# Geographic Aware Augmented Reality

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# Location Based Services

## Lifecycle

PROCESSES TO BE MODELED HOW?

NEW TECHNOLOGIES?

PERSONALIZATION - ADAPTATION

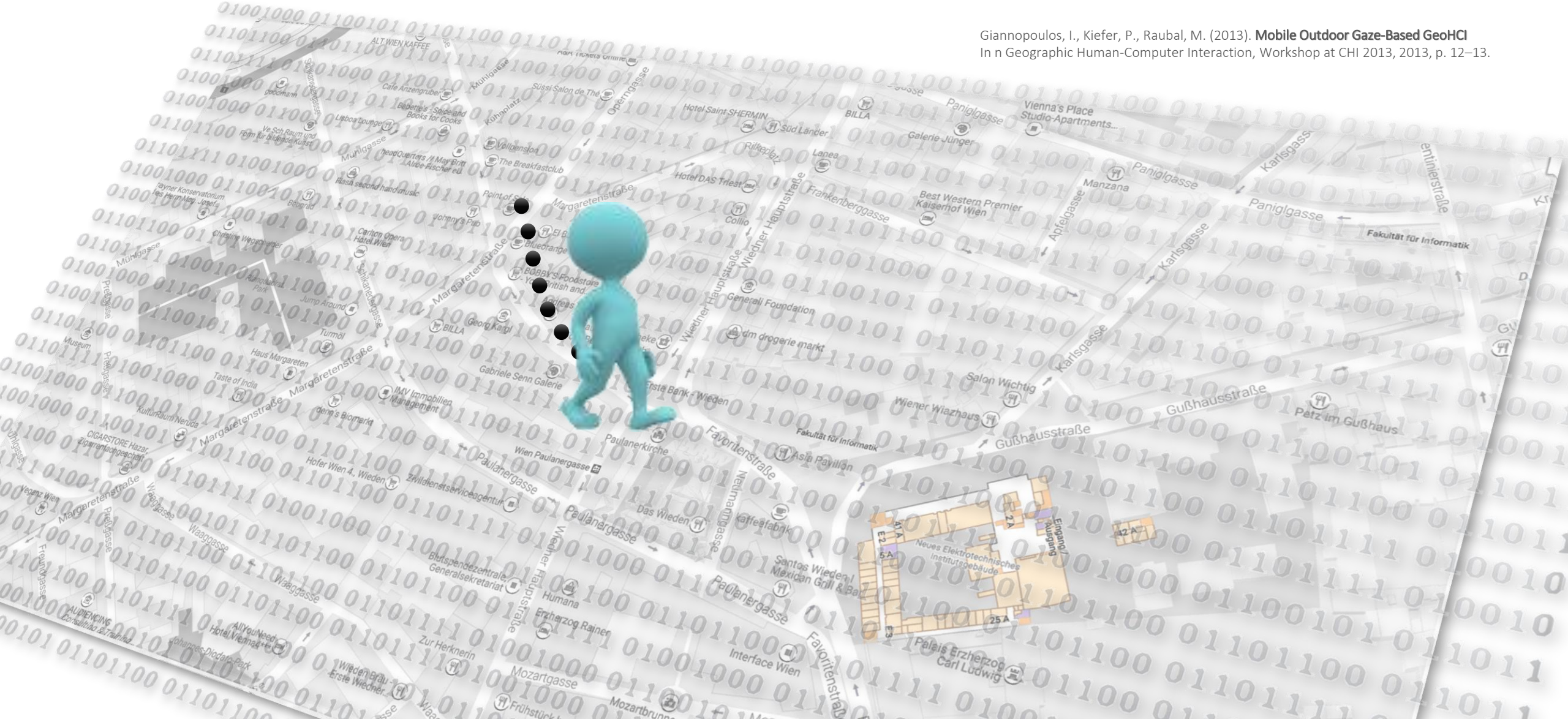
EVALUATION

GEOGRAPHIC-AWARE AR FOR LBS

# The Space the User Interacts **in**

## Mobility Patterns – Urban Structure

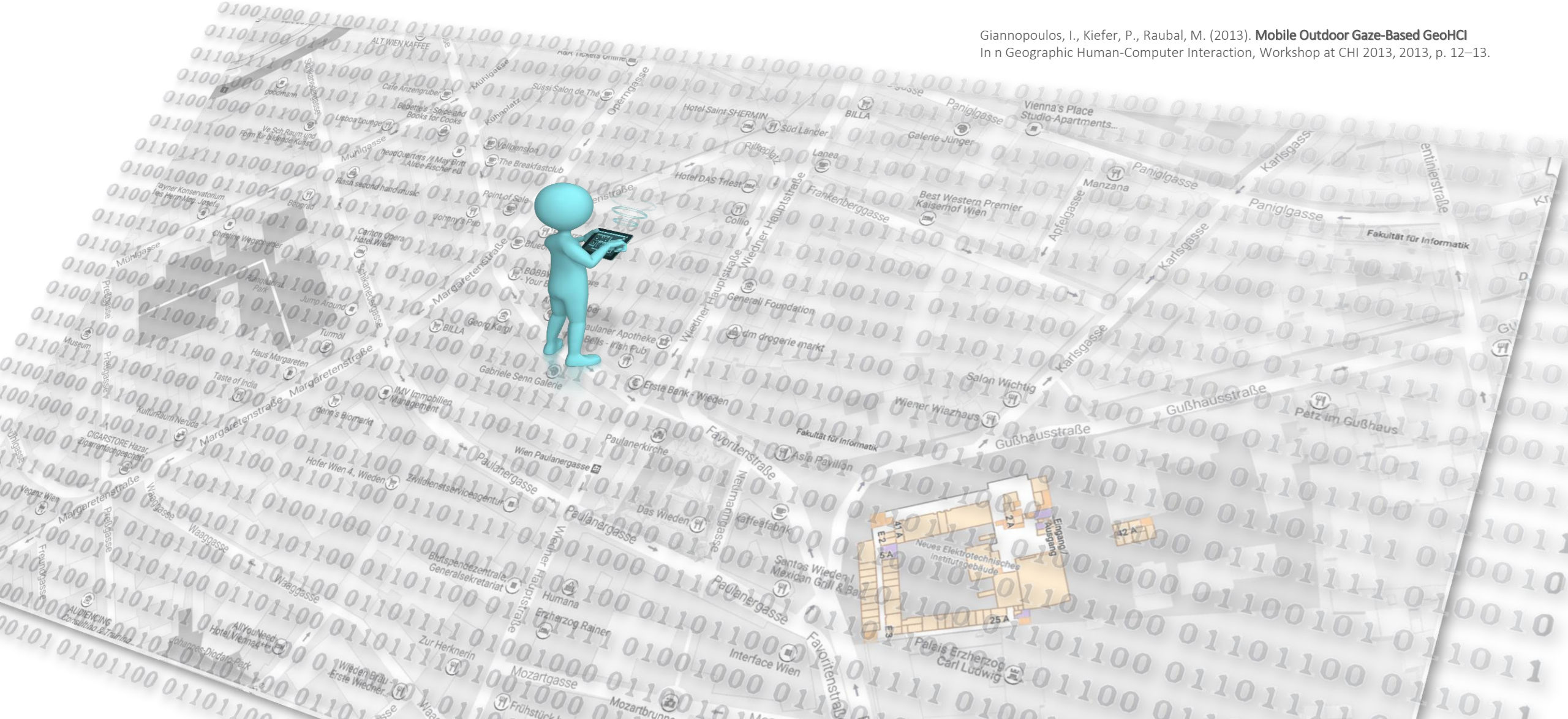
Giannopoulos, I., Kiefer, P., Raubal, M. (2013). **Mobile Outdoor Gaze-Based GeoHCI**
In n Geographic Human-Computer Interaction, Workshop at CHI 2013, 2013, p. 12–13.



