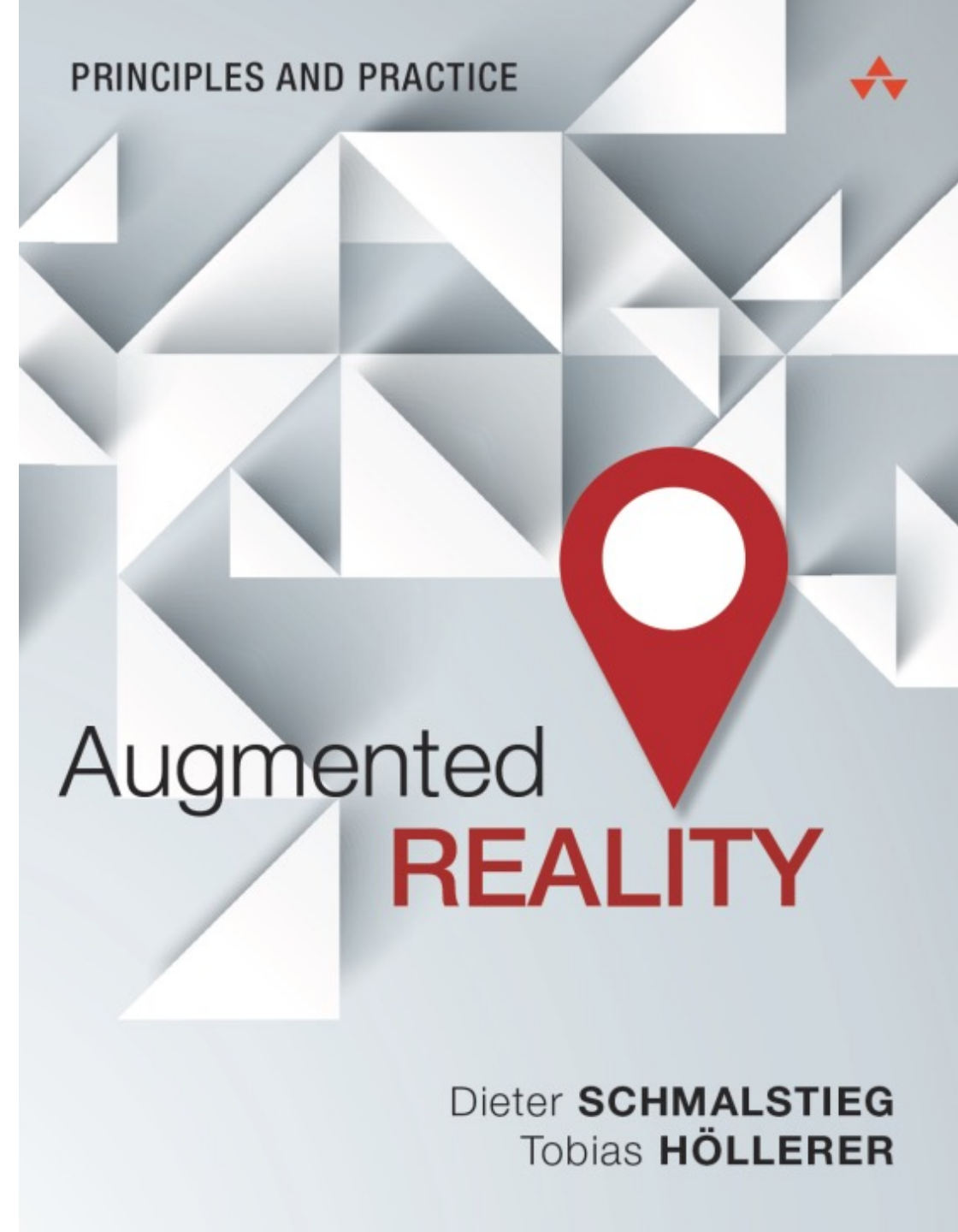


*Submit a proposals for an Android compatible Augmented Reality app development opportunity as Project 2.*

# Chapter 9: Modeling and Annotation

Augmented Reality – Principles and Practice

<http://www.augmentedrealitybook.org>

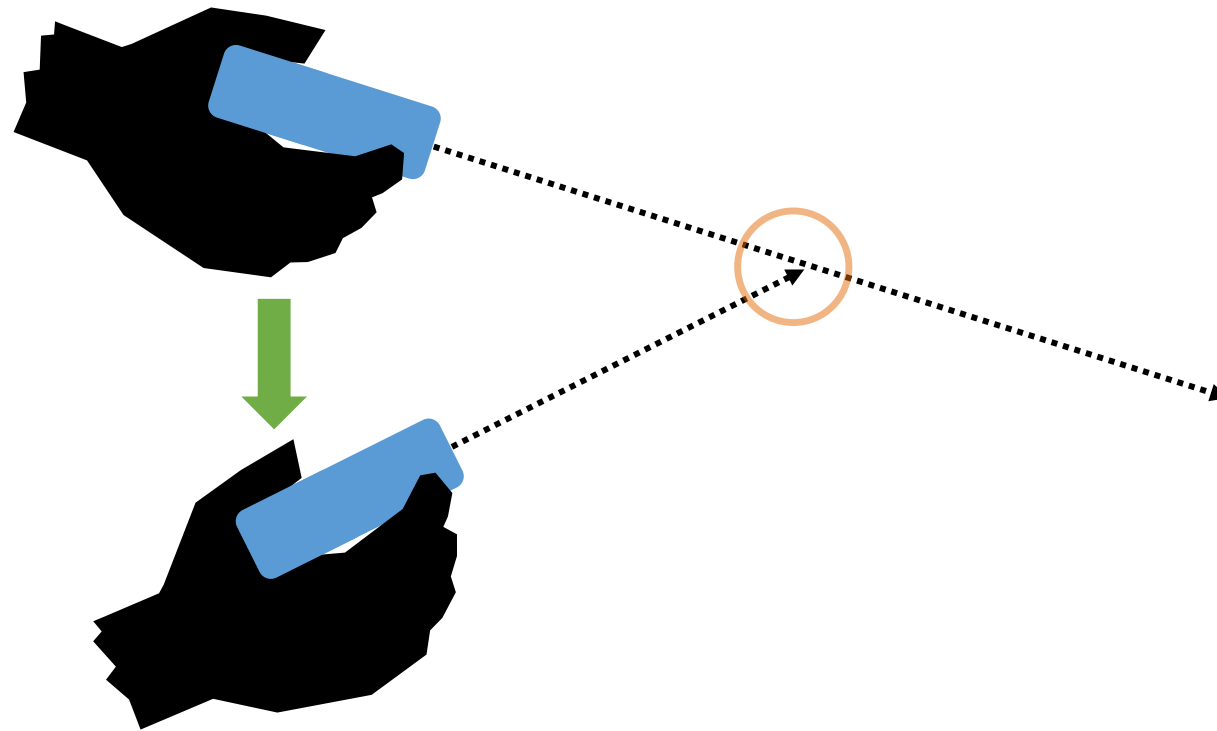




# Modeling and Annotation

- Interaction with AR is exciting, but ultimately limited if only preexisting content is available.
- Modeling and annotation let AR users create new content that is spatially registered to the real world.
- Unlike preparing geometric and visual content in advance, in a setting that is detached from the task location, *situated* modeling provides the opportunity to work directly on location and, therefore, to verify that the input is truthful to the real world.

