

# Augmented Reality

## technische Möglichkeiten und praktische Anwendung



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# Daten mit Raumbezug



# Visualisierung



Augmented Reality





# Augmented Reality

- Verbindet Reales und Virtuelles
- In 3D registriert
- Interaktiv & in Echtzeit



# Augmented Reality



## Virtual Reality

– Isoliert von der realen Welt

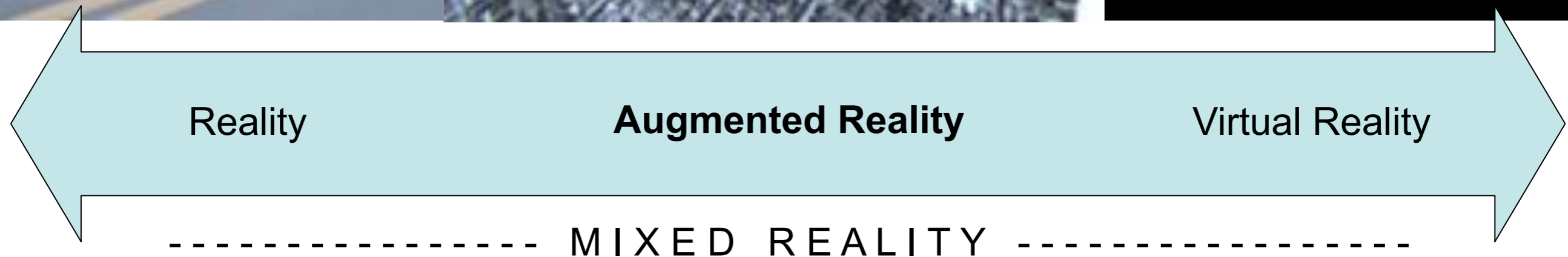


## Augmented Reality

– Erweitert die reale Welt



# Milgram's "Mixed Reality" Kontinuum



# Medizinische Anwendungen



TU München

UNC



We tested the visualization technique also within the scope of an in-vivo study.

