VU Augmented Reality on Mobile Devices

- Peter Rautek, Michael Gervautz
- VU 3.0
- MO 17:15-18:45
  SemRaum ICG

- Topics
  - Computer Vision for Augmented Reality
  - Computer Graphics, Visualization,
    User Interfaces for Augmented Reality
- http://www.cg.tuwien.ac.at/courses/ARMD/index.html

Schedule

- 21.3. Introduction and AR application areas
- 28.3. Q&A
- 4.4. Interaction Techniques
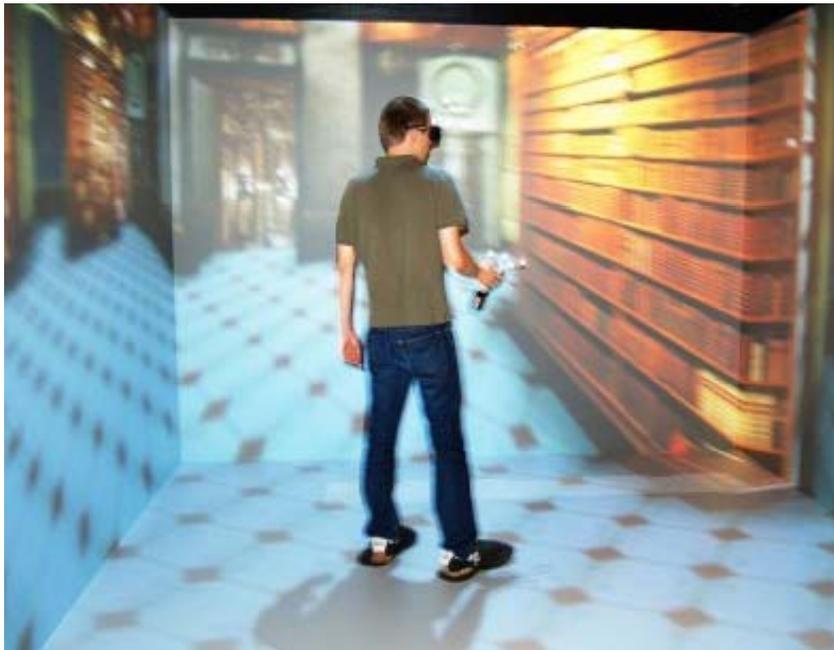- 11.4. Interaction Techniques

  Easter

- 02.5 Tracking
- 09.5 Tracking
- 16.5. Q&A und Practice Update
- 23.5. Visual Coherence
- 30.5. Wrap Up

- 20.6. Abgabegespräch
- 27.6. Präsentationen und ARMD Awards

What is Augmented Reality ?

- **Virtual Reality**
  - User in computer generated world
  - isolated from the real world
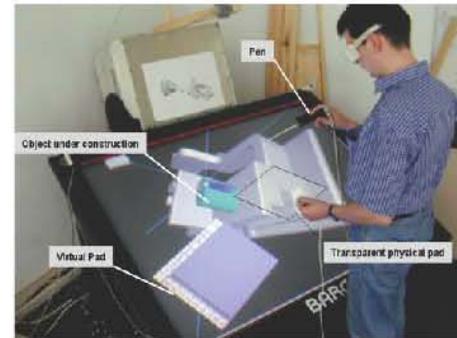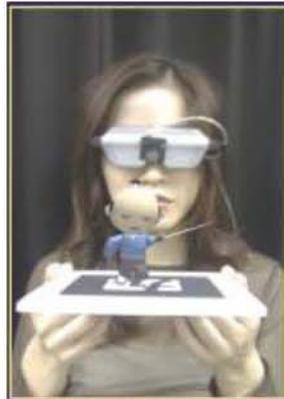- **Augmented Reality**
  - Adds to the real world

What is Augmented Reality ?

- Superimposes virtual information on the real world
- Interactive in real time
- Spatial - virtual objects are registered in 3D space
  - [Azuma, '97]

- Display for spatial information
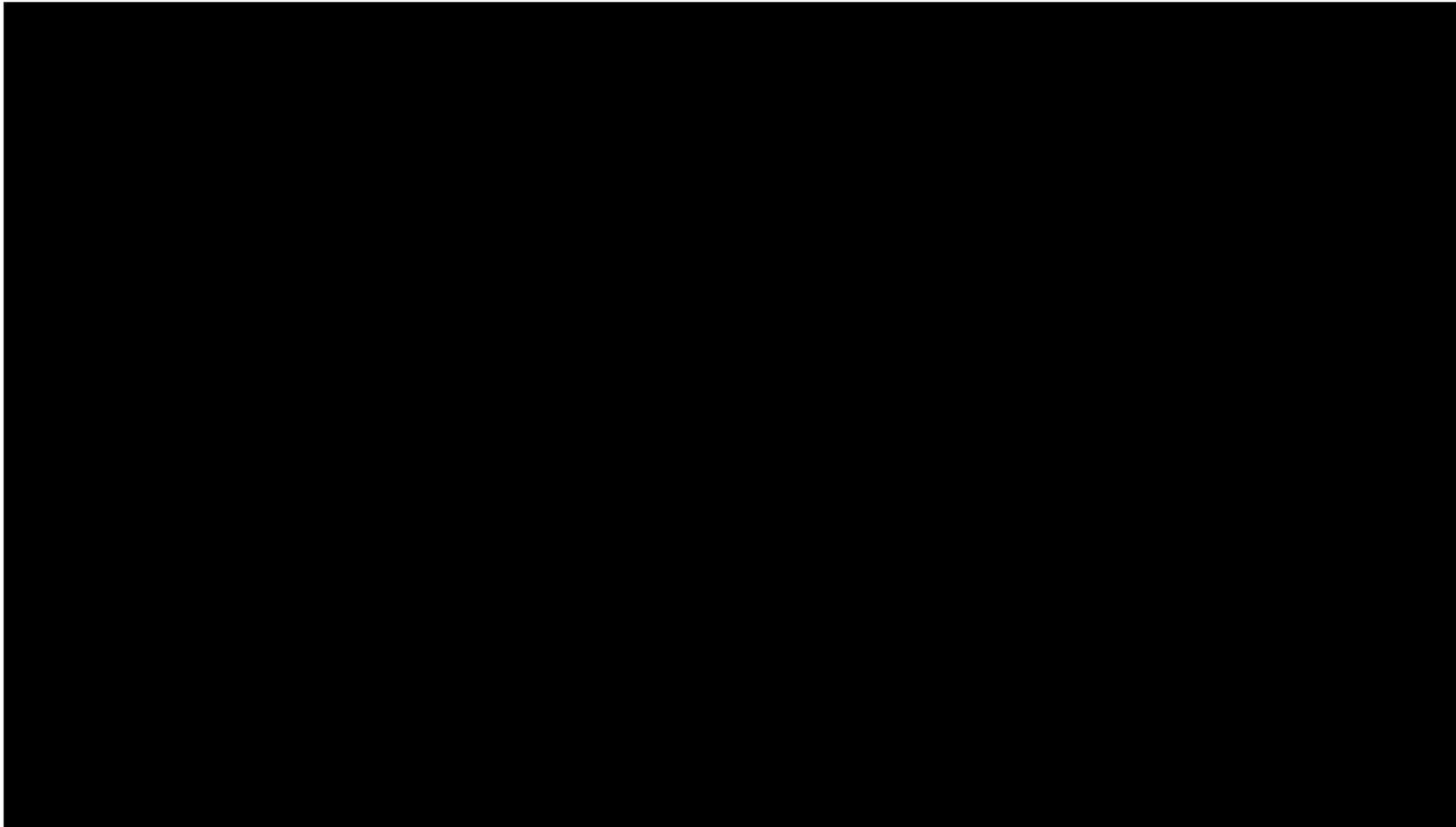 - mostly visual, but also other senses
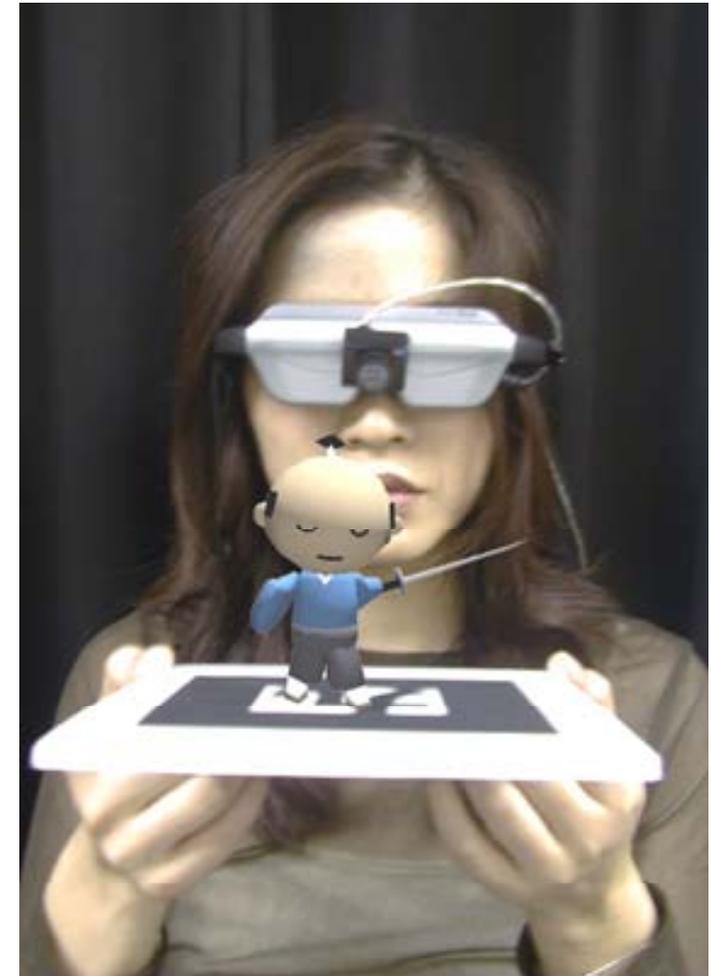
Milgram's Reality-Virtuality continuum