# Specifying points



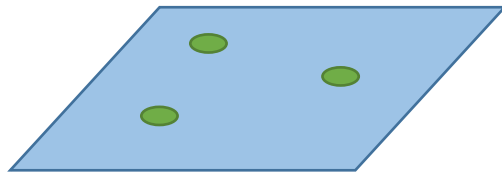
A 3D point in free space can be specified by intersecting two rays

# Aerial view

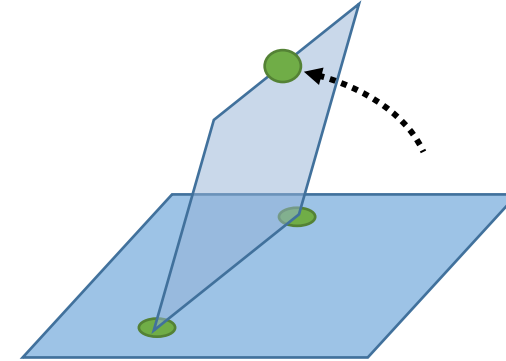
Example annotation created by specifying two dimensions in the first-person view and the third dimension (distance) in a corresponding aerial image (insets in the lower-left corner). In this case, a region annotation is rendered as a wireframe bounding box.



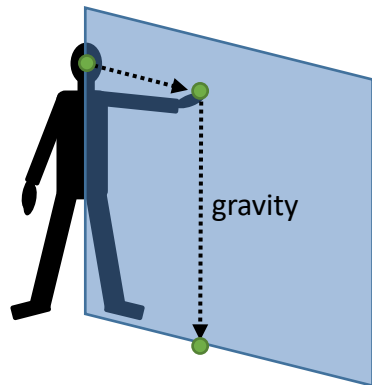
# Specifying planes



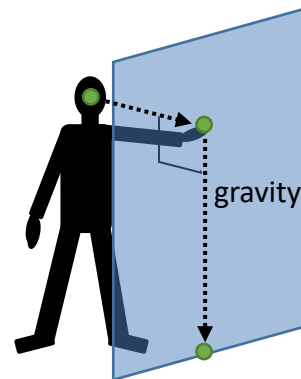
From 3 points



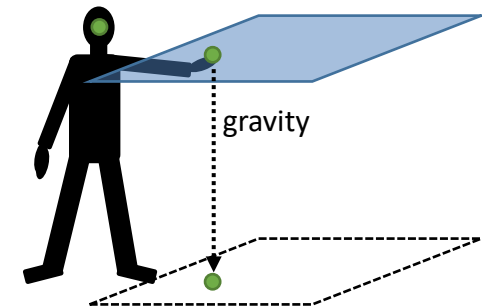
From 2 points + tilt



Vector head  $\rightarrow$  hand + gravity



Plane orthogonal to  
vector head  $\rightarrow$  hand + gravity



hand + orthogonal to gravity

# Annotations

- Many compelling AR applications deal with geometry or appearance
- Annotations help users to understand and remember their environment better.
- Sharing annotations with other users is a key requirement for social computing
- Today's commercial AR browsers already let users contribute simple geo-referenced content, such as textual annotations.
- By depositing new annotations on a server indexed by location, this sharing of information becomes a collaborative effort.



# Annotations - Sample Code for iOS/iPadOS

## Creating Screen Annotations for Objects in an AR Experience

- Annotate an AR experience with virtual sticky notes that you display onscreen over real and virtual objects.

[https://developer.apple.com/documentation/arkit/content\\_anchors/creating\\_screen\\_annotations\\_for\\_objects\\_in\\_an\\_ar\\_experience](https://developer.apple.com/documentation/arkit/content_anchors/creating_screen_annotations_for_objects_in_an_ar_experience)

**Note:** This sample uses RealityKit to anchor virtual content in the real world. RealityKit requires iOS 13. ARKit is not available in iOS Simulator.

For information about AR annotation in Android apps:

<https://developers.google.com/ar/develop>

# SLAM Annotations

Semi-automatic annotation lets the user attach instructions, such as the directional arrows indicating maintenance operations, directly to features in a SLAM map