# The **Spatial Information** the User Interacts **with**

## The Information Provided by the LBS

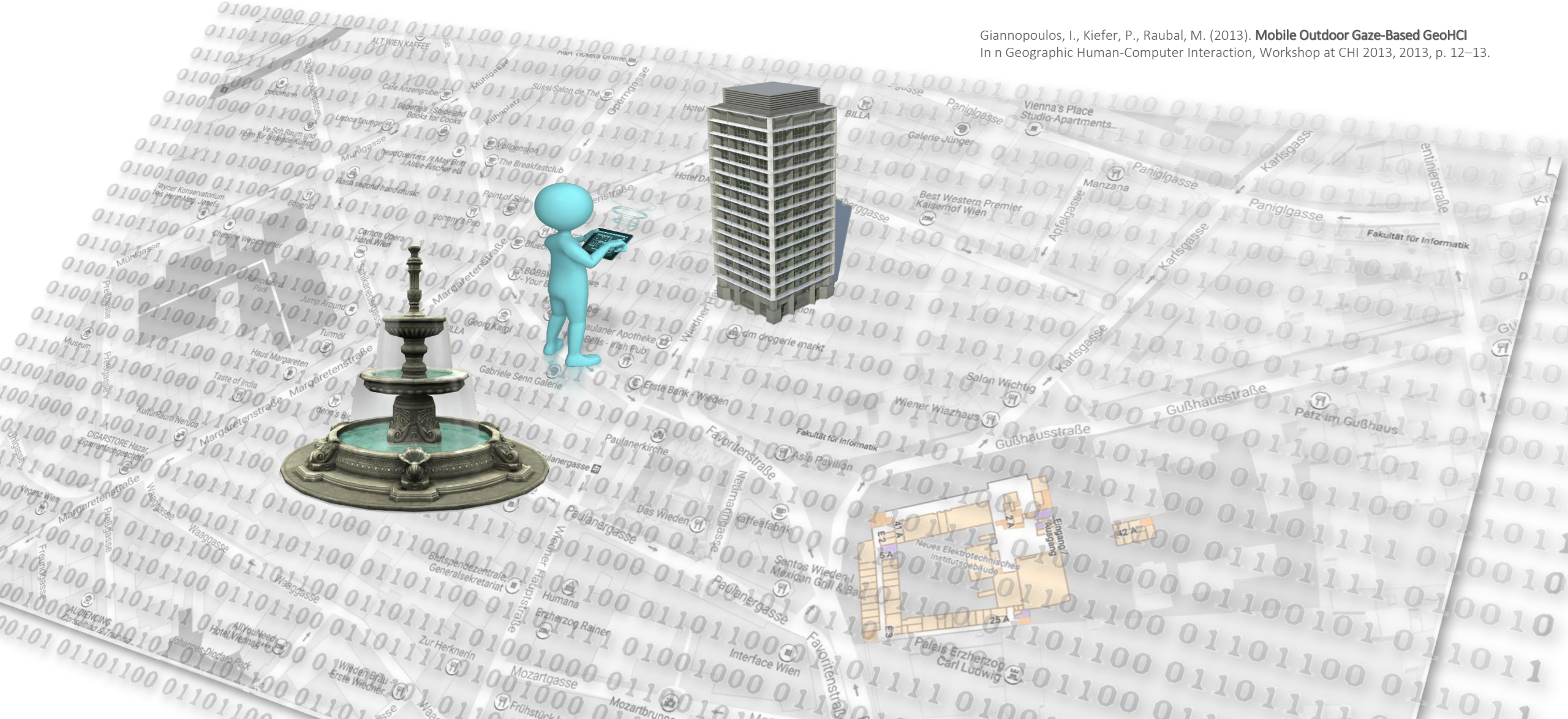
Giannopoulos, I., Kiefer, P., Raubal, M. (2013). **Mobile Outdoor Gaze-Based GeoHCI**
In n Geographic Human-Computer Interaction, Workshop at CHI 2013, 2013, p. 12–13.