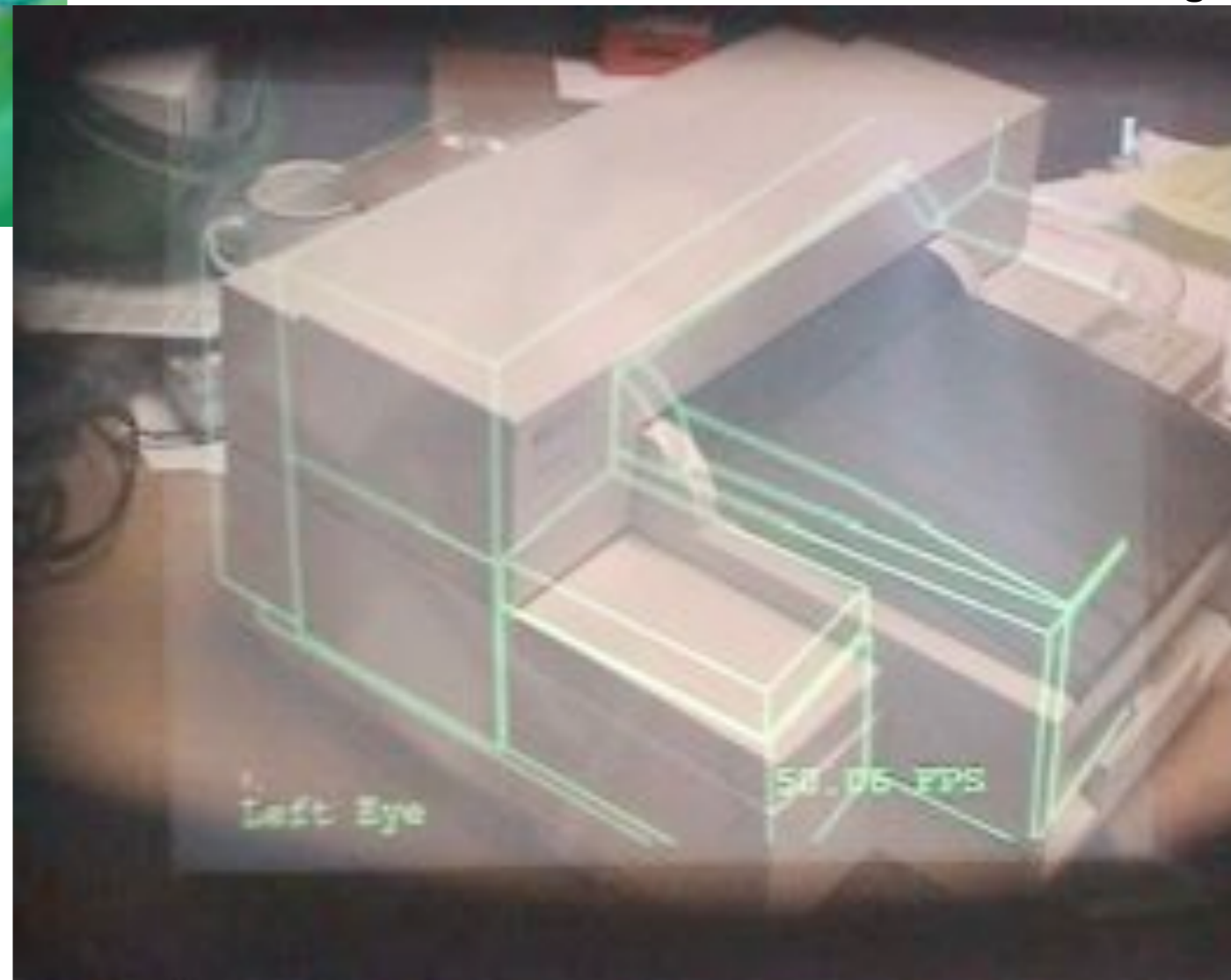


# Maintenance & Instructions



Univ. Cambridge

BMW

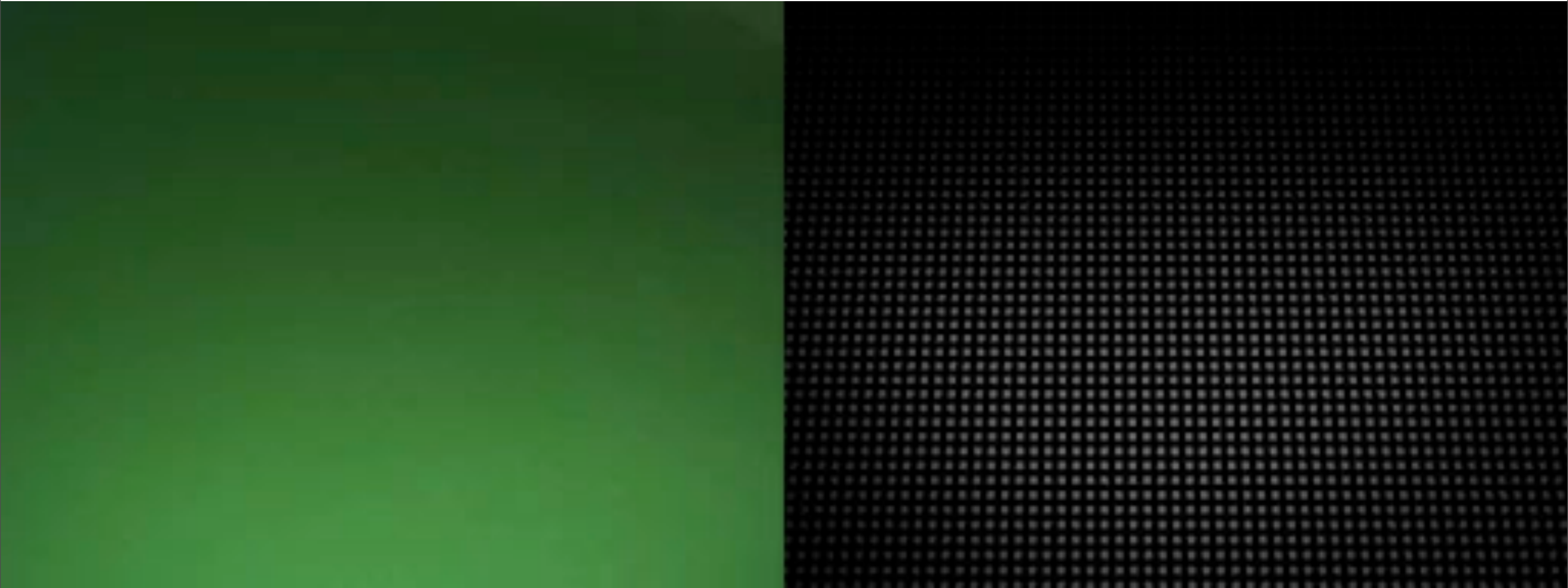




# TV - First Down Line



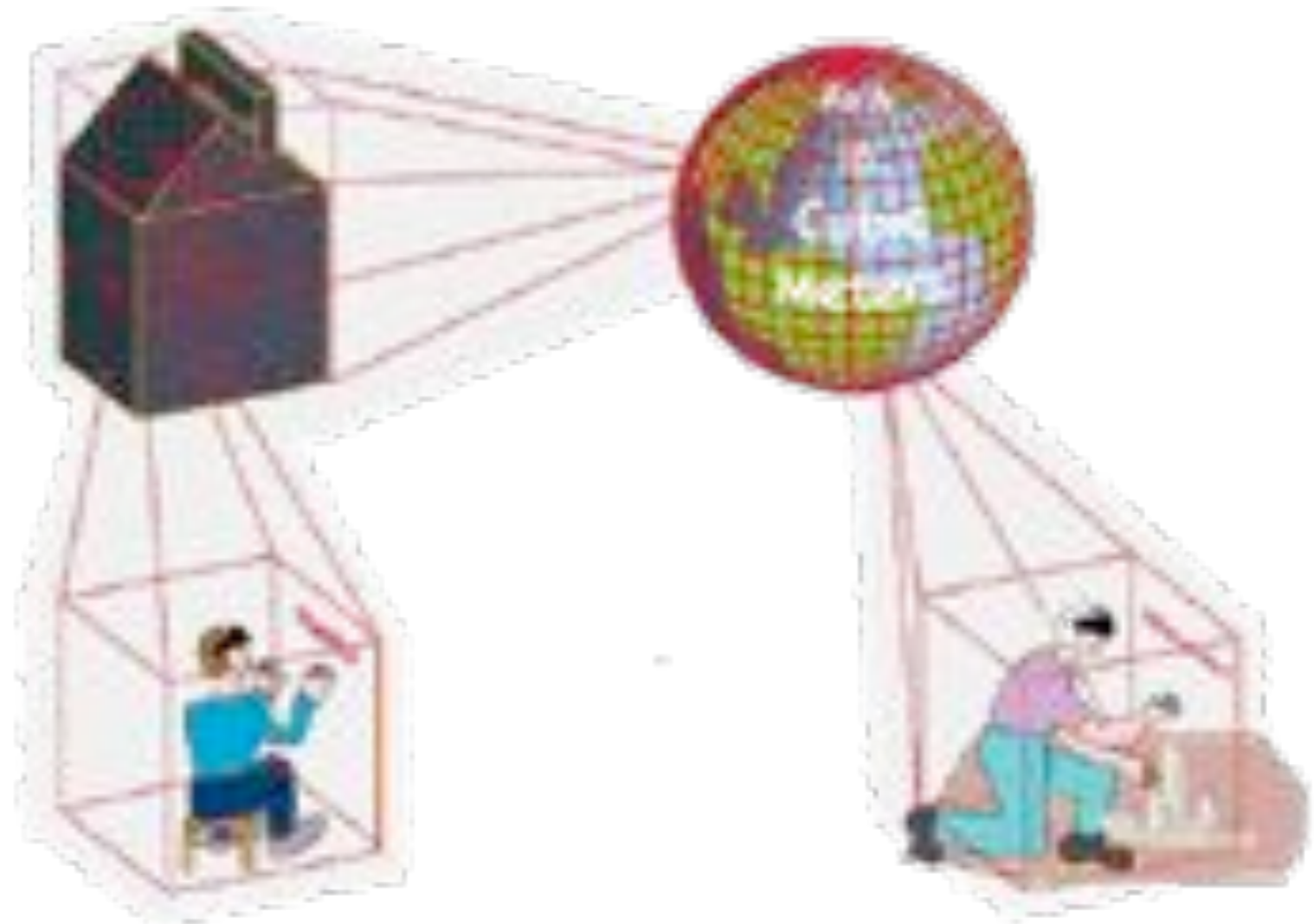
# Virtueller Spiegel





# Mobile Anwendungen

- Ort als Index für Daten
  - Location-Based Services
  - WorldBoard [Sporer '96]



- Mobile Augmented Reality als User Interface für ortsbezogene Information !