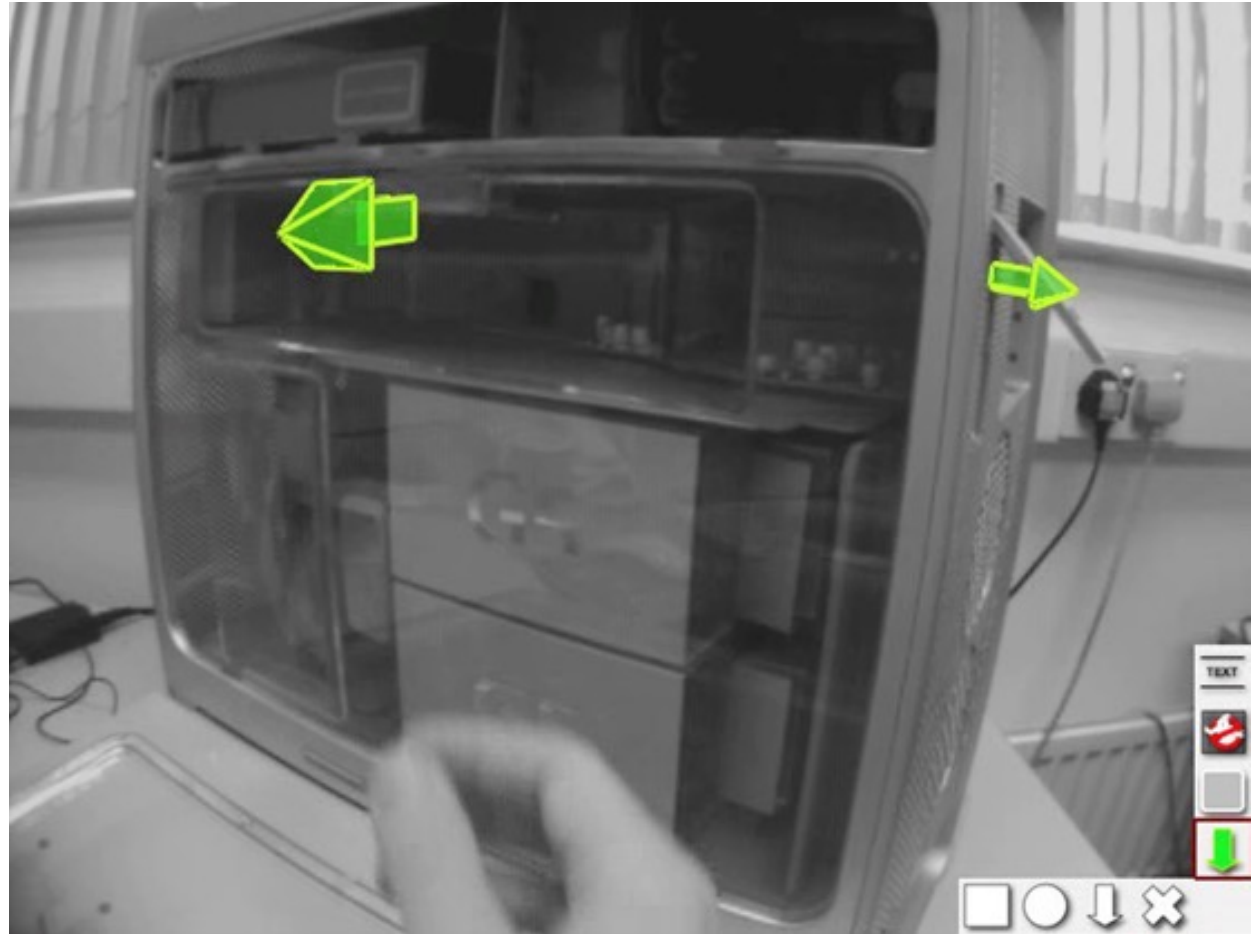


Image: Gerhard Reitmayr, Ethan Eade, and Tom Drummond



# Anywhere Augmentation

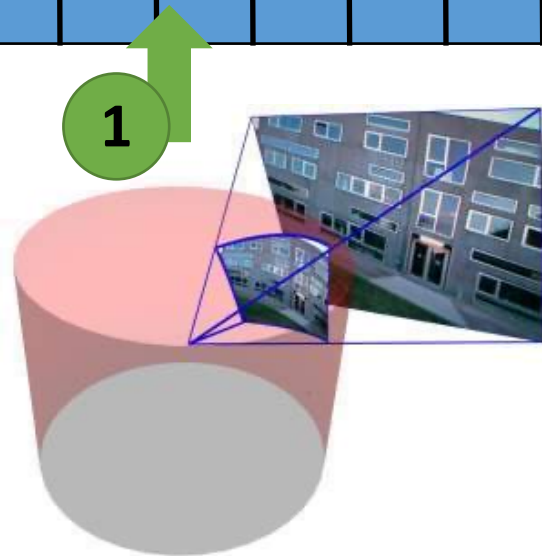
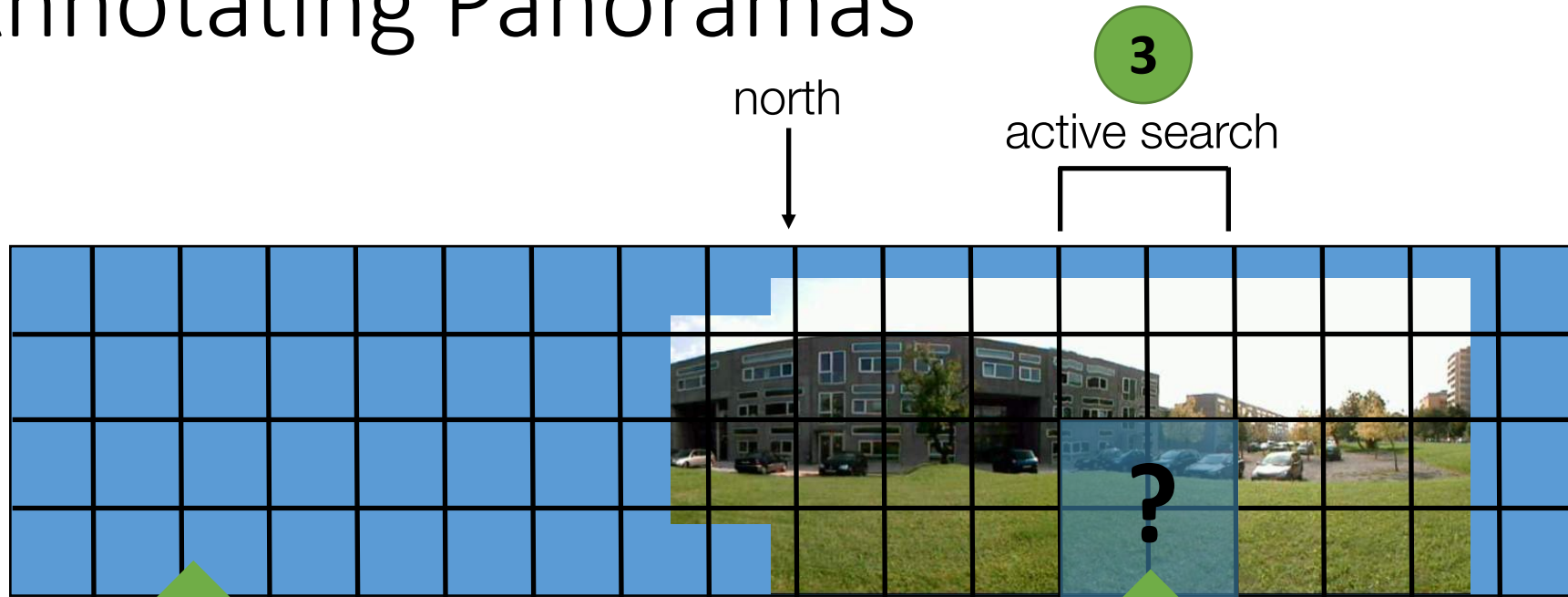
Live annotation attached during tracking a building corner