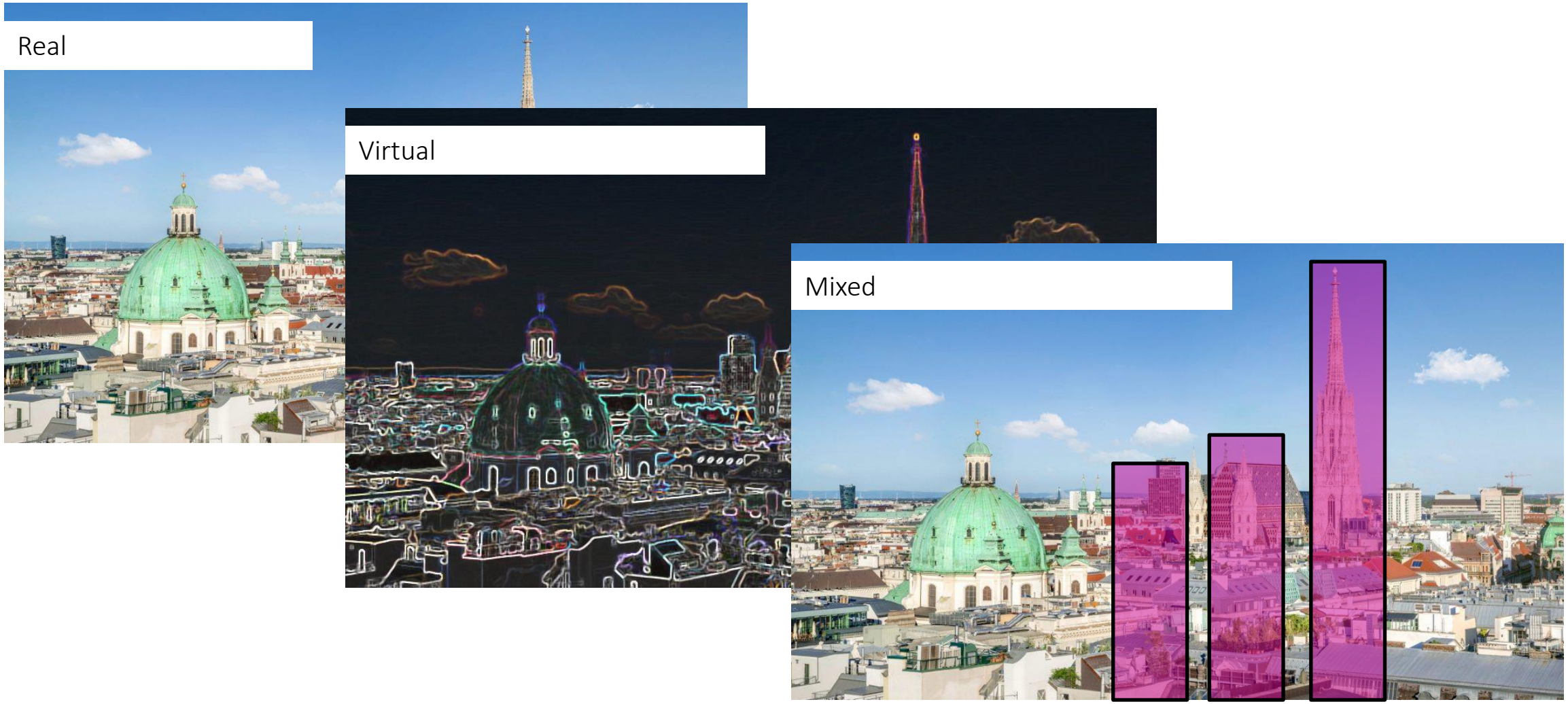
# The **Space** the User Interacts **with**

## The Elements in the Surrounding Environment the User Interacts

Giannopoulos, I., Kiefer, P., Raubal, M. (2013). **Mobile Outdoor Gaze-Based GeoHCI**
In n Geographic Human-Computer Interaction, Workshop at CHI 2013, 2013, p. 12–13.