# Mobile AR - vor 10 Jahren



Inertial sensor

Kamera

HWD



DGPS

Notebook  
WLAN  
GPRS modem



Position: 137.8 49.8  
Target  
Current: Point\_1817172M1  
Distance: 1



Position: 137.7 49.8  
Target: Karlsplatz\_13  
Current: Point\_1817172M1  
Distance: 176.73434



# Evolution



Backpack+HMD:  
...5-8kg  
... > \$10K

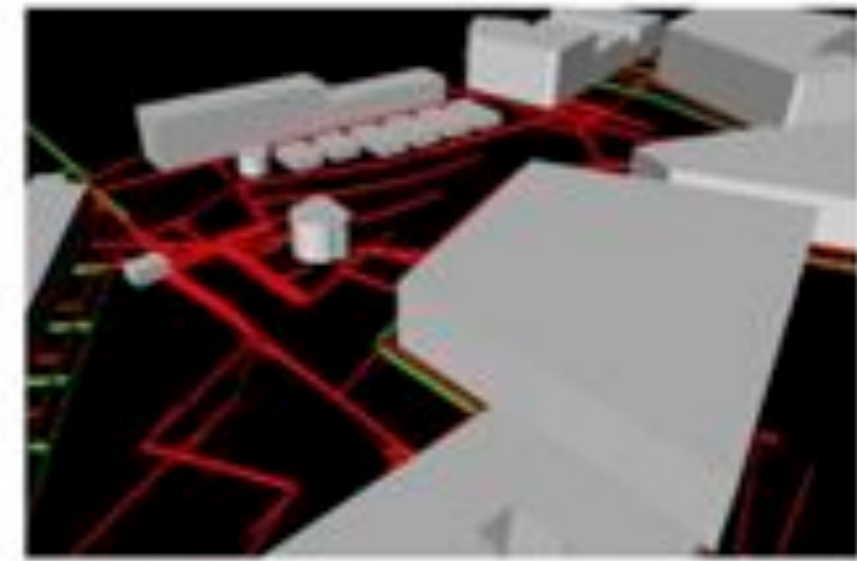
**Scale it down:**  
...Sony UMPC 1.1GHz  
...1.5kg  
...still >\$5K

# Anwendung: Visualisierung von Infrastruktur





# GIS Daten Pipeline



Smallworld™ GML Output



Scenegraph Format



Extruded Footprints

- Leitungsdaten von Infrastrukturbetreiber
- 3D Graphik für Visualisierung

# Evolution II



Backpack+HMD:  
...5-8kg  
... > \$10K



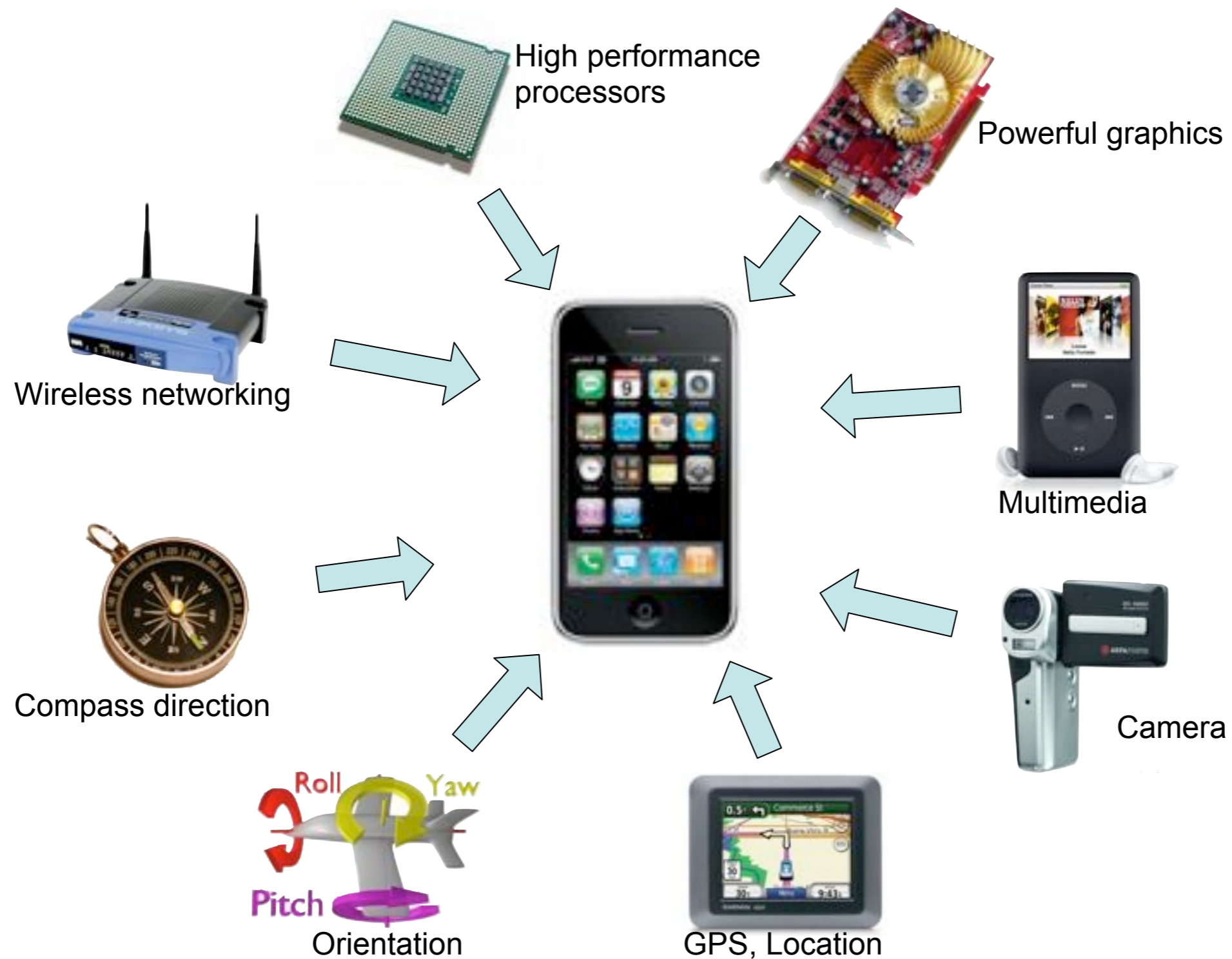
**Scale it down:**  
...Sony UMPC 1.1GHz  
...1.5kg  
...still >\$5K



**Scale it down more:**  
Smartphone...\$500  
...All-in-one  
...0.1kg  
...billions of units



# Ideale Plattform für Augmented Reality



# Smartphones

- Billig
- Akzeptiert von Benutzern
- Vertraut
- Diskret
- Weit verbreitet
- (relativ) intuitiv zu bedienen