Image: Sehwan Kim



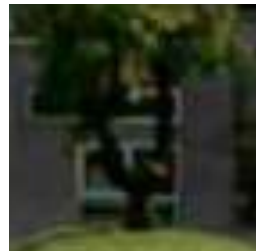
# Annotating Panoramas



Real-time panorama mapping

Augmented Reality

Interest point  
with GPS tag  
from server

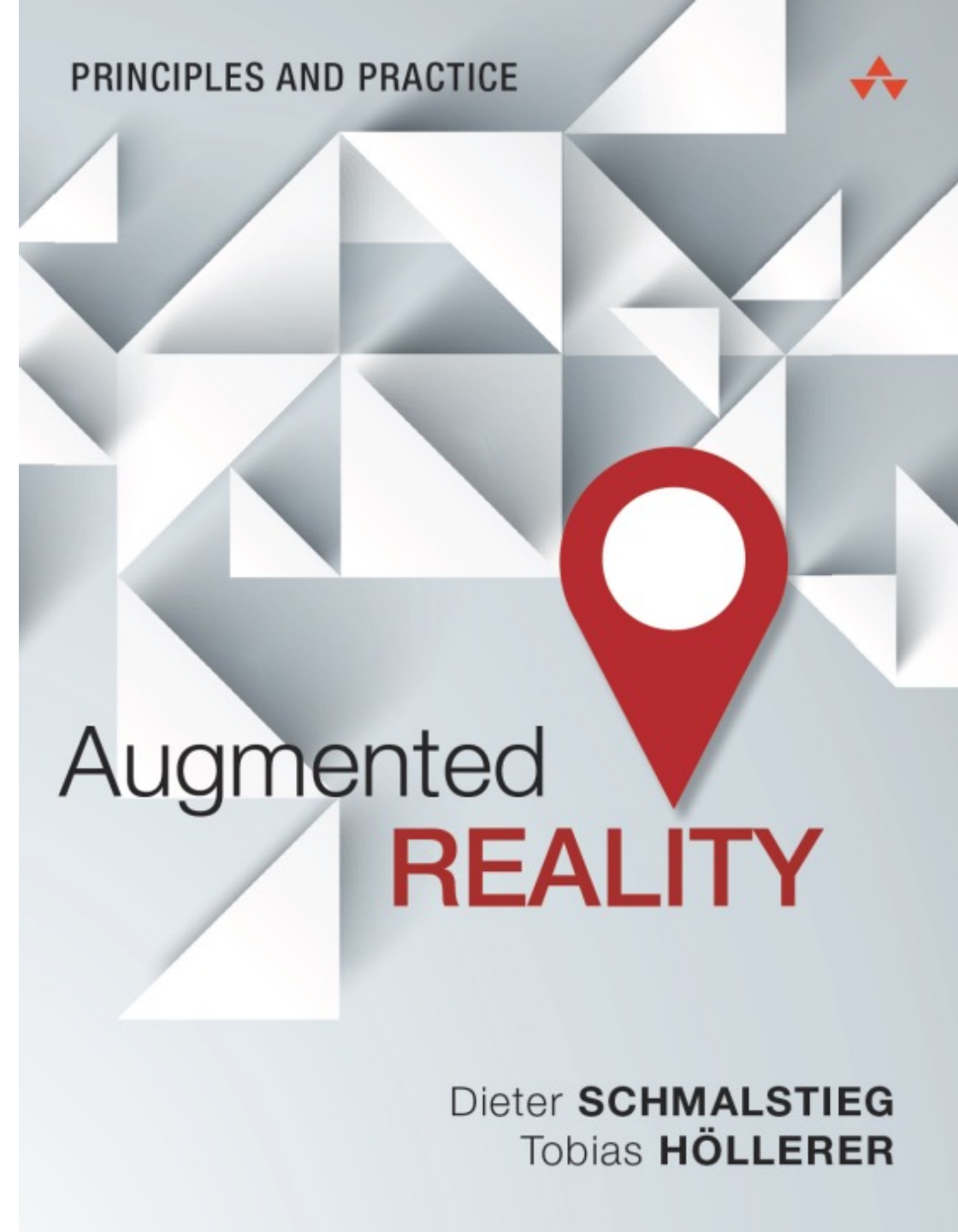


1. User maps a partial panorama using a mobile client device.
2. Mobile client retrieves interest points based on the current GPS position.
3. Interest points are detected in the panorama, using the compass as a prior for active search.

# Chapter 10: Authoring

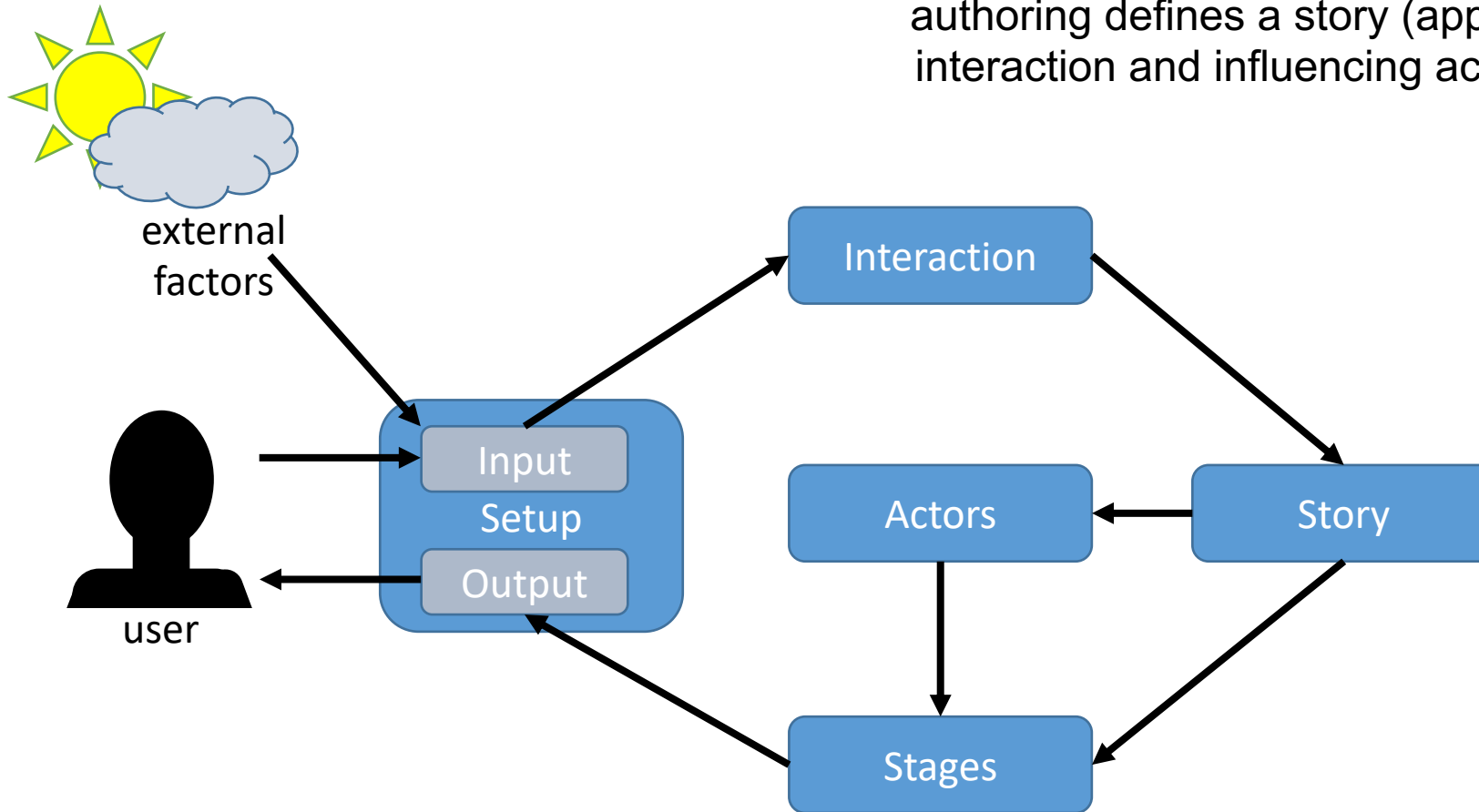
Augmented Reality – Principles and Practice