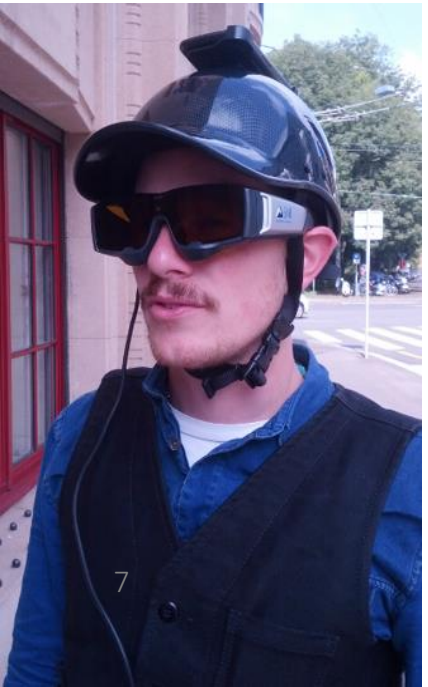
# Relevant Environments

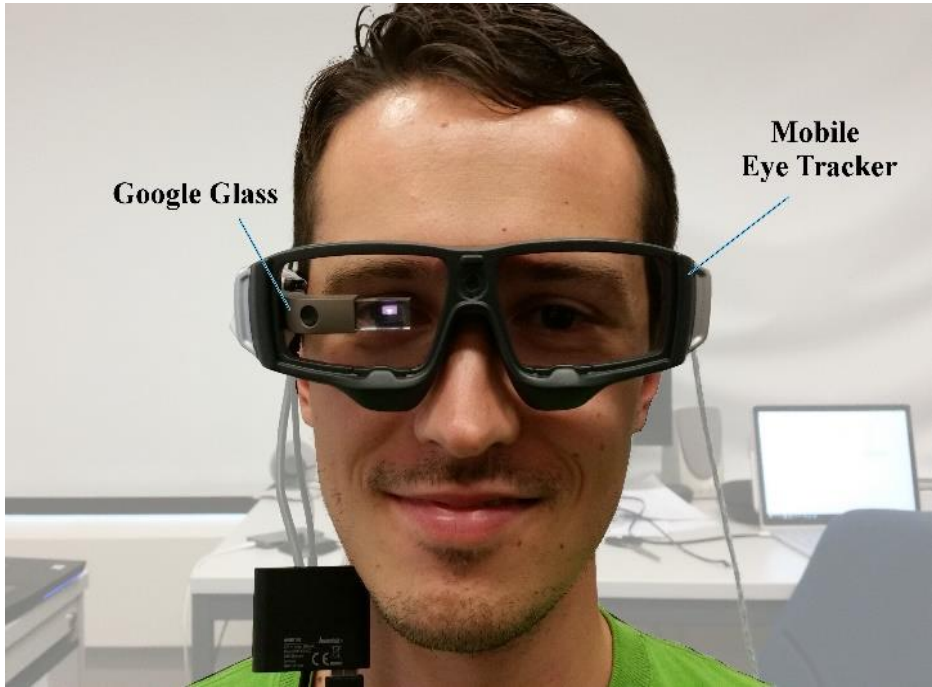



Lappajärvi
Vimpeli


12:28 PM


Oculus




Google Glass
Mobile
Eye Tracker

# AUGMENTED REALITY

## Geographic-Aware Systems


TU WIEN GEO information

# VIRTUAL REALITY (VR)

completely excludes the real world

immerses users in a new 360° world (immersion)

is realized by using VR glasses or Cardboards

gives the feeling of being somewhere else

# AUGMENTED REALITY (AR)


enhances human perceptions by displaying additional visual information or objects in real time

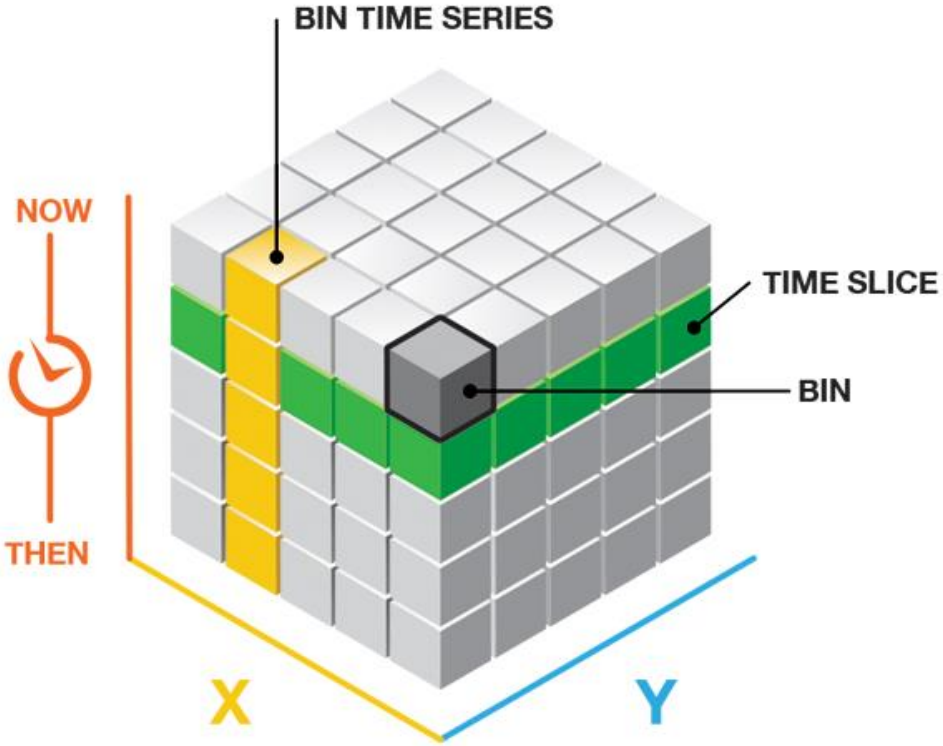
is realized with smartphones, tablets, head-up displays, or AR glasses

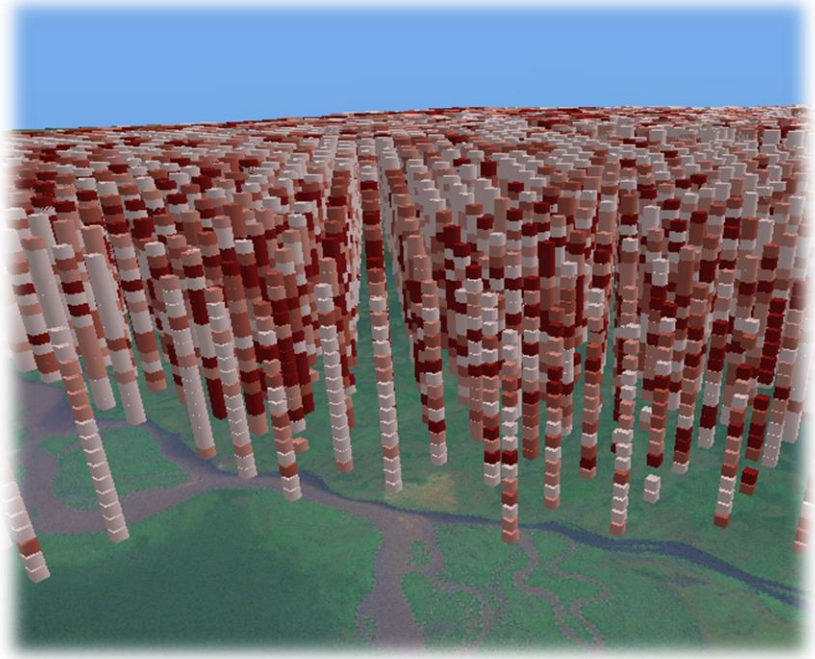
requires being at the location

examples are navigation devices or the game Pokémon Go

# 3D Data and GIS

How to interact with 3D Data in MR



Quelle: esri.com

Click for Video

GEO information

TU WIEN

GEO

# GEOGRAPHIC-AWARE AUGMENTED REALITY

# Geographic-Aware AR

## Geo-AR Glasses



Fogliaroni, P., Mazurkiewicz, B., Kattenbeck, M., and Giannopoulos, I. (2019). **Geographic-Aware Augmented Reality for VGI**.
In *Proceedings of the 15th International Conference on Location Based Services (LBS 2019)*.