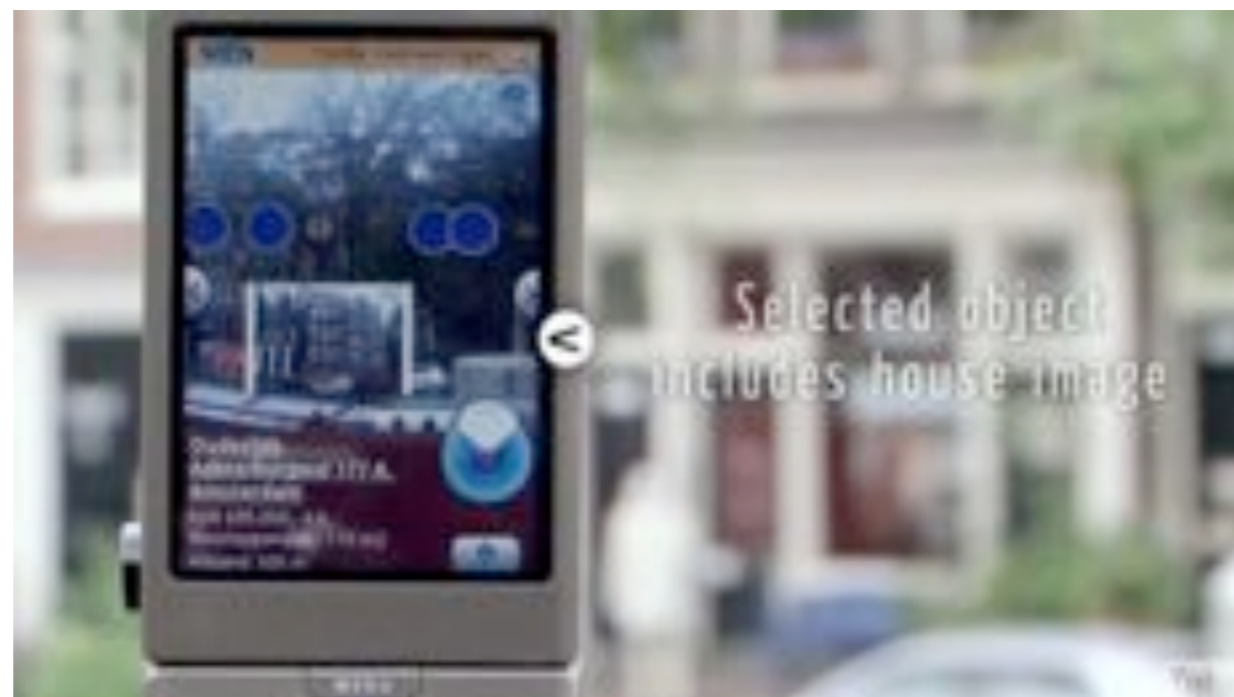
# Mobile Informationssysteme



Wikitude  
Geo-referenced Information Layers



Peak.ar  
Berggipfel identifizieren



Layar  
Verschiedene Inhalte

# Navigation



Wikitude Drive  
Navigationsinformation



acrossair  
Nearest Tube



# Werbung

„Red Bulletin“

The screenshot shows the Red Bulletin website interface. At the top left is the logo "THE RED BULLETIN" with a red bull icon. To the right, there's a navigation menu with "HOME", "SPORTS", "CULTURE", "HEROES", and "WHAT'S ON". A search bar is also present. Below the navigation, a featured article titled "Red Bulletin Print 2.0 - October 2009" is displayed. The main content area features a large video player showing a man holding a magazine cover. To the right of the video, there are instructions for using a webcam to view the magazine. At the bottom, there are links for "Contact", "About Us", "T&C", "Advertise", "Media", and "Partners", along with a copyright notice "© RedBulletin.com 2009".

THE RED BULLETIN

HOME SPORTS CULTURE HEROES WHAT'S ON

SEARCH

Red Bulletin Print 2.0 - October 2009

Mark Webber  
"It's an incredible day for me"

TURN ON YOUR WEBCAM

VIDEO GALLERY

1. Turn on your webcam.  
If there is no webcam integrated on your computer, you can choose any other webcam.

2. Look out for the 'Bull's Eye' logo on the pages and hold the magazine into the camera.

3. For optimized viewing of videos click the button.

IN THE ISSUE

Check out the cover, and the stories on pages 5, 20, 33, 41, 49, 62/63 and 68/69

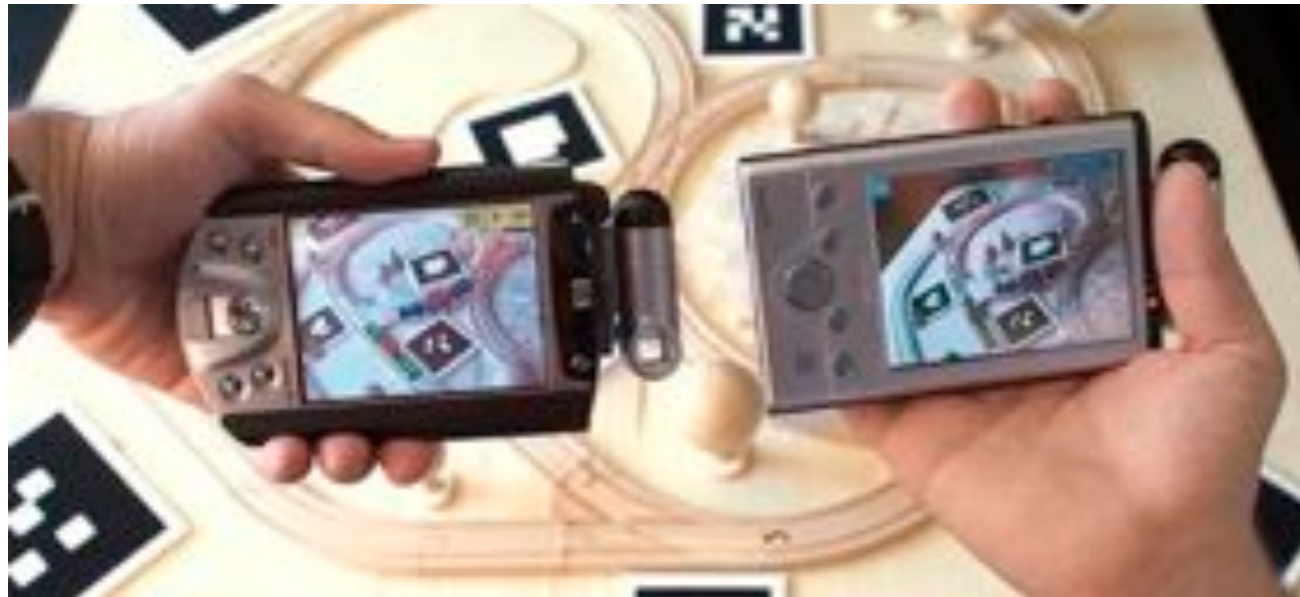
NO RED BULLETIN?