Milgram et al, '94

What is Augmented (Hyper-)Reality

Examples for AR

UNC Chapel Hill

Boeing Company
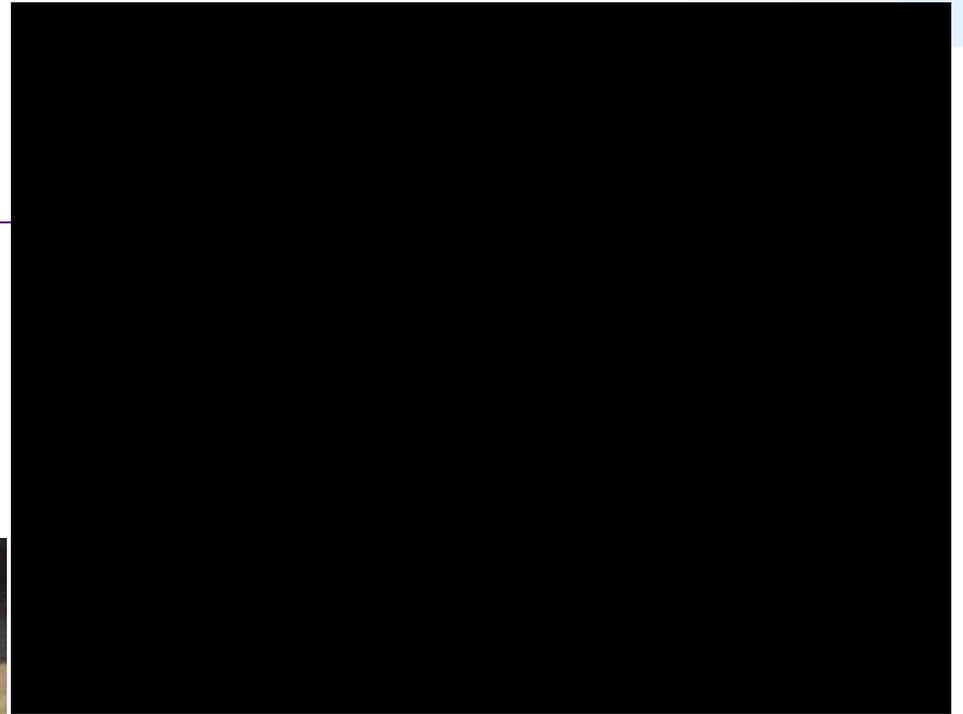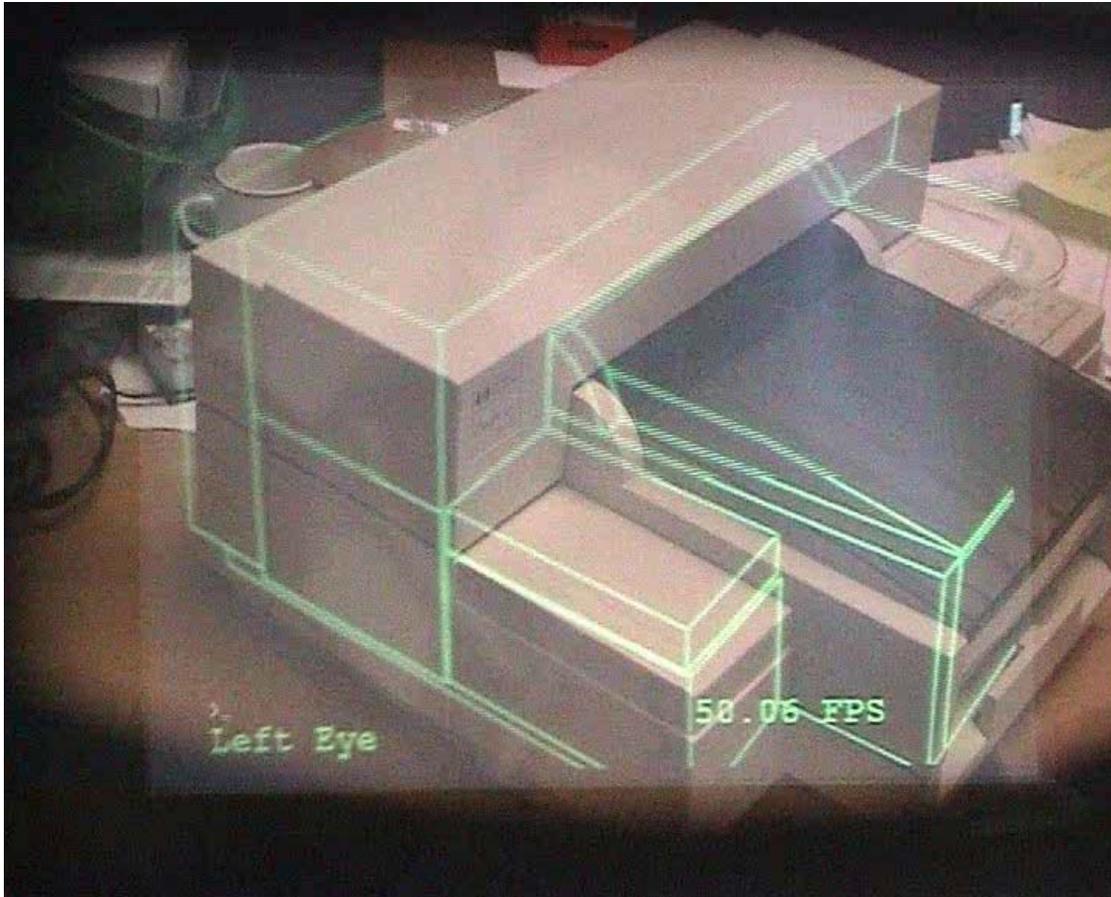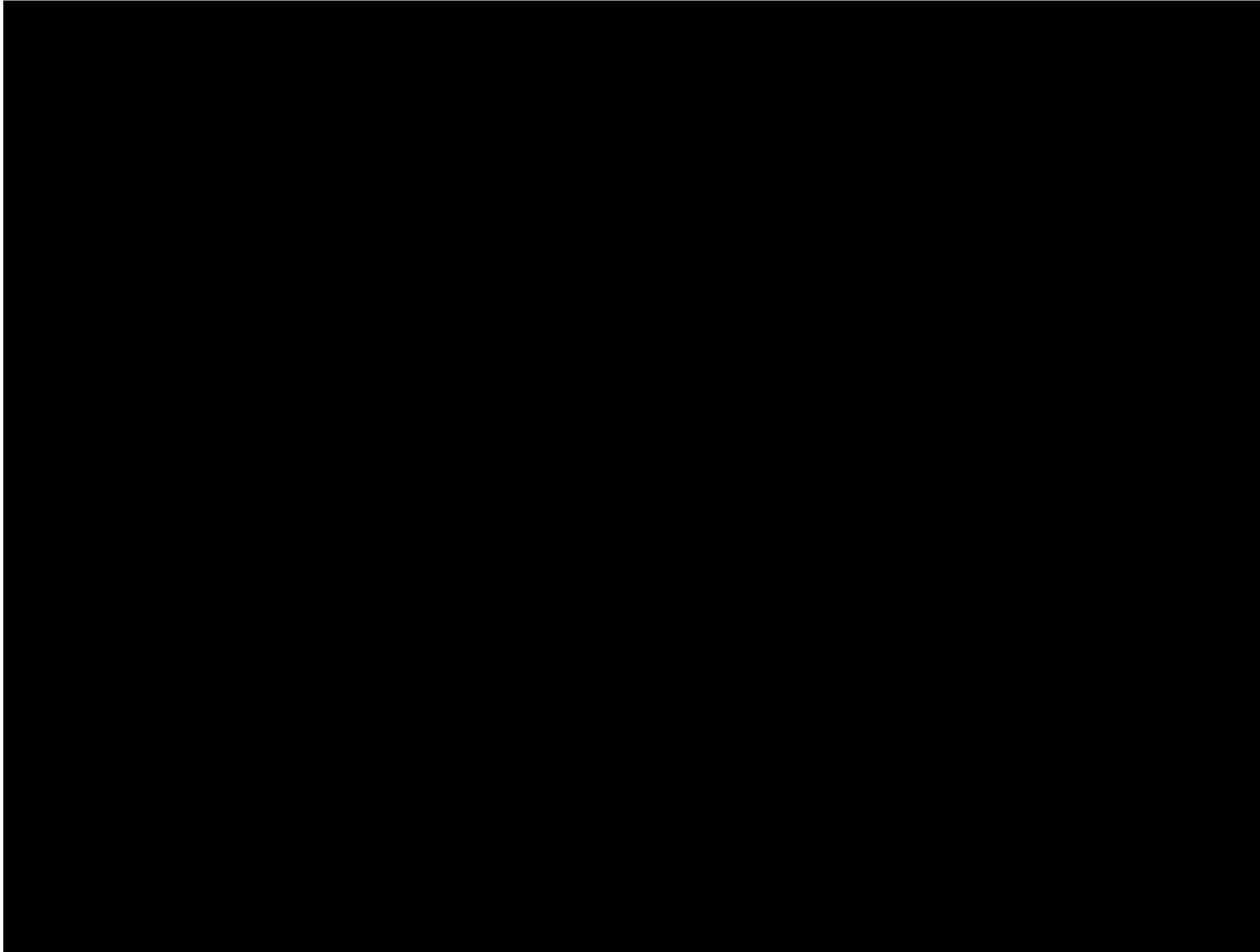