Click for GeoAR Video

# Augmented Gaze-Based Interaction

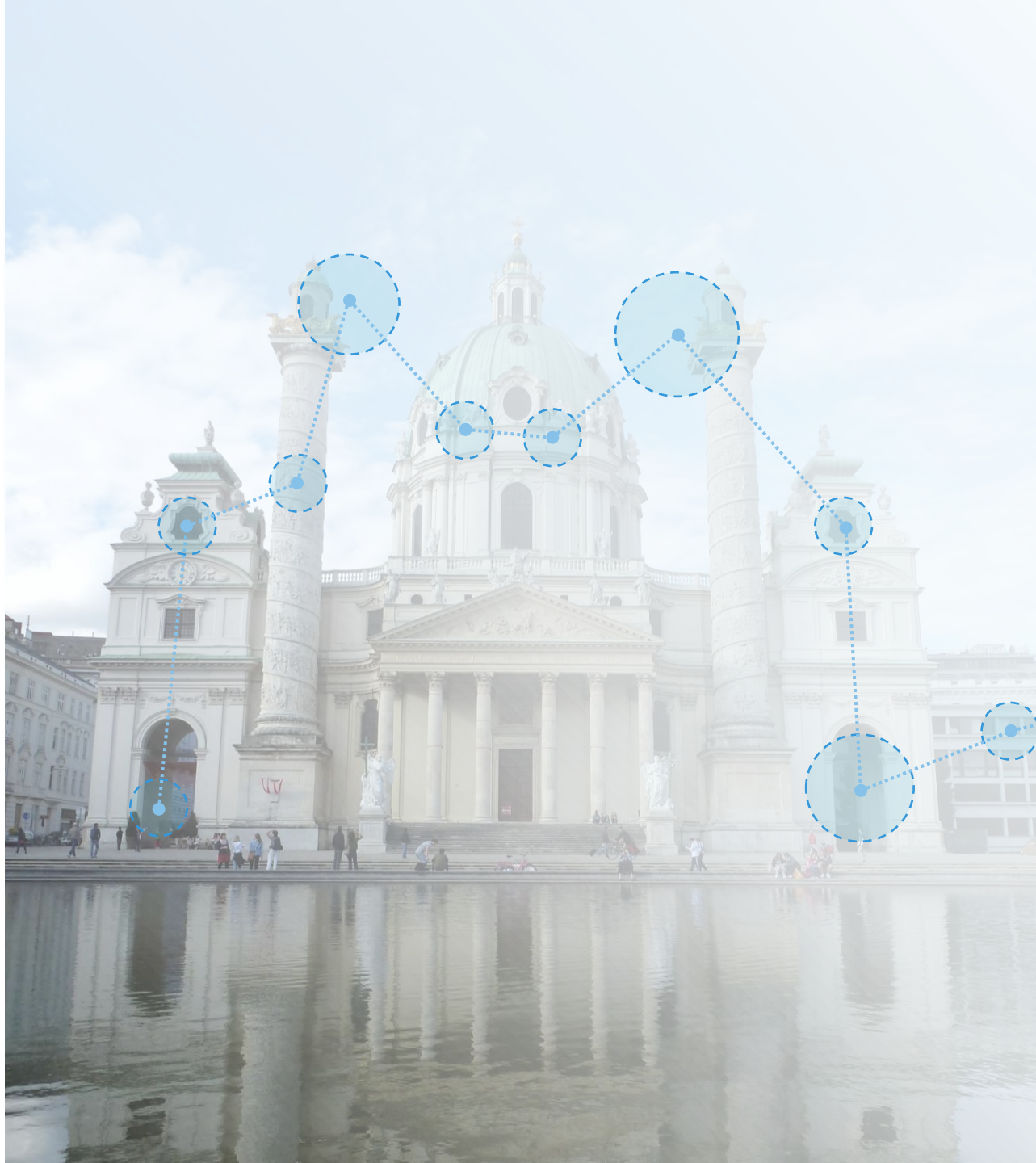
## Interaction with the Surrounding Environment

- *Enable explicit interaction with the surroundings*
  - *Gaze Informed LBS*

Anagnostopoulos, V., Havlena, M., Kiefer, P., Giannopoulos, I., Schindler, K., & Raubal, M. (2017). **Gaze-Informed location-based services.** International Journal of Geographical Information Science, 31(9), 1770-1797.

  - *Watch were I am looking at!*

Giannopoulos, I., Kiefer, P., & Raubal, M. (2015). **Watch What I Am Looking At! Eye Gaze and Head-Mounted Displays**. In Mobile Collocated Interactions, Workshop at CHI 2015