<http://www.augmentedrealitybook.org>



# Elements of authoring

Based on a definition of setup for input and output, the authoring defines a story (application logic), driven by interaction and influencing actors arranged on stages



# Virtual Showcase “Heidentor”

Heidentor (heathen gate) is a Roman ruin from the 4th century, located in eastern Austria.

The figure shows a scale model augmented with multimedia information.

The user has selected the middle part with a red ray, causing a historic photograph to be displayed.

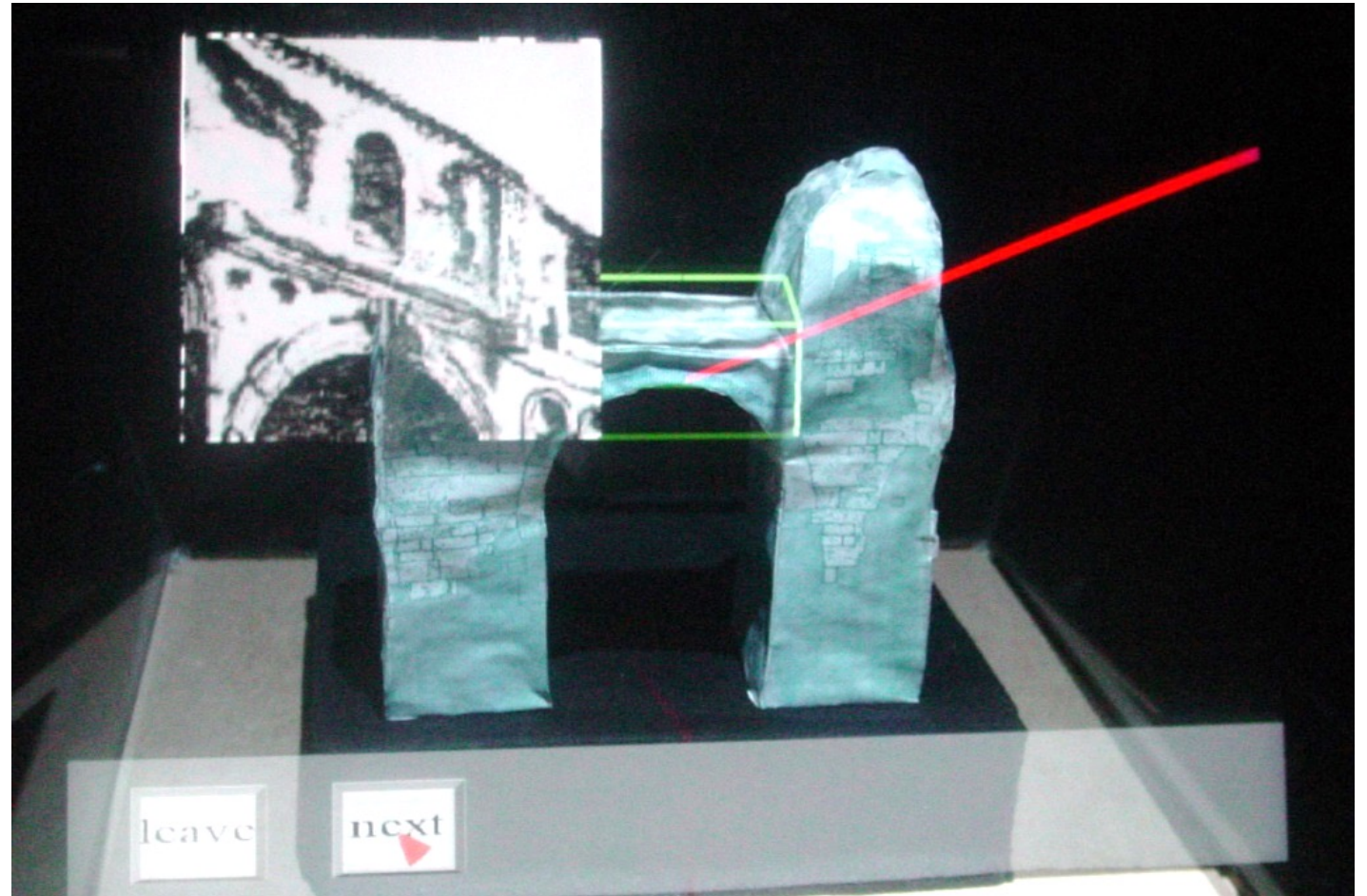


Image: Florian Ledermann



# Do-it-Yourself Furniture Assembly

A virtual model shown next to the chair to guide the user what to do next

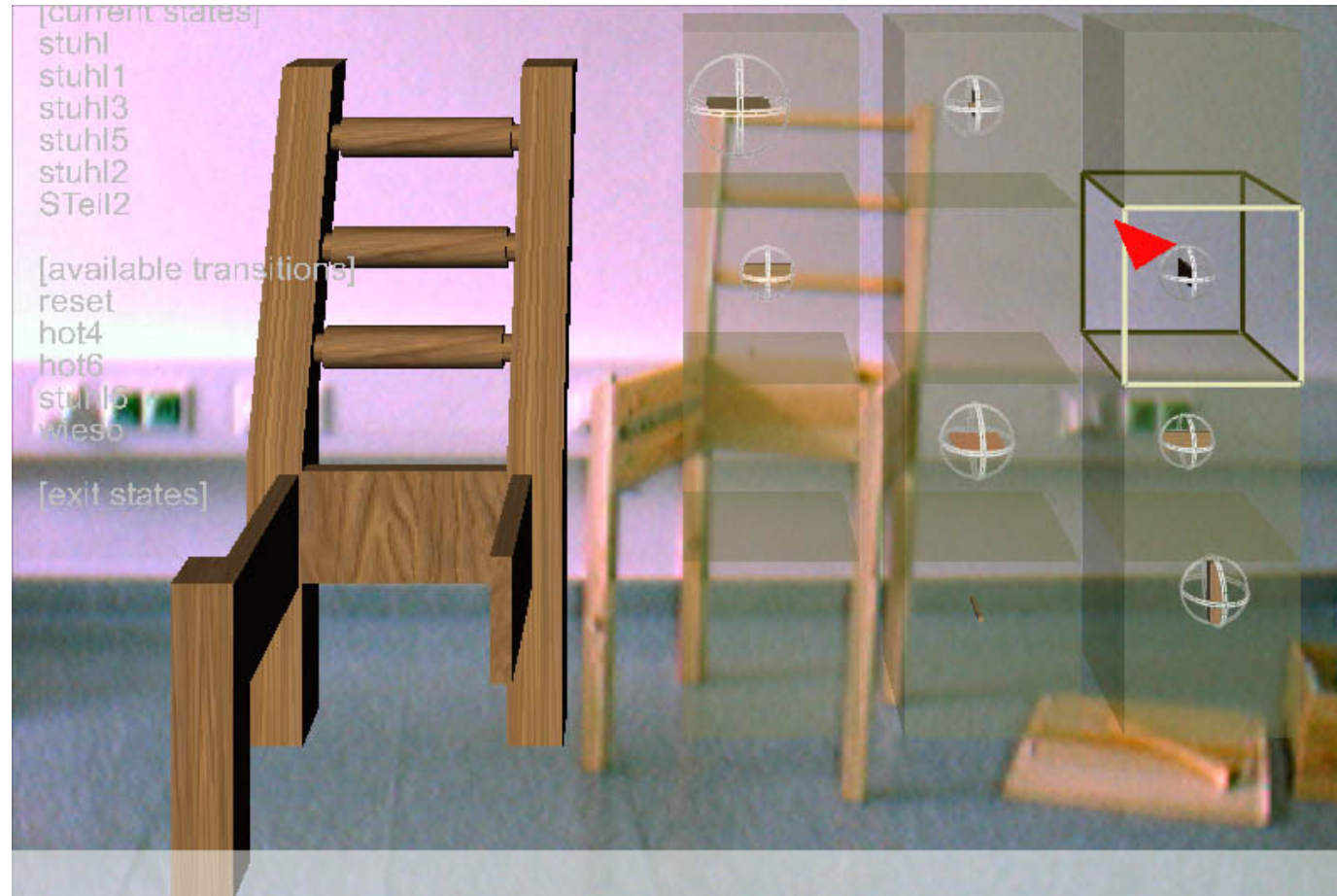
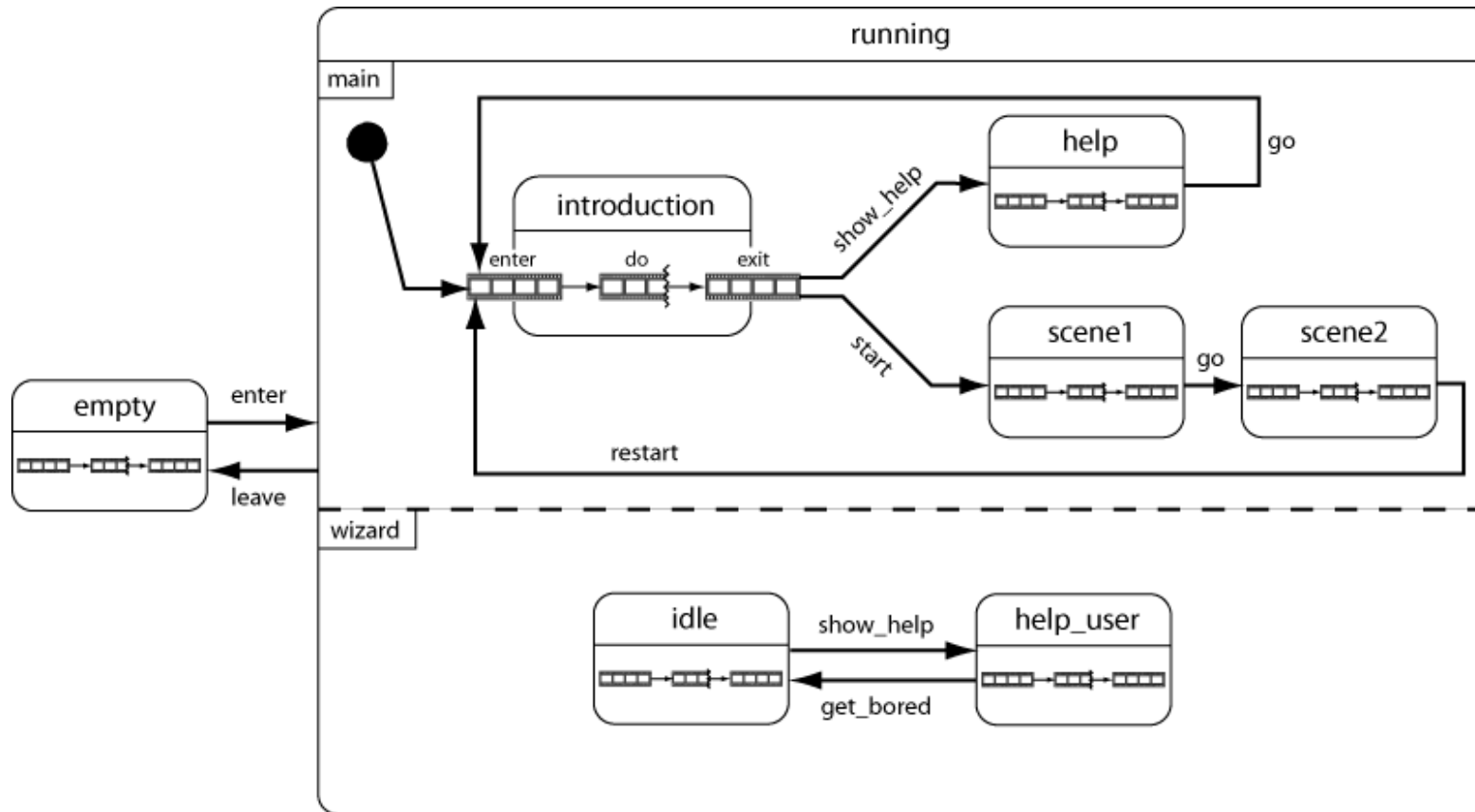