Fraunhofer IGD

Junaio

Maintenance

[Klein, 03]

TV

Entertainment

Entertainment

University of Koblenz presents...

COMPUTERVISUALISTIK

UNIVERSITÄT
KOBLENZ · LANDAU

Media

[Imagination, 09]

Sales Support – Virtual Mirror
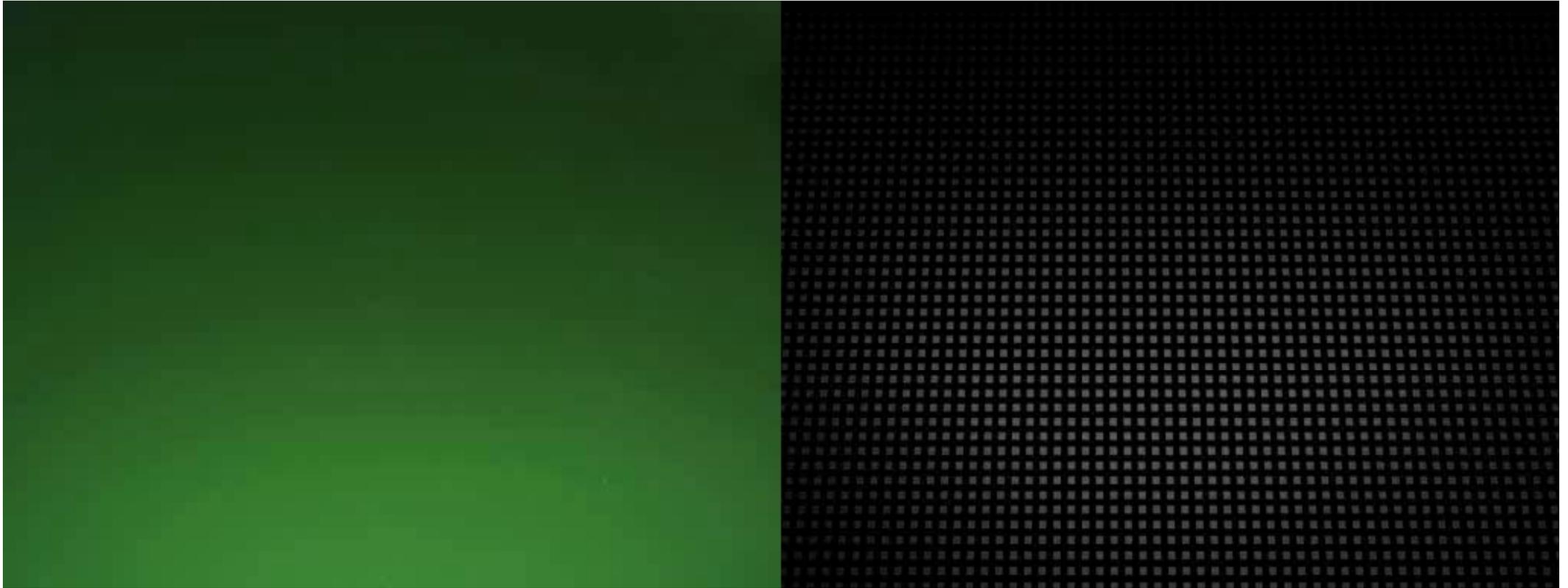
Medical Applications

[UNC Ultrasound]

[Bichlmeier, 08]

Mobile & Handheld Augmented Reality

Trend to Mobile/Ubiquitous Computing

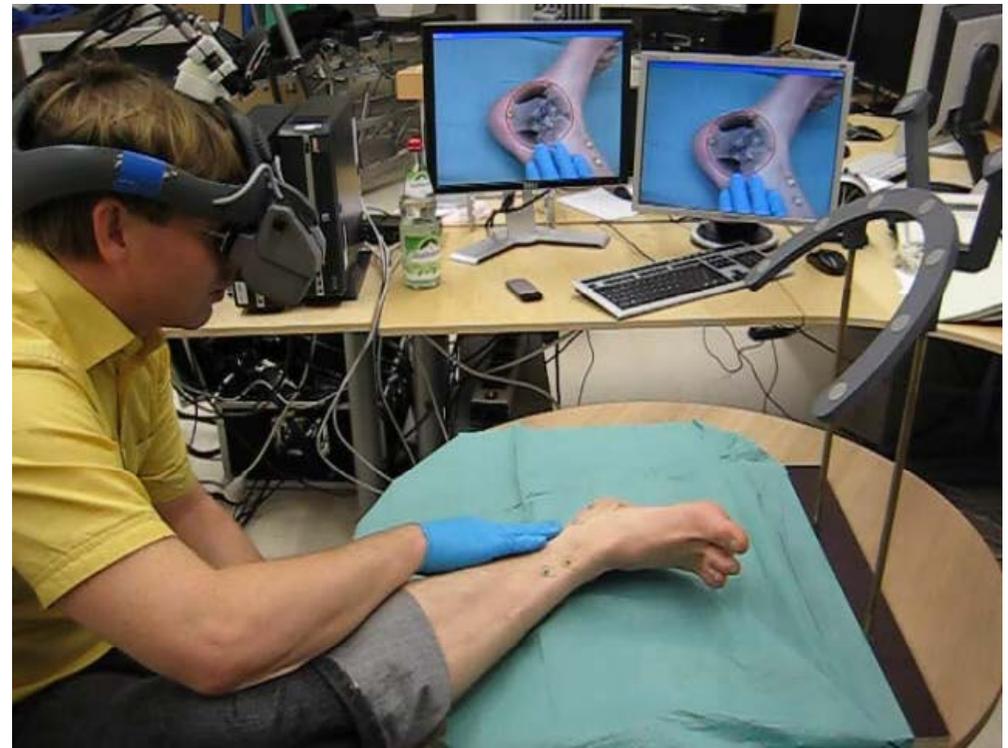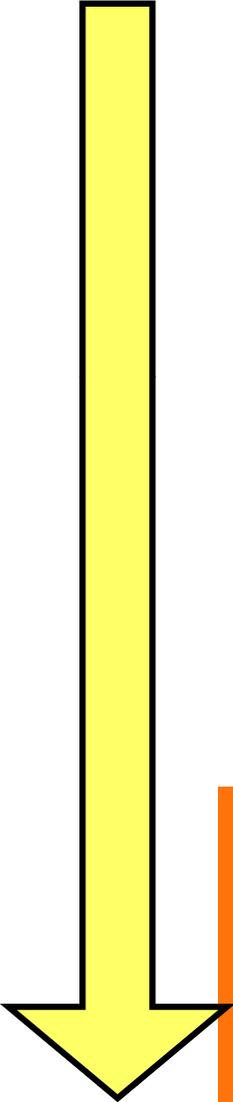| Computer Form Factor	User Relationship	Users/Computer
Building	Submit	>100
Room	Share	>10
Desk	Sit at	1
Box		1
Laptop	... carry around	1/2
PDA/mobile	Hold	1 - 1/3
Clothing	Wear	1/10