# Free Choice Navigation

# Landmark Based Navigation

# Spatial Perception of AR Visualizations

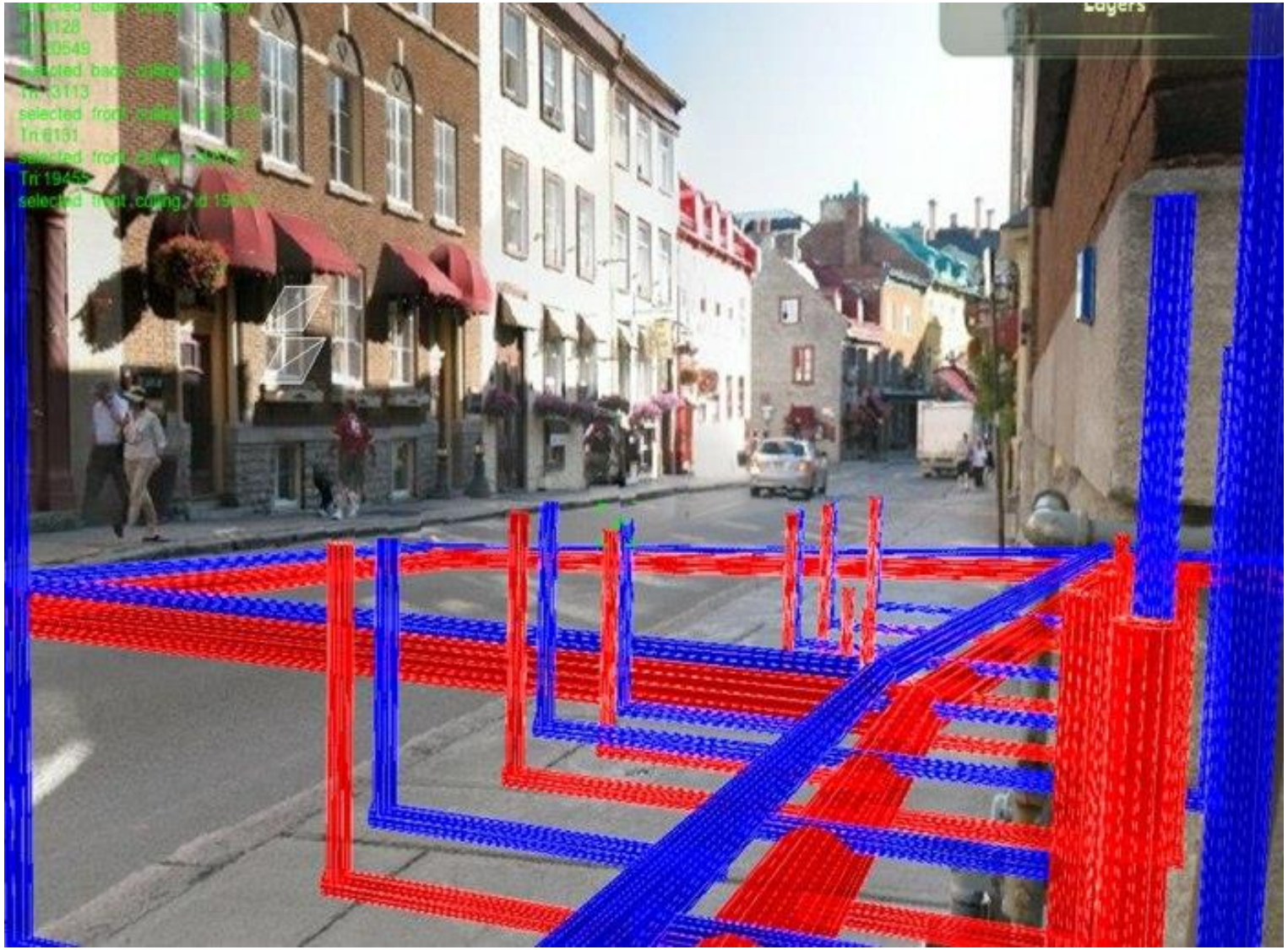
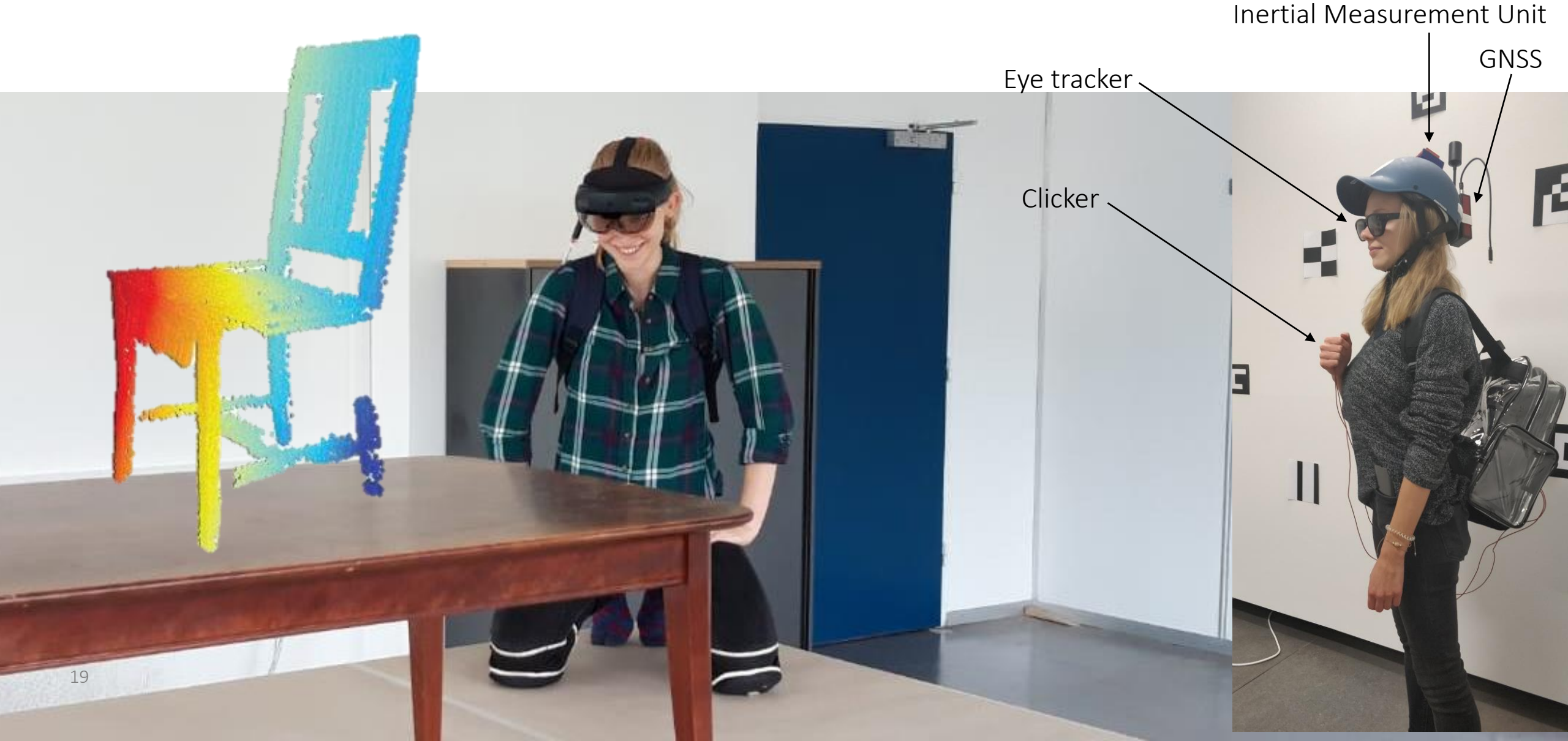