That you can download the latest issue and print the pages.

Contact About Us T&C Advertise Media Partners

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# Games



Invisible Train, '04



MARQ, '07



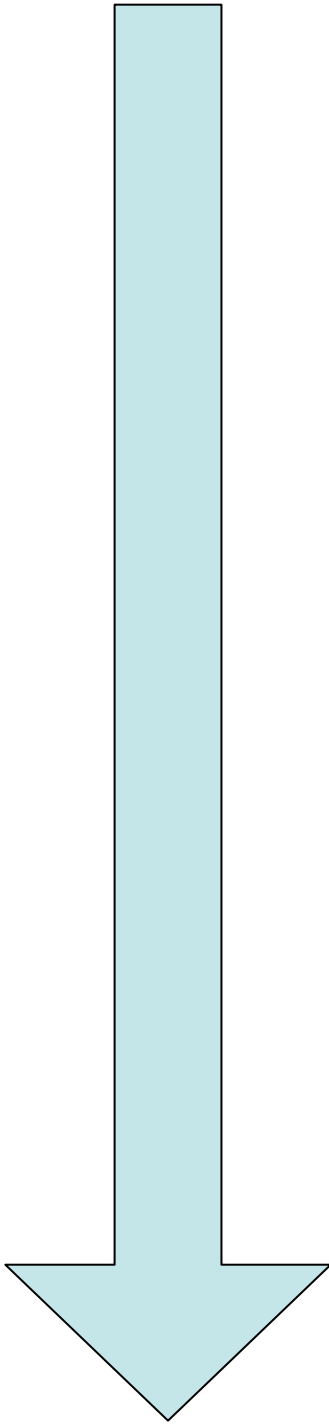
Put-A-Spell, '09



Sony invizimals, '09

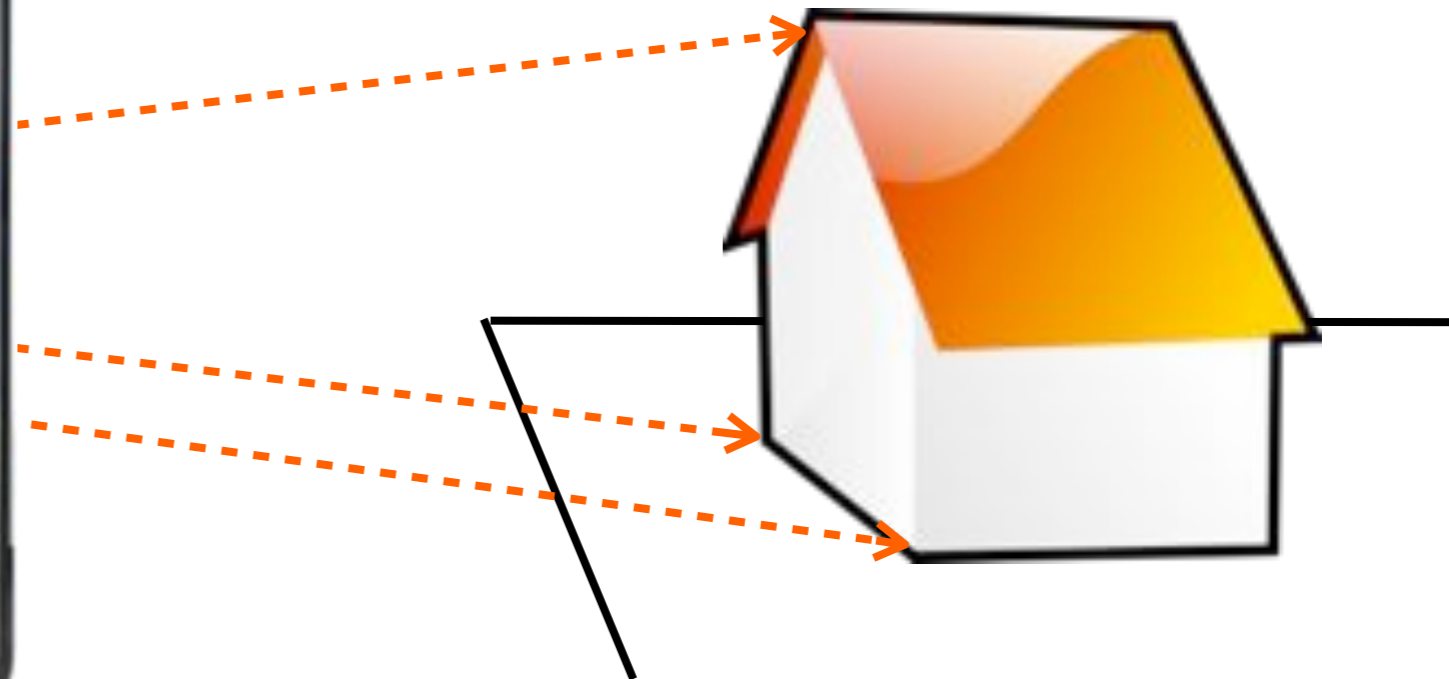


# Wie realisiert man AR ?

- 
- Tracking
    - 6D Lagebestimmung
  - Visualisierung
    - Unsichtbares Sichtbar machen
    - Clutter
  - User Interfaces
    - Interaktion
    - Navigation

# Tracking

- Positionsbestimmung, Registrierung
  - GPS Koordinaten + Höhe
  - Lage der Kamera





## Innenbereich

- Viele Spezialgeräte
  - Magnetische Tracker
  - Ultrasound
  - Cameras
- Camera am Gerät
  - Marker
  - Umgebungsmodell