Implications of Wearability
(after S. Mann, B. Rhodes, T. Starner)

- **Mobility**
  - usable/used indoors and outdoors

- **Intimacy**
  - sense the wearer's body, communicate privately

- **Context sensitivity**
  - take into account changing environment

- **Constancy**
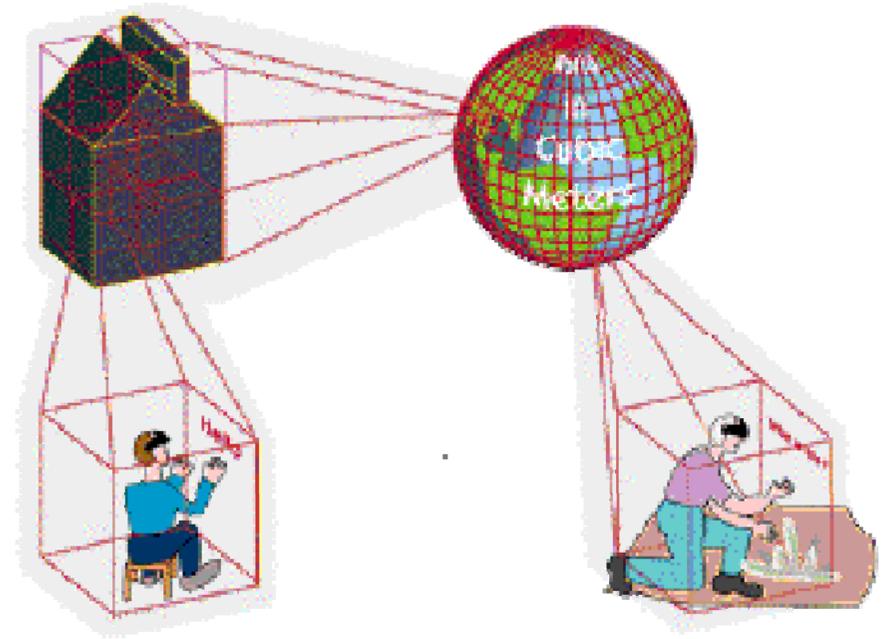 - Permeation of UI into wearer's life

Wearable Computing Group @ MIT

Location-based Computing

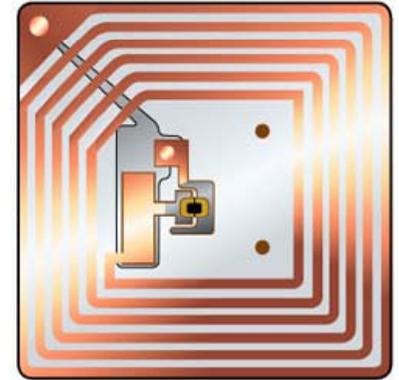- **WorldBoard (Sporer '96)**
  - The world as a repository of information
  - Place as index to information

- **Mobile Augmented Reality as User Interface for location-based information!**
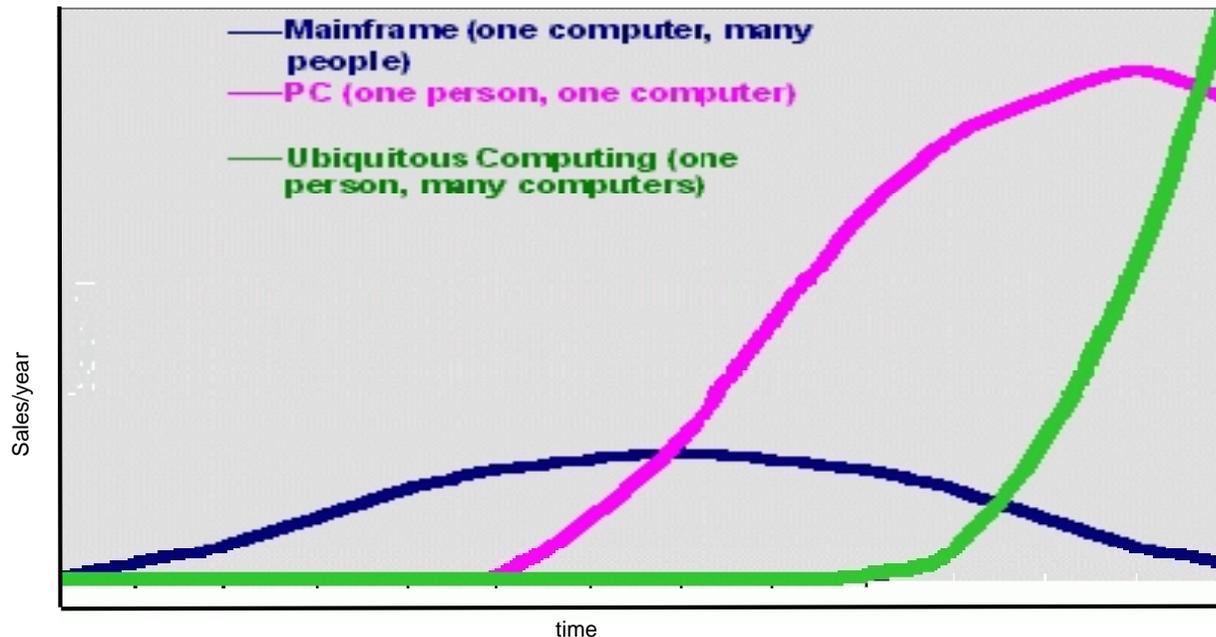
Internet of Things (Tagging)

- **RFID – Radio Frequency ID**
- **Barcodes**
- **2D Barcodes (DM, QR-Code,…)**
- **NFC – Near Field Communication**