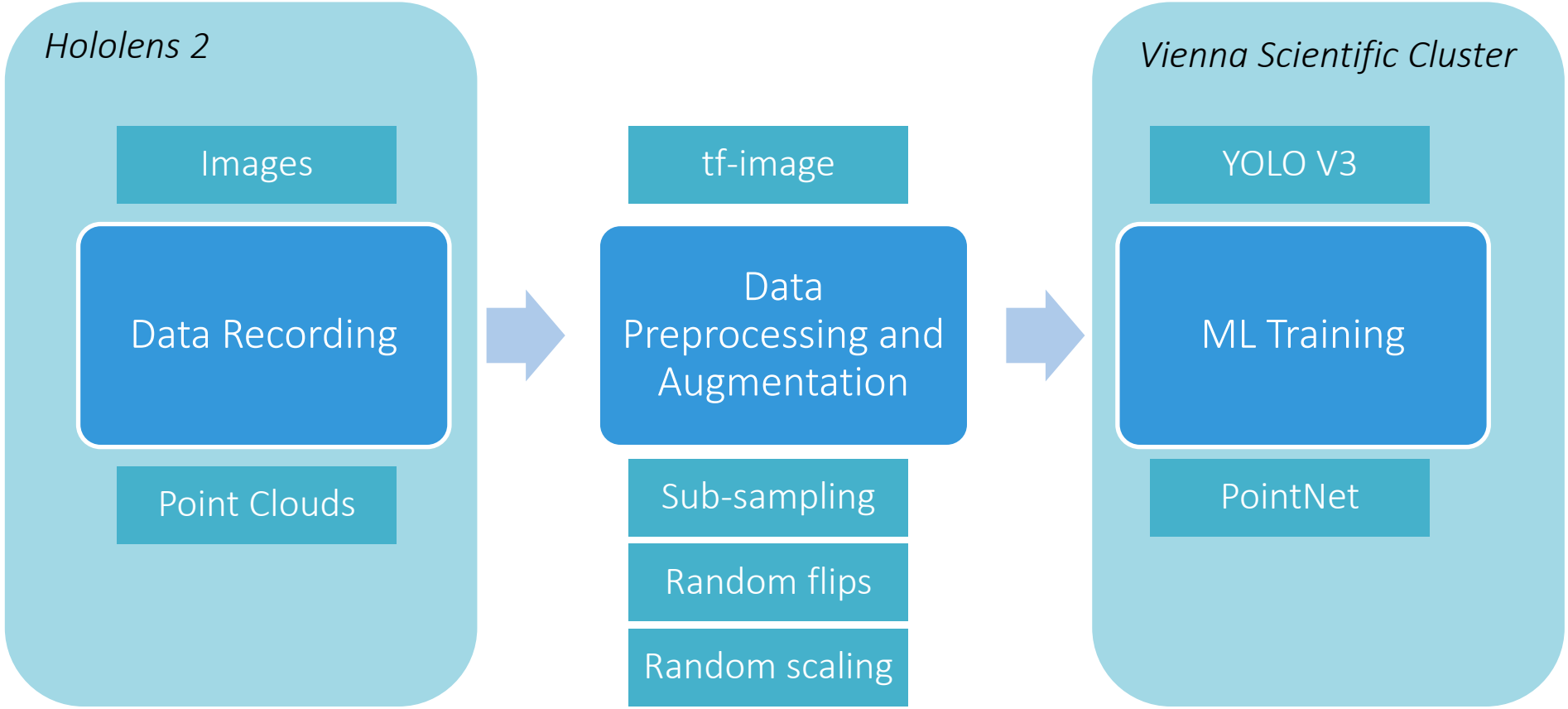
Image source: Bentley

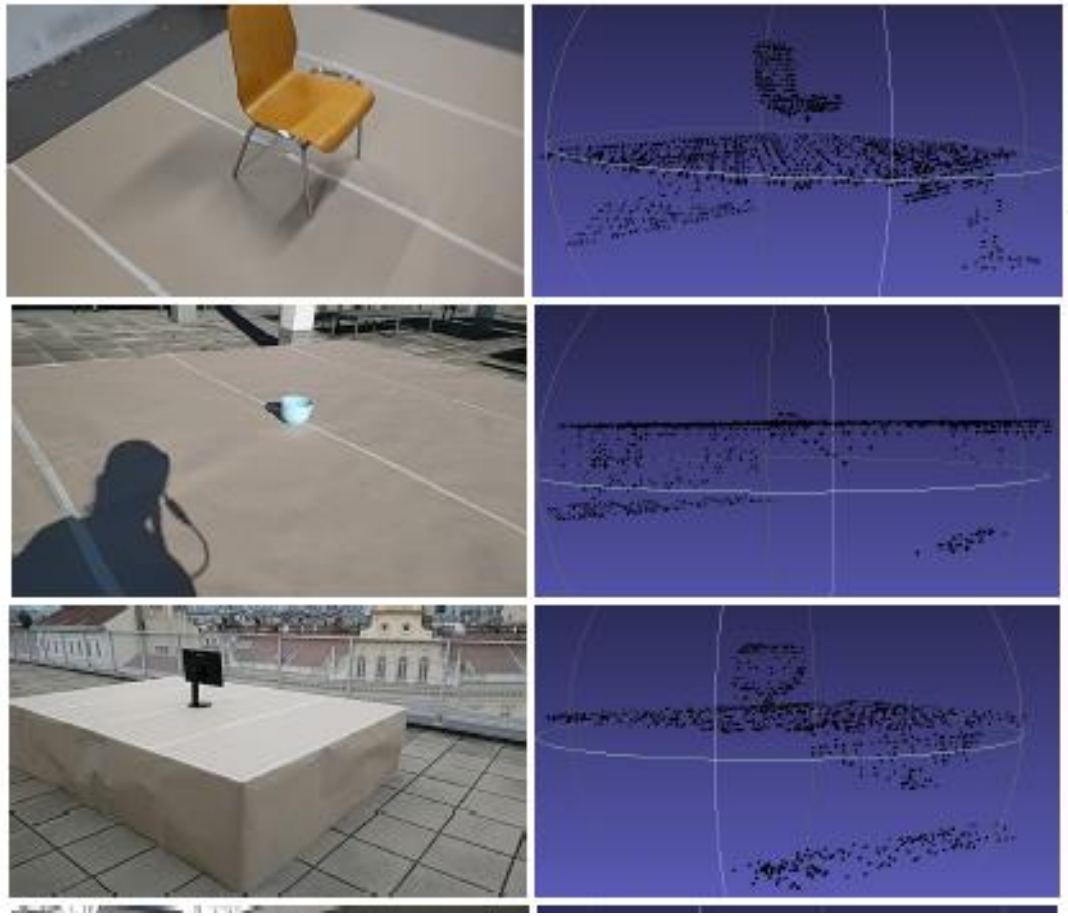
# 2D vs. 3D Object Detection and Tracking



# 2D vs. 3D Object Detection and Tracking

## Pipeline