## Aussenbereich - GPS

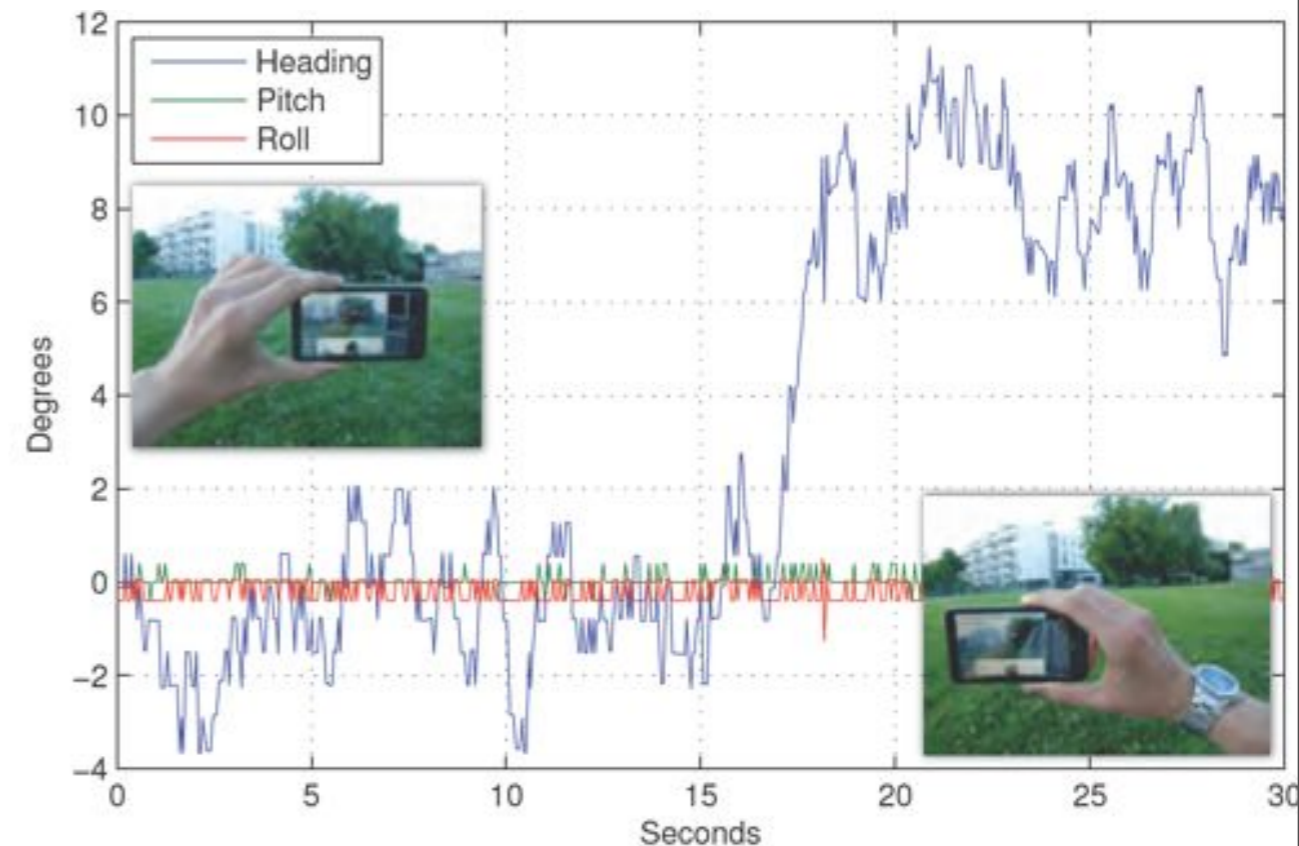
- Pseudo Range zu Satelliten
  - Überall verfügbar
  - Viele Fehlerquellen
- Für Consumer-Level
  - 5 - 50m
  - Abschattung durch Gebäude, Körper, ...





# Lage - Orientierung

- Inertialsensoren
  - Lineare Beschleunigungsmesser  
Erdanziehungskraft !
  - Gyroskope
- Magnetometer ~ 3D Kompass
  - Leicht zu stören



# Bild-basierte Registrierung

- Geräte mit Kameras
- Computer Vision → Pixel genaue Registrierung



Marker



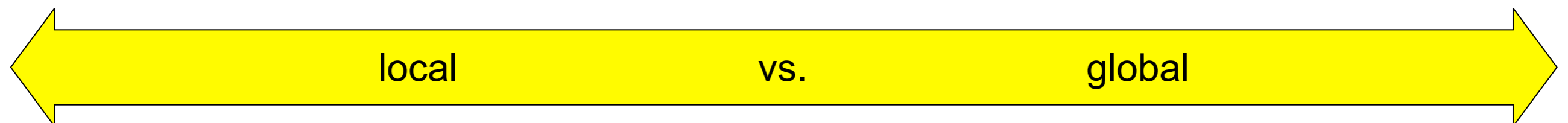
Natural Features



Image-based Localization



Visual Search





# AR Soccer



# Visualisierung

- Superman's X-Ray Vision ?





# Visualisierung

- Illustrative Visualisierung
  - Verdeckungen erzeugen
  - Ausschnitte



# Infrastruktur Visualisierung





# Interaktion

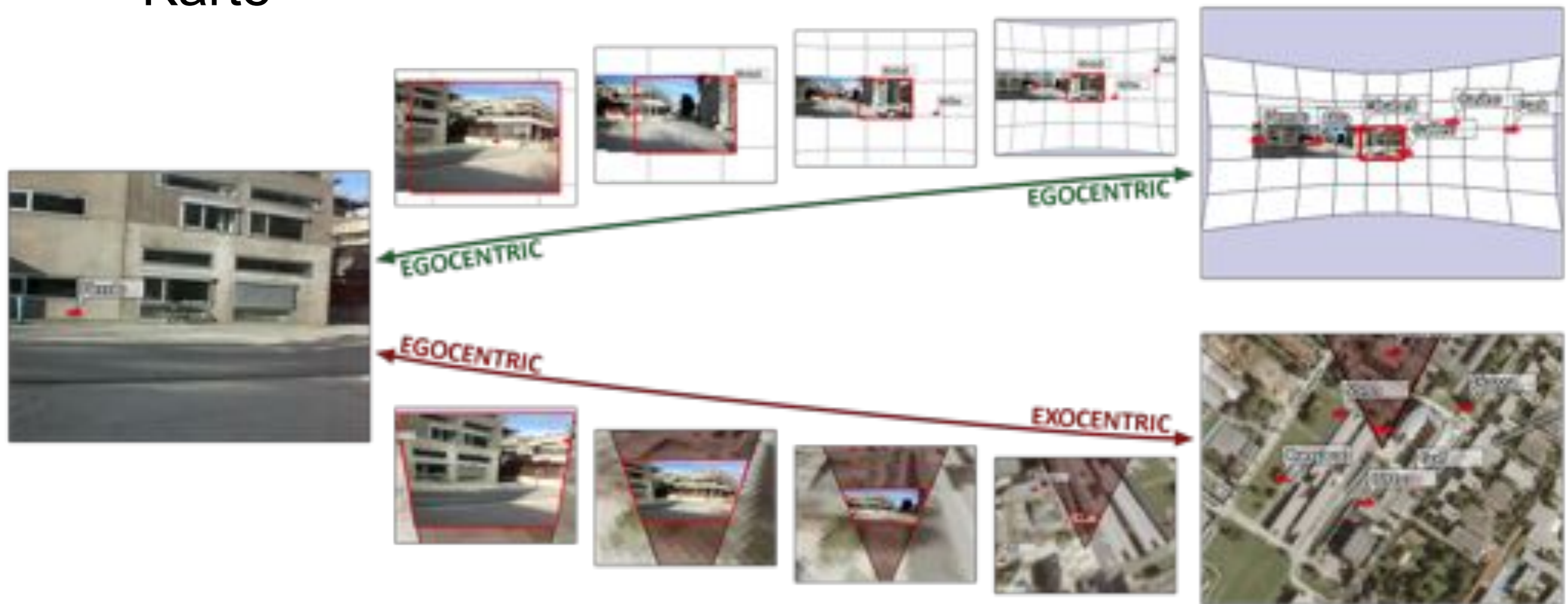
- Information Browsing - mit kleinen Bildschirm