9 87654 32109 8

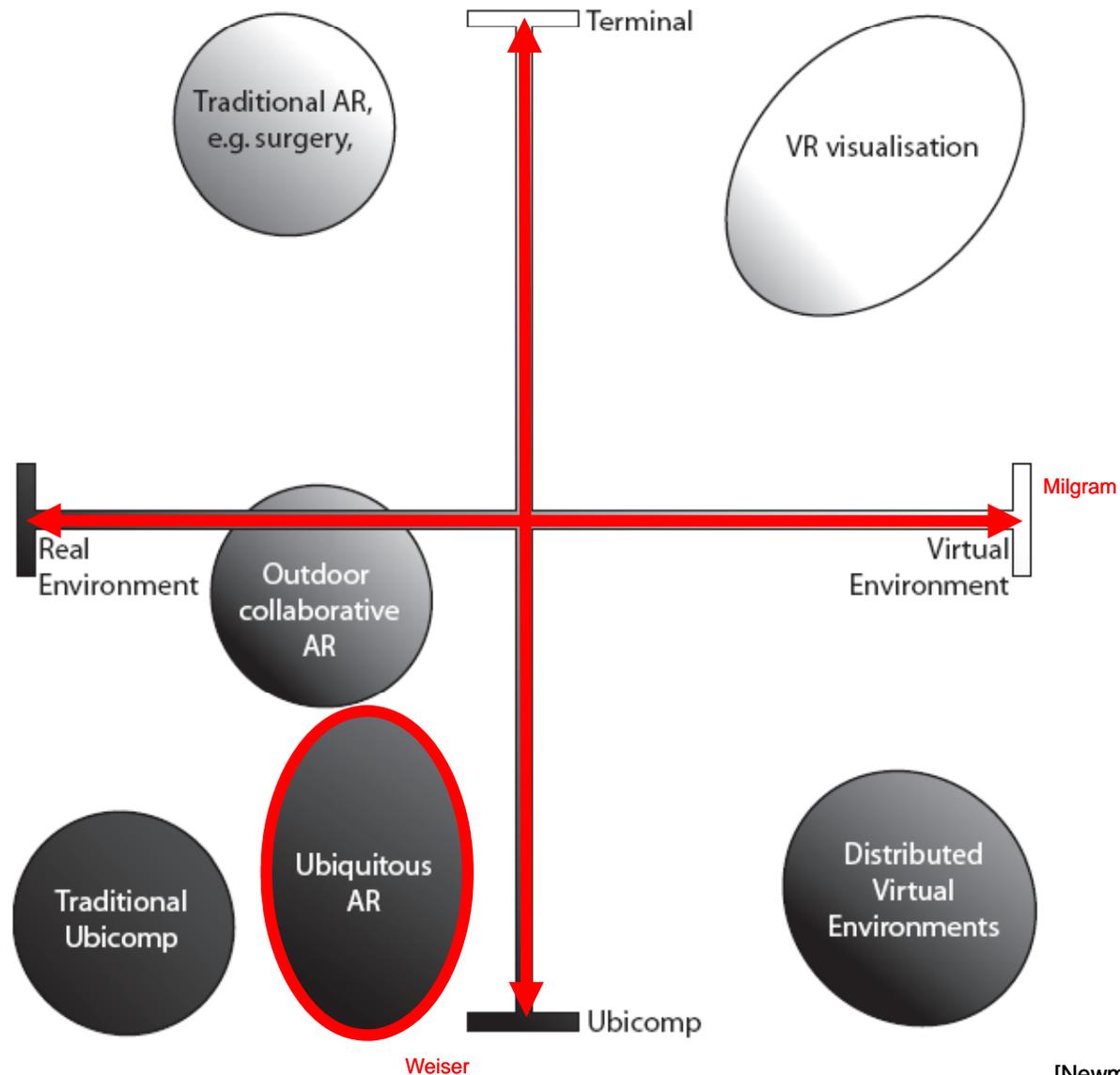Mobile AR is a user interface to objects around us!

Ubiquitous Computing

- **Mark Weiser, Xerox PARC (1952-1999)**
- **The third wave of computing:**
  - Computing woven into fabric of our everyday live
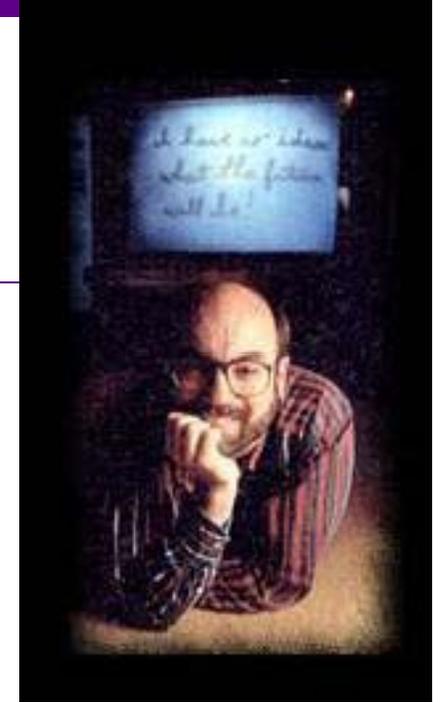
- **Augmented Reality as an interface for Ubiquitous Comp.?**

Milgram-Weiser Continuum

[Newman VR 2007]

Mobile Augmented Reality
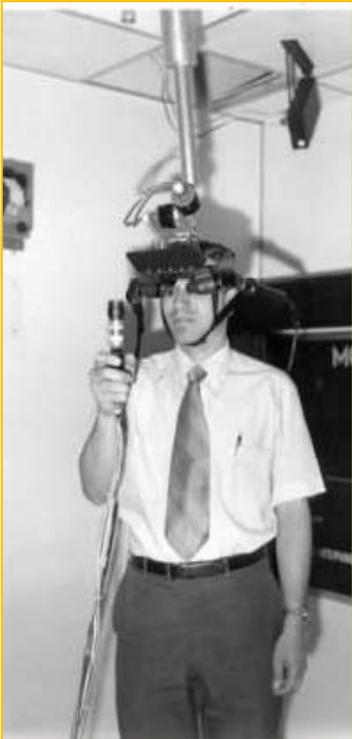

AR Backpack Examples

1997

Handheld Augmented Reality

- Low Cost
- Robust and fool-proof
- Billions of devices
- Intuitive user interface
- Self-contained operation

- Networking support
- Tracking support
- Rapid prototyping
- Content creation pipeline

Mobile Augmented Reality: The History

1968

2003

2005

now

Ivan Sutherland
Workstation
Fix mounted
> $100,000

Backpack+HMD
External sensors
5-8kg
> $25,000

UMPC 1.1GHz
External sensors
1.5kg
>$5,000

Smartphone
Built in sensors
0.1kg
< $600

Real World View

Live camera view

Virtual Content

Information about points of interest

GPS and Compass-based Augmented Reality Experience

Good for rough location of items outside our field of view
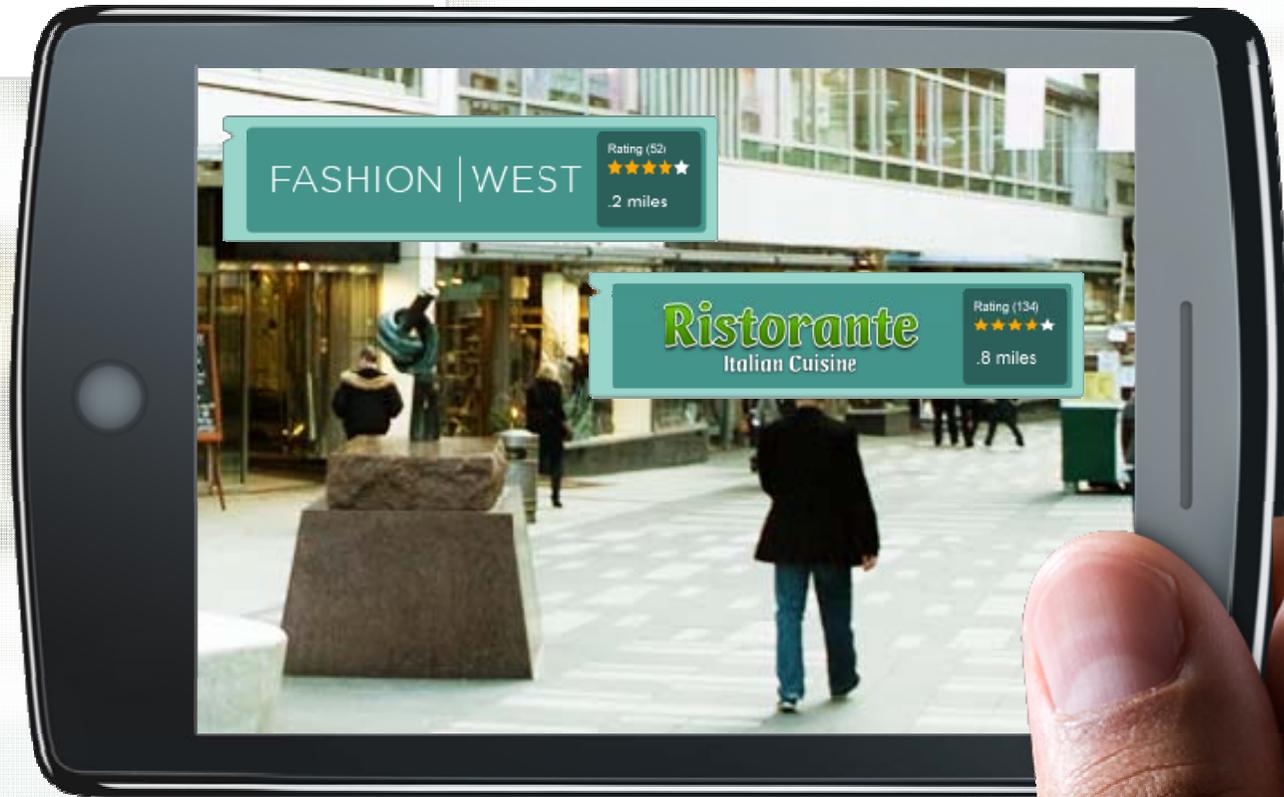
FASHION | WEST
Rating (52)
.2 miles