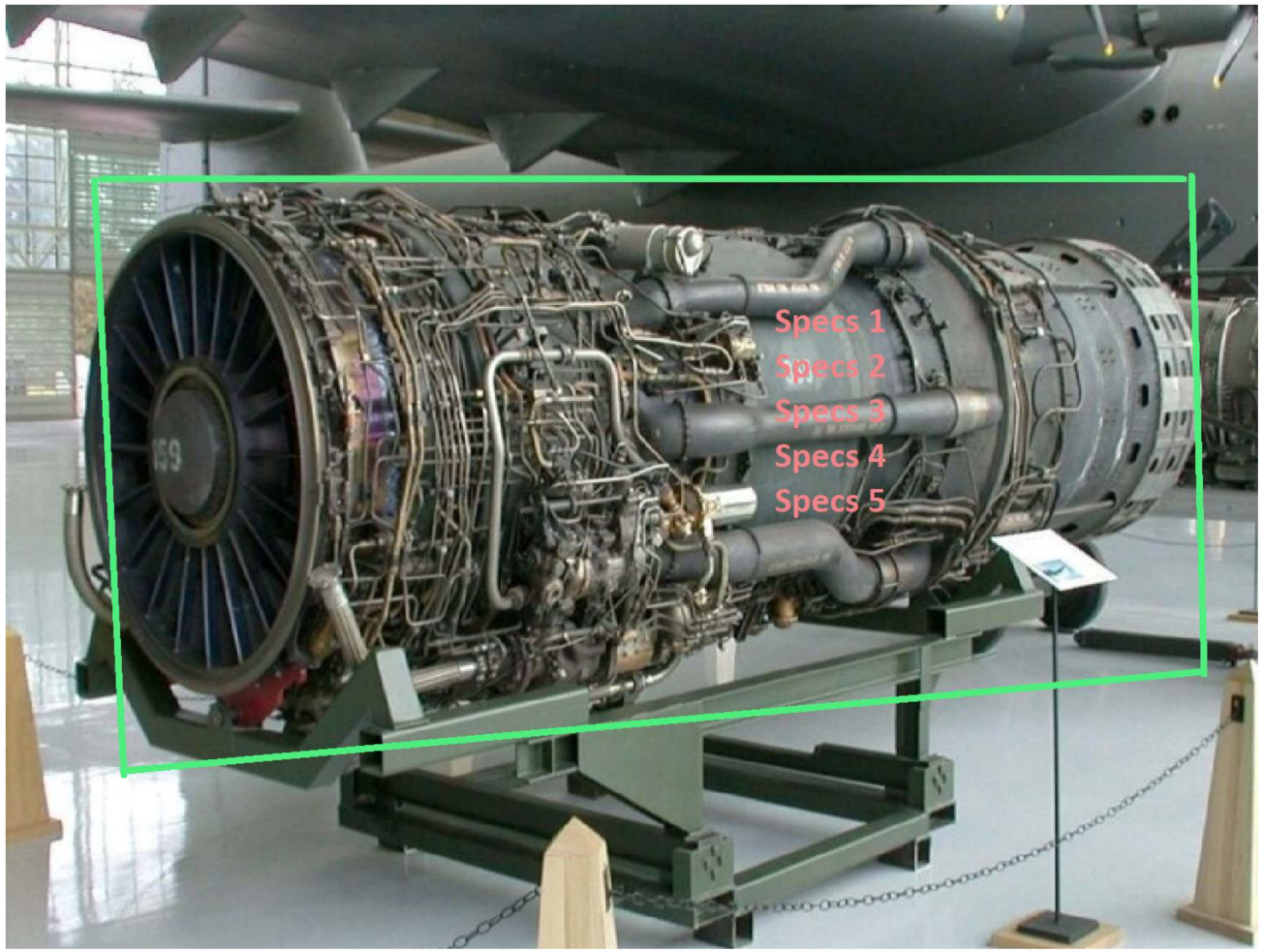




(a) pottedplant (b) cup (c) chair (d) table

Image source: Master Thesis Sophie Hermann


This fountain is awesome!


Specs 1
Specs 2
Specs 3
Specs 4
Specs 5

# Thank you!