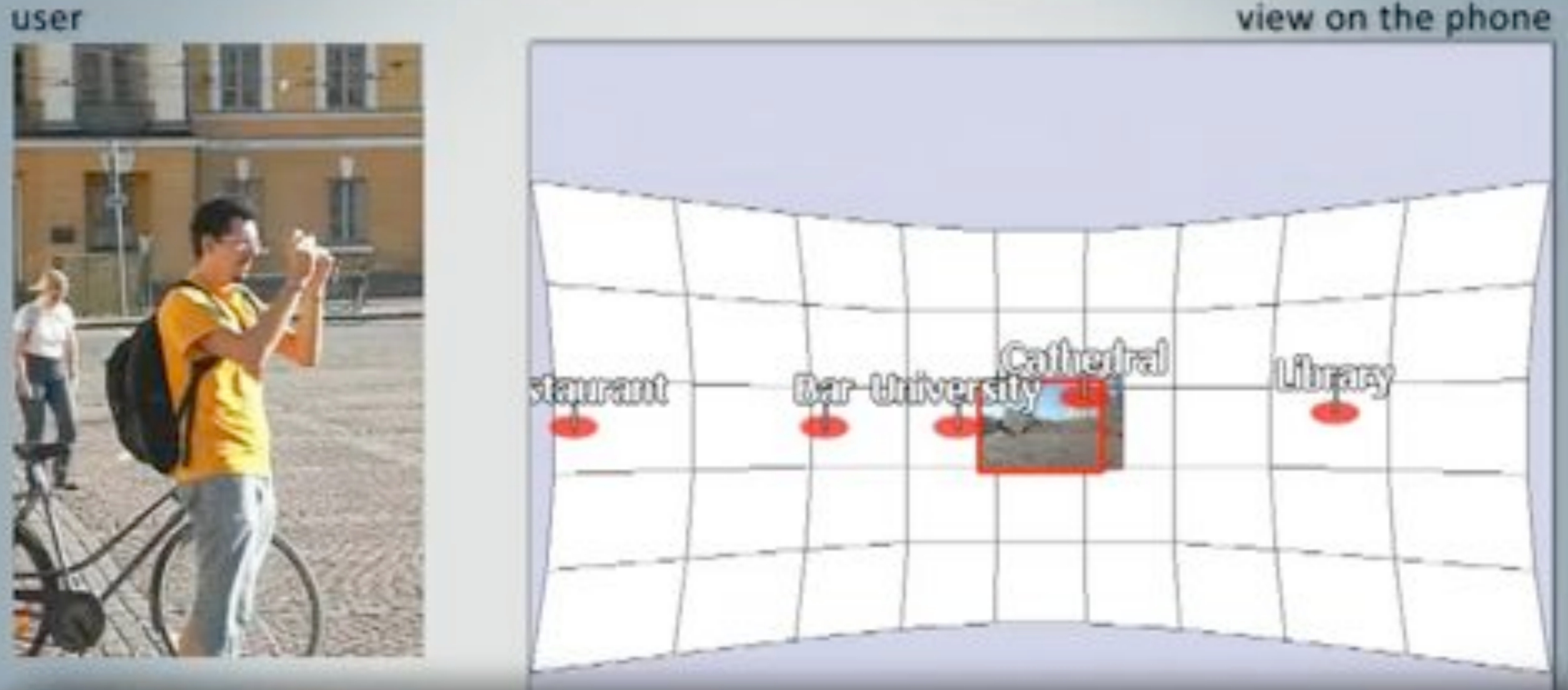


# Zooming Interfaces für Navigation

- Zoom für Überblick
  - Panorama
  - Karte



# Zooming Interfaces für Navigation



The Zooming Panorama is triggered using the zoom buttons, like in ordinary digital cameras.

# Ausblicke

- Bild-basierte Lokalisierung
- Integration mit 3D Weltmodellen
- Social Augmented Reality