Ristorante
Italian Cuisine
Rating (134)
.8 miles

Real World View

Live camera view

Virtual Content

Vision-based AR recognizes objects in field of view and aligns graphics tightly to target object

Vision-based Augmented Reality Experience

Enables a more immersive and interactive experience

Real World View

Live camera view

Virtual Content

Vision-based AR recognizes objects in field of view and aligns graphics tightly to target object

Vision-based Augmented Reality Experience

SCANS

COMPARES

POSITIONS

RENDERS

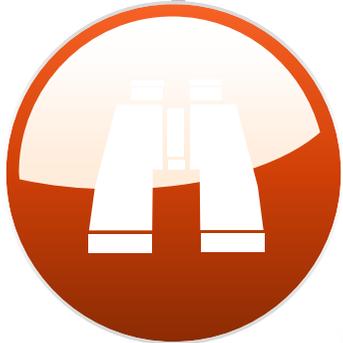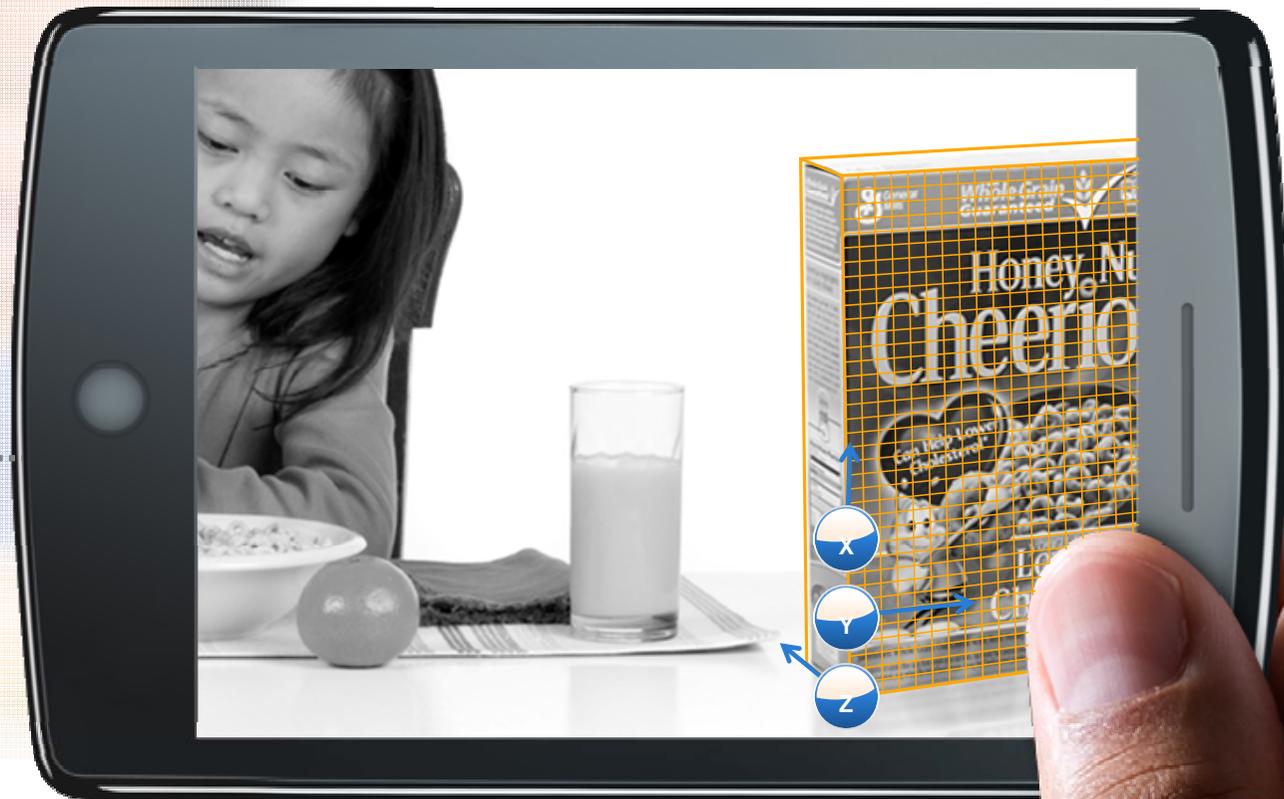Enables a more immersive and interactive experience

Pull Video Frame from Camera,
Scan for Known Objects or Features

Compare to Database of Known Images

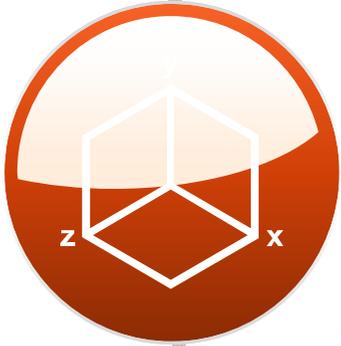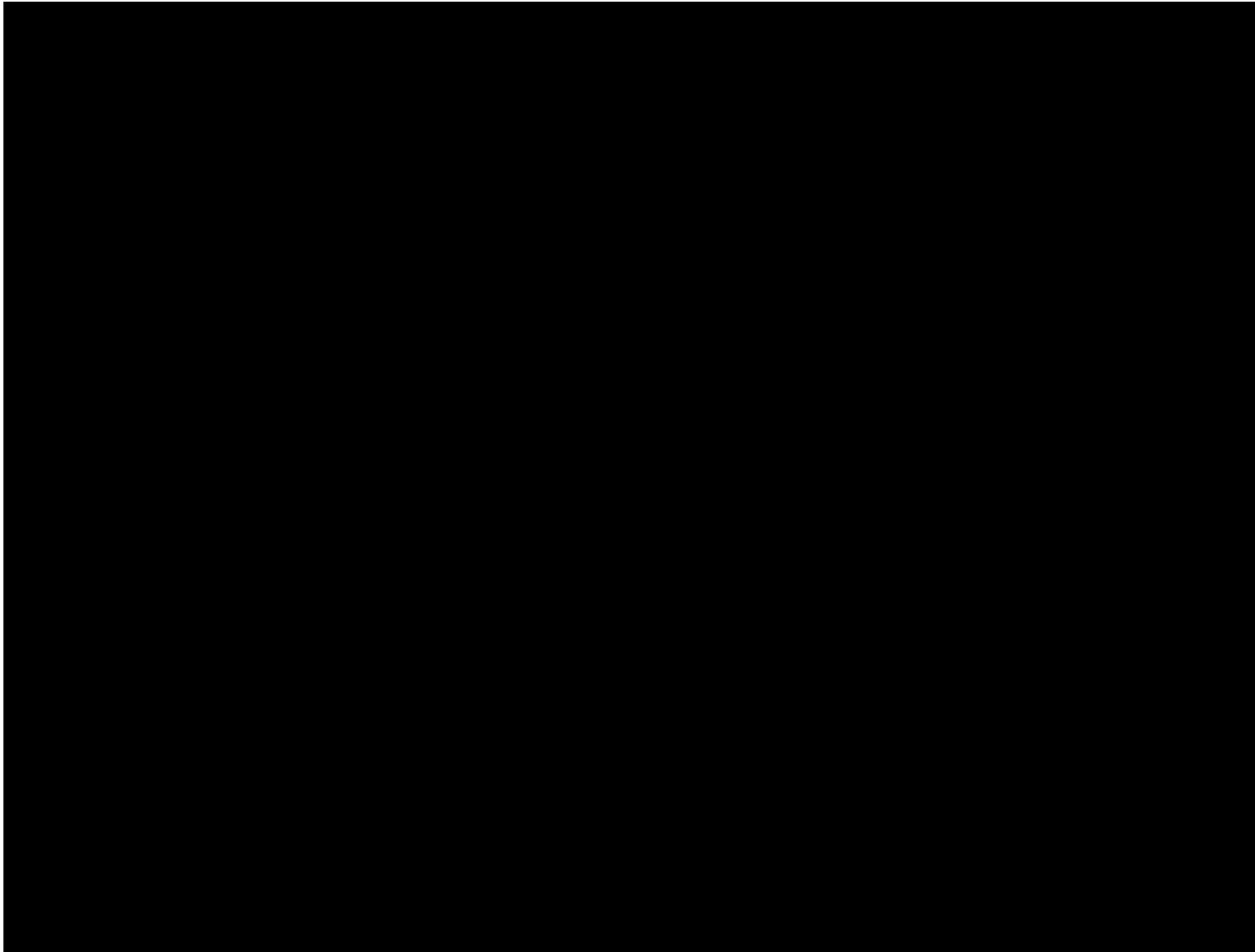Position and Orientation Determined