Image: Florian Ledermann

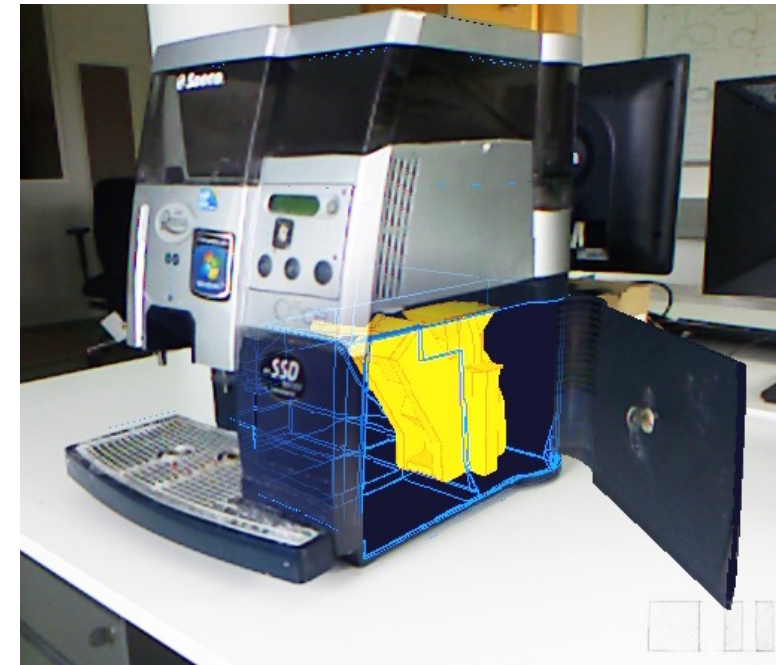
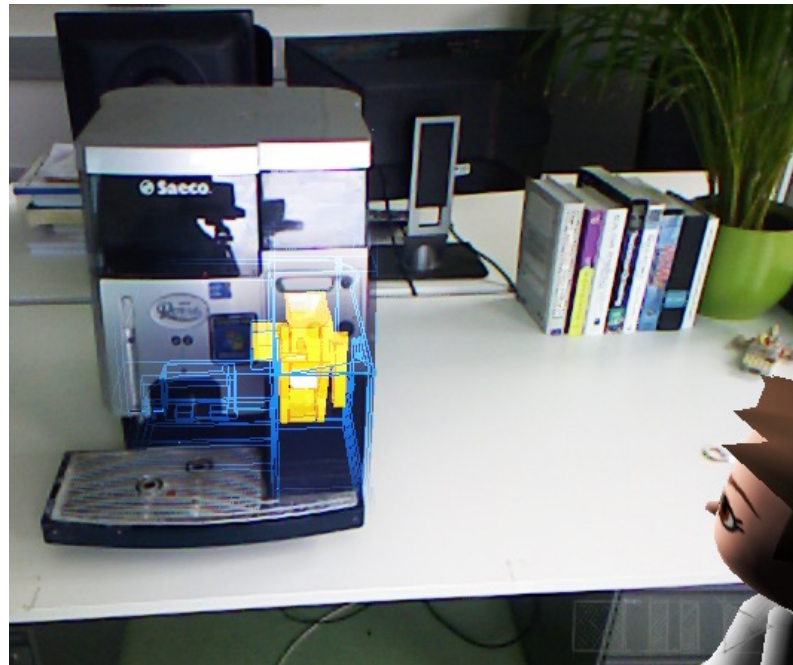
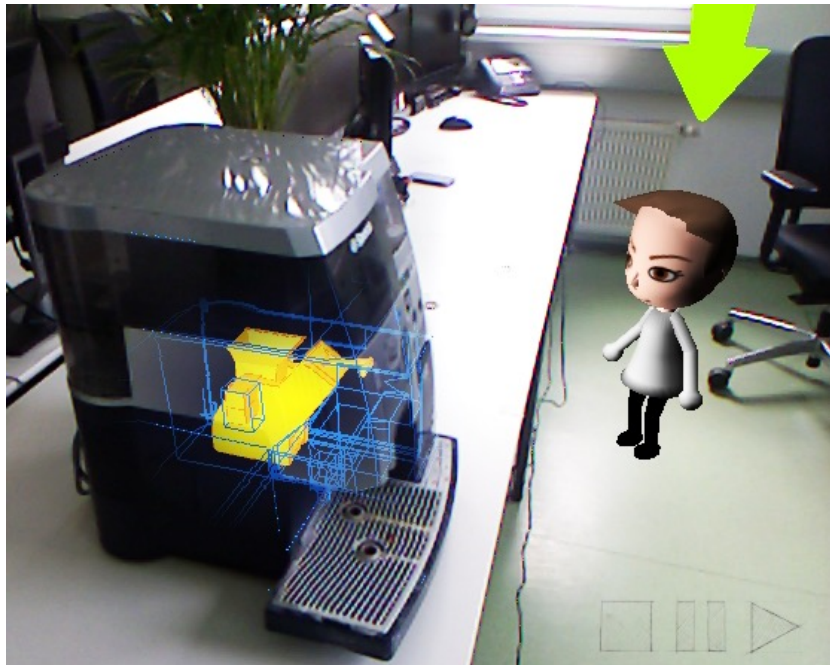
# Story Modeling with State Machines



UML state chart editor showing a part of an annotated state chart for an augmented reality tour using the APRIL framework. Image: Florian Ledermann

# Retargeting

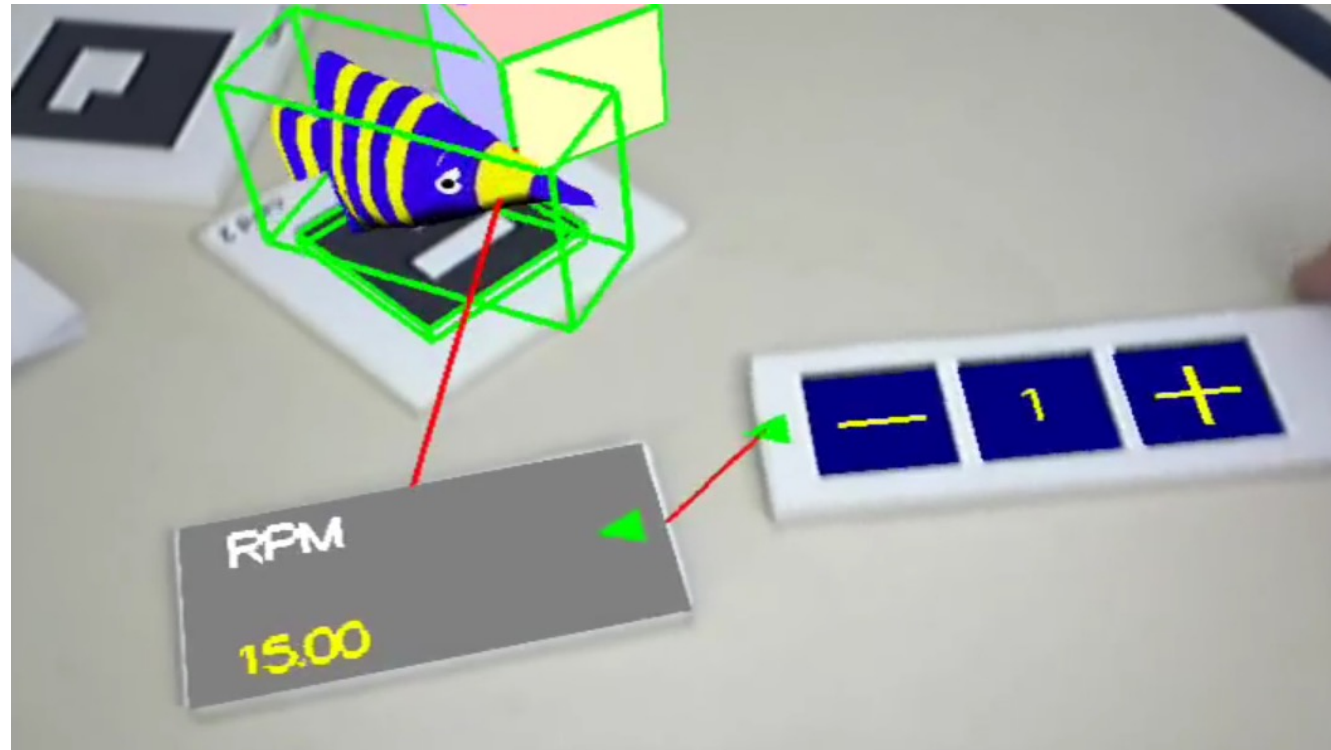
The avatar indicates which viewpoint the user should assume