# Zukunft: Bild-basierte Lokalisierung



Users can browse the annotated environment using their device as a magic lens

# Zukunft: Integration mit 3D Modellen

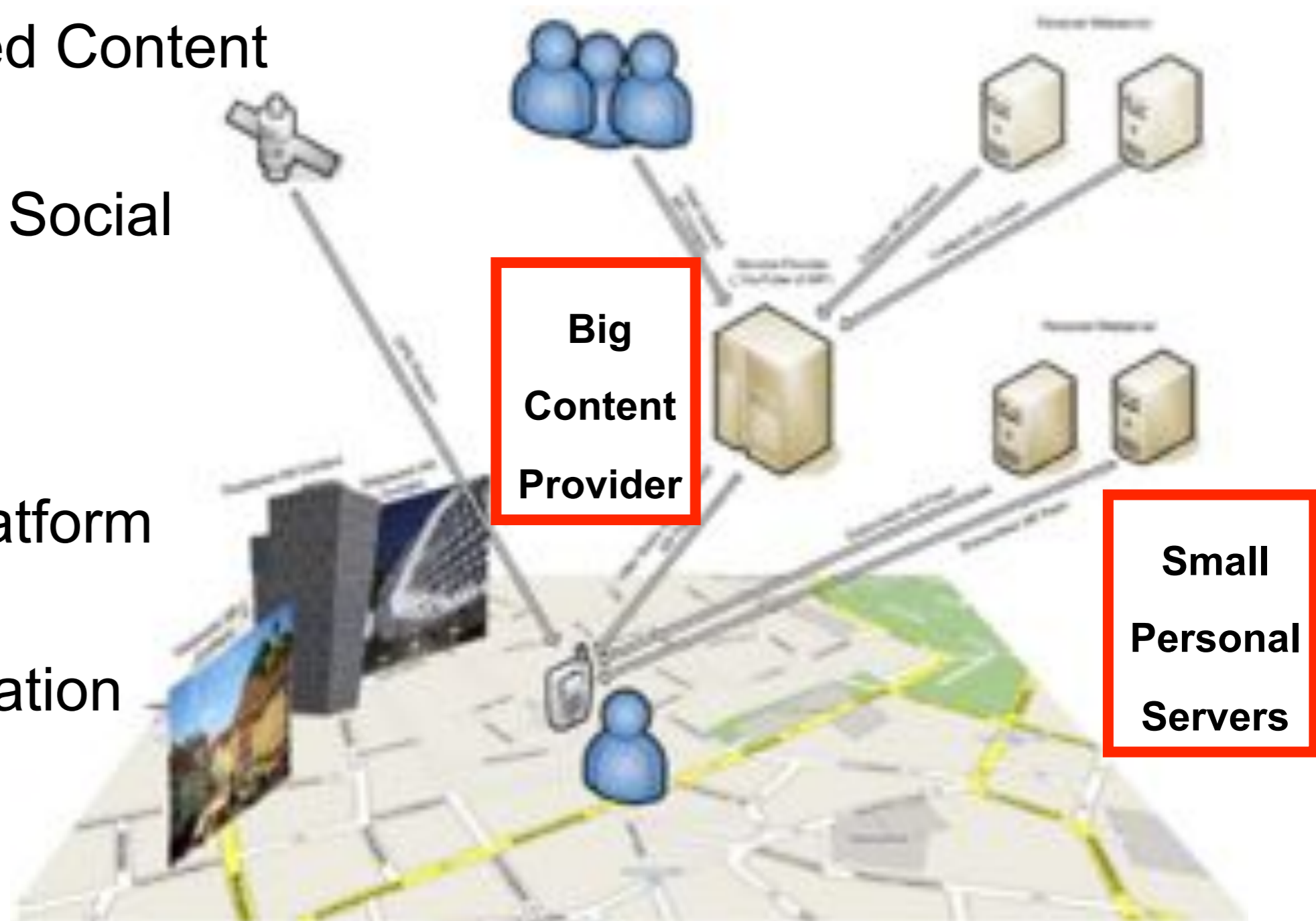
- Anbindung an 3D Weltmodelle  
– Google Earth, Microsoft Bing
- Genauere Lokalisierung
- Integrierte Plattform für Inhalte
- Innenräume





# Zukunft: Augmented Reality 2.0

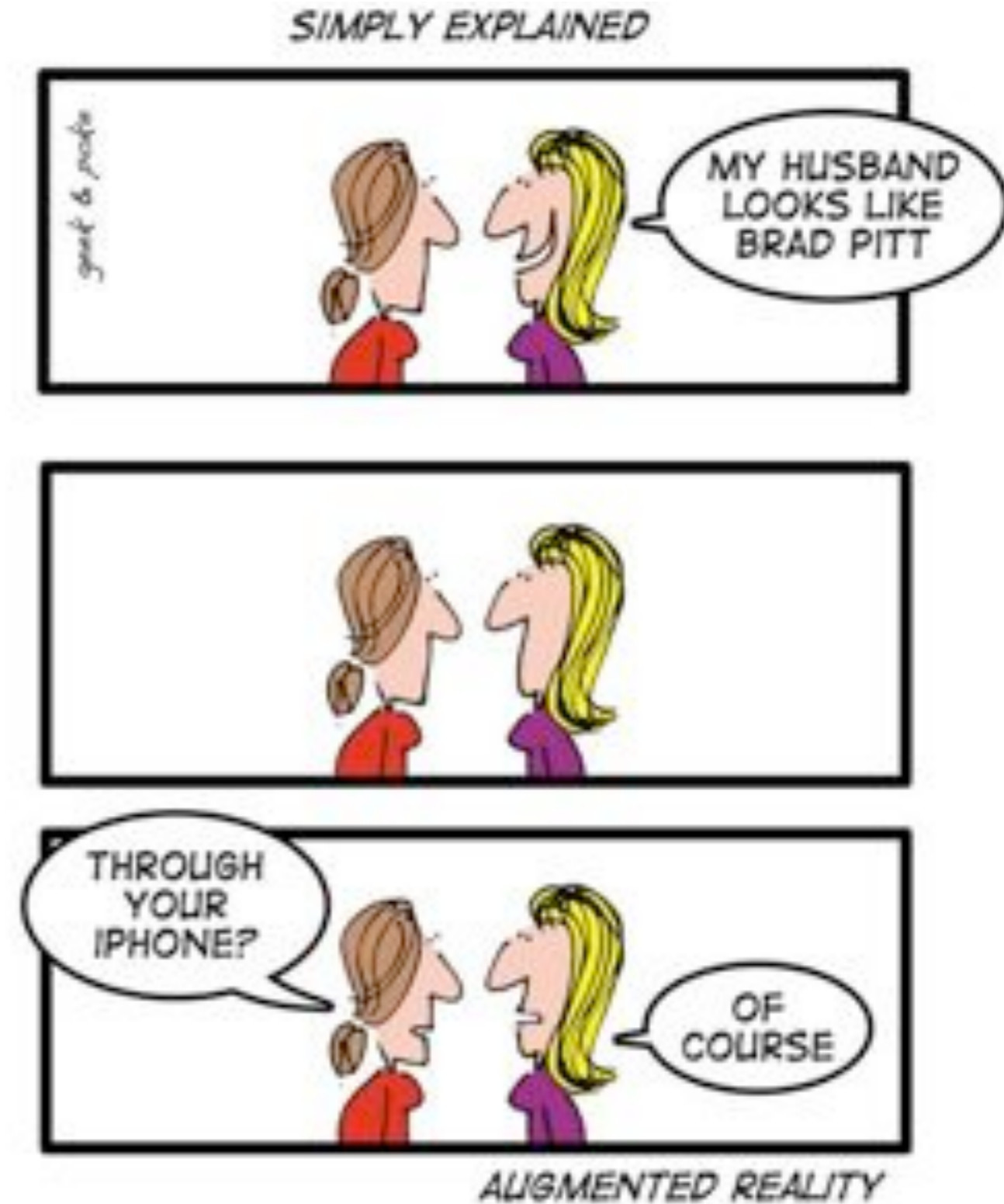
- User Generated Content
- Integration mit Social Networks
- Einheitliche Applikationsplattform
- Content generation in Echtzeit





Danke für Ihre  
Aufmerksamkeit

[www.studierstube.org](http://www.studierstube.org)



**Handheld Augmented Reality**  
Christian Doppler Laboratory