Graphics are Rendered

SCANS

COMPARES

POSITIONS

RENDERS
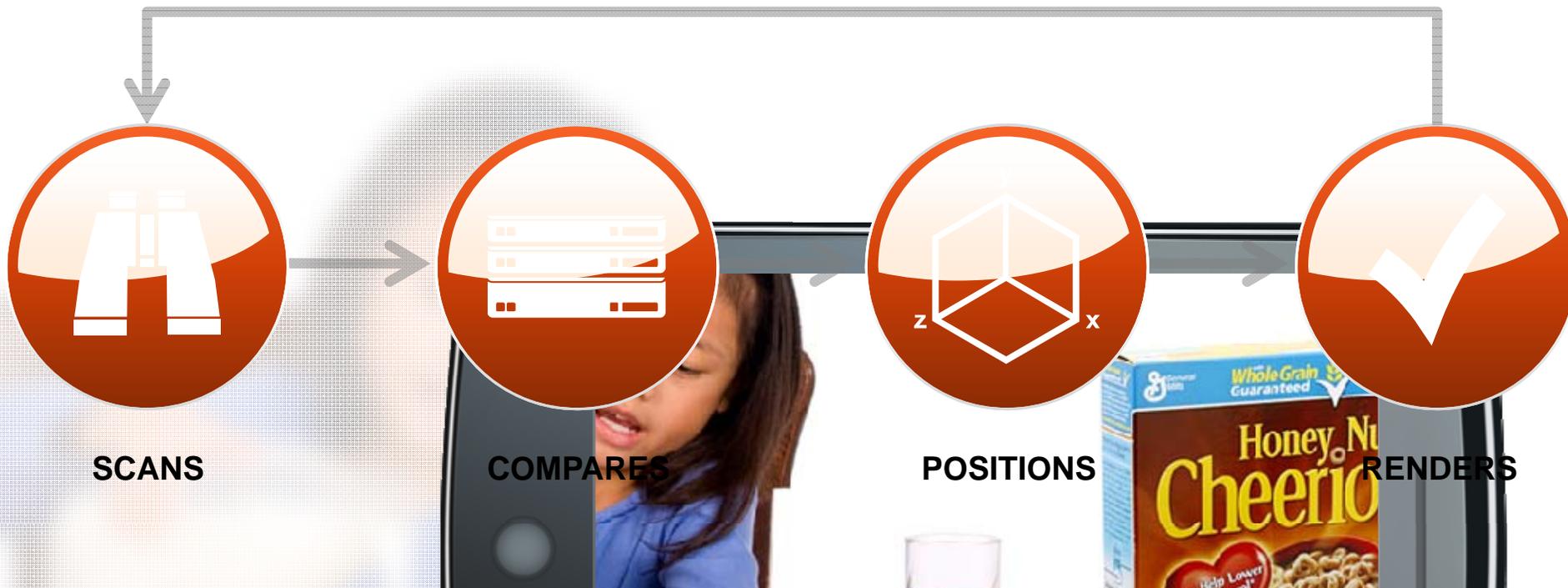
30+ times per second

Demo Developer Challenge!

Applications

Today

Gaming & Play

3D games in real world
environments vs. "game worlds"

Media / Advertising

Making print , outdoor, TV media, and product packaging
"come alive"

Instructional

Visualizing instructions
e.g. furniture assembly

In the future…

Navigation & Discovery

Visualizing points of interest

Social Networking

Placing photos, notes, "graffiti"
in real world for friends to find

Visual Search

Retrieving related information
from web for the object in view

Mobile AR Applications

- Navigational aids
- Tourism
- Entertainment
- Journalism
- Personal location-based information DB
- Social Networking
- General UI for appliances
- Construction
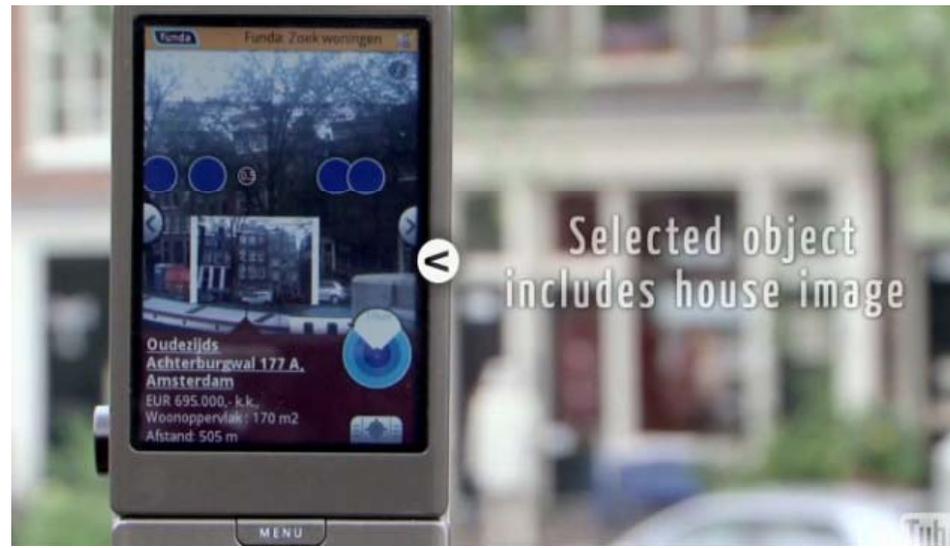- Maintenance
- Military training and war-fighting

Handheld Information Browsers

Wikitude
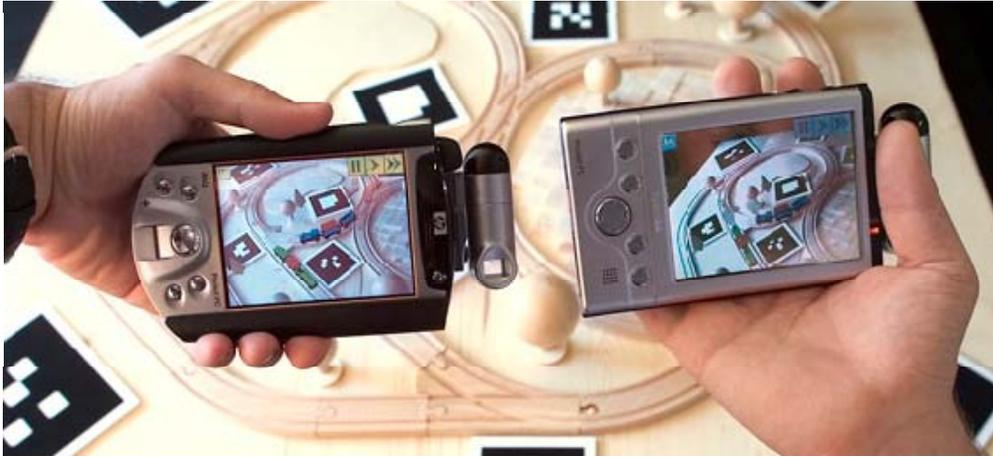Geo-referenced Wikipedia information