After the user moves to the indicated position, the door opens to reveal the brewing unit

Image: Peter Mohr

# Tangible Authoring



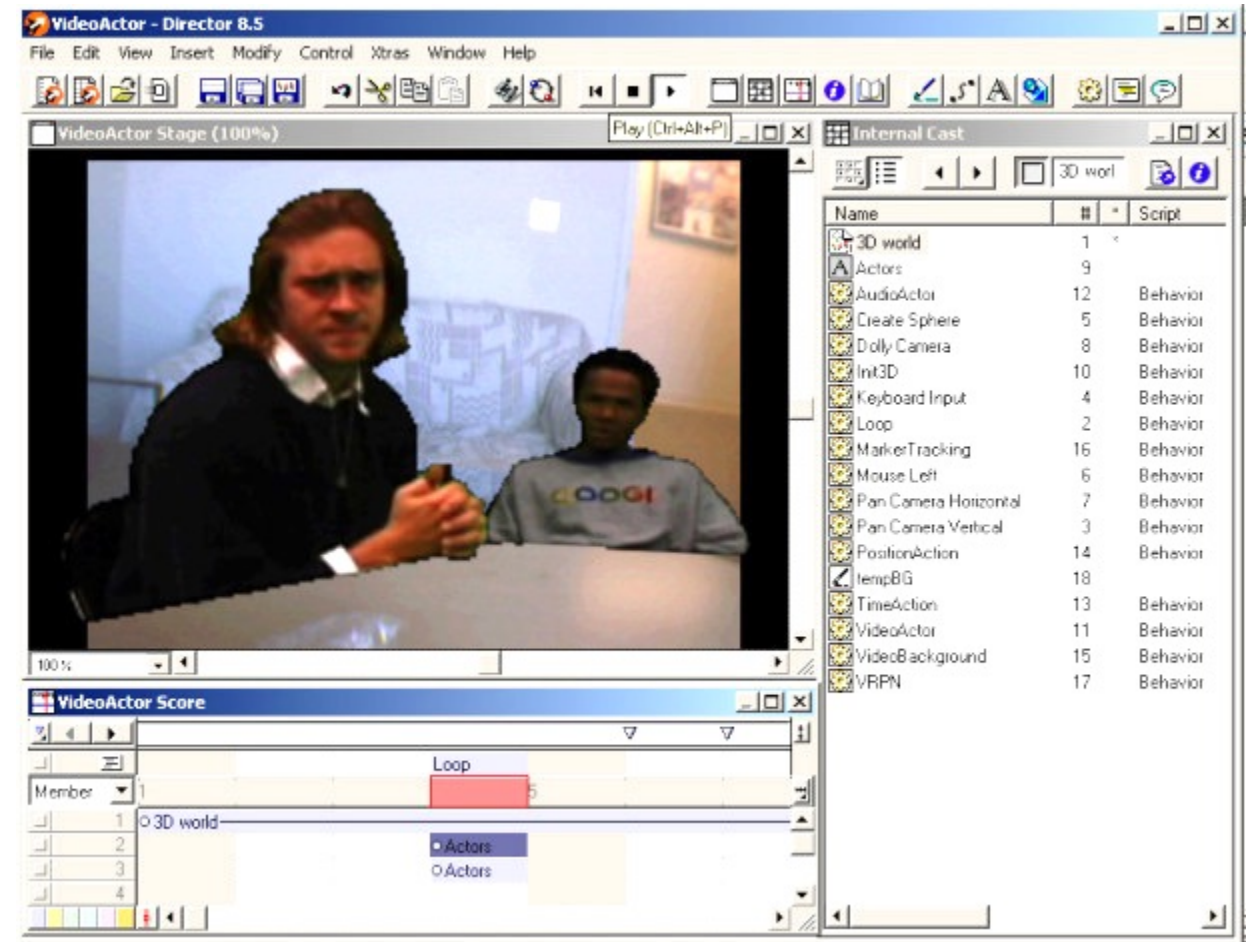
This sequence of screenshots from the framework for immersive authoring of tangible AR shows how to change the scale of a cube with an inspector widget and a keypad  
Image: Mark Billingham



# Designer's Augmented Reality Toolkit (DART)

DART adds augmented reality authoring  
inside the Macromedia Director  
authoring environment

Image: Blair Macintyre



# AR Web Browser

The Argon browser displays multiple channels of content defined through web technologies

Image: Blair Macintyre



# AR Project Exercise

- Research and develop your AR App Concept as proposal
- Discuss your AR App Concept within your group
- Post on BB your answers to the question below:
  1. What was one new thing you learned that you may incorporate in your app design?
  2. What will you change or take out from your app, based on what you learn from your group or received as feedback?
  3. What was one thing you contributed to your group, such sharing a new information or recommending design enhancements for other apps?

# **AR Project**

## Developing Concept App

Group Study

# What is New on Black Board?

## The best augmented reality apps for Android and iOS

<https://www.digitaltrends.com/mobile/best-augmented-reality-apps/>

<https://www.tomsguide.com/round-up/best-ar-app>

What is your experience with  
a good AR App?



# Festival of Animations – Spring 2022

## **Festival of Animations**

Date and Time: TBD

Computer Animation, Games, Graphics

AR and VR Apps

# **Next Week**

## **CASE STUDY: AR-ECDIS**

### **A Mobile Maritime Navigation Assistance System**

**Dr. Hurriyet Ok**