Peak.ar
overlays names of mountains

Layar
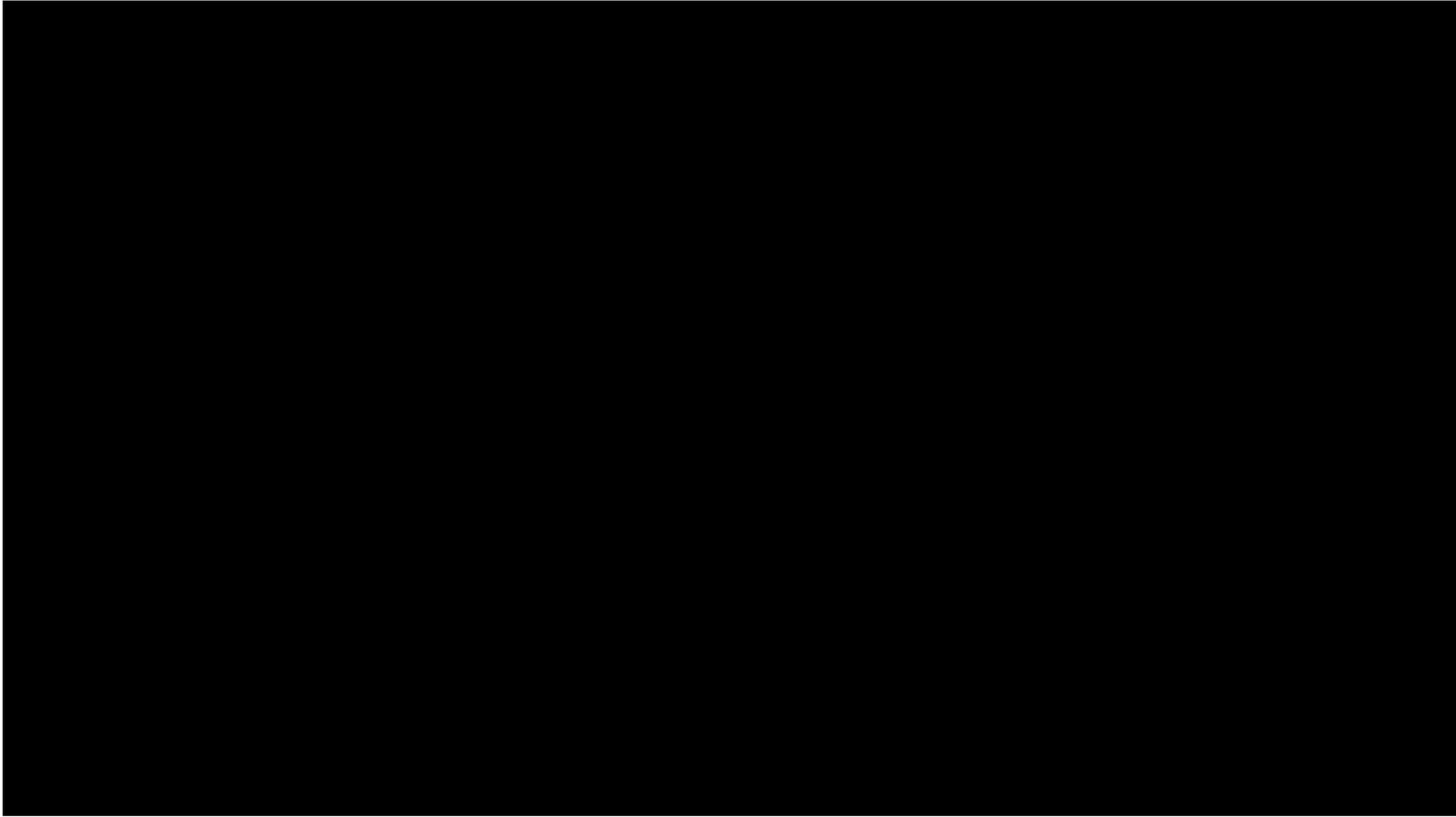Dedicated content layers

Games

Invisible Train, '04

MARQ, '07

Put-A-Spell, '09

Sony invizimals, '09

Arrrrrr!

Advertising, Marketing and Sales

WWF China "Fate's in your Hands"
Mobile Advertising
2'20"
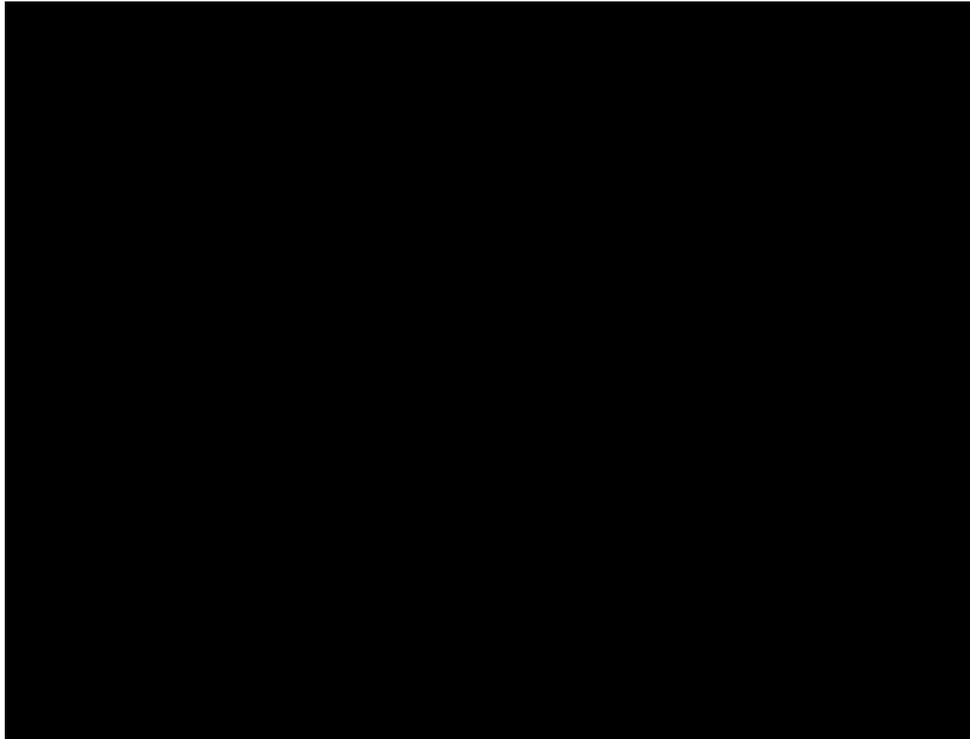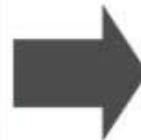
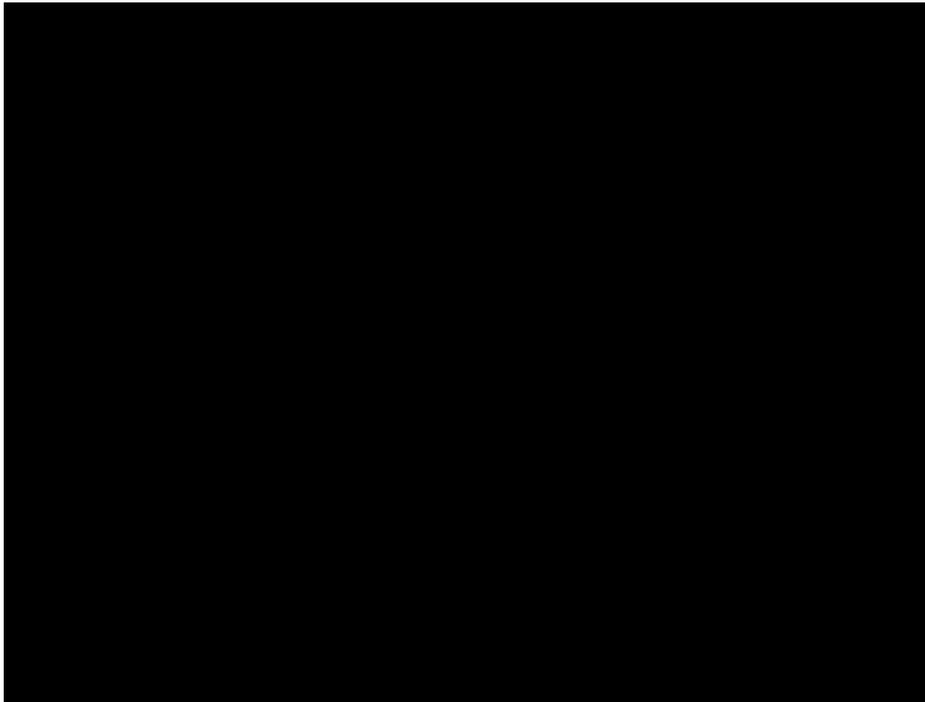# AR Navigation

Mobilizy, Wikitude Drive '11

Visual Search

Foodtracer

Google Goggles, '09

Location-based Social Networking

Augmented ID

Junaio

Thank you!