# Continguts

- Realitat Virtual
- **Augmented Reality**

# Introduction to AR

- Augmented Reality is a combination of a **real scene** viewed by a user and a synthetic **virtual scene** that augments the scene with additional information.
- AR environments differ from VEs in that we have access to both real and virtual objects at the same time.

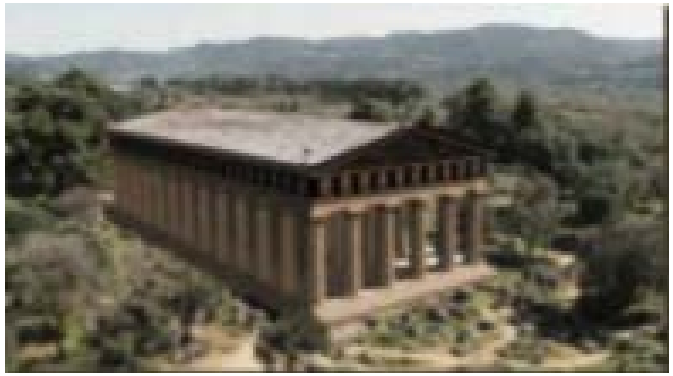
# Goal of AR

- Goal: enhance user **performance** and **perception** of the world.
- Challenge: keep users from **perceiving the difference** between the real world and the virtual augmentation of it.

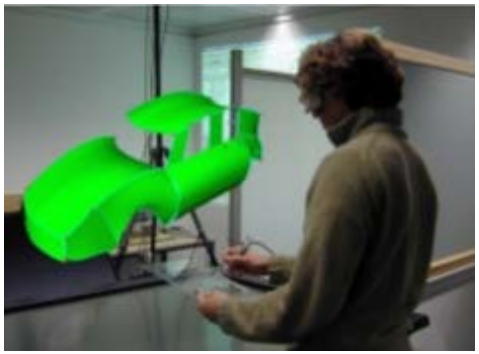
# Augmented Reality

# AR applications

- Archeology
- Entertainment



- Engineering design
- Consumer design



# Augmented vs Virtual Reality

## Augmented Reality

- System augments the real world scene
- User maintains a sense of presence in real world
- Needs a mechanism to combine virtual and real worlds

## Virtual Reality

- Totally immersive environment
- Visual senses are under control of system (sometimes aural and proprioceptive senses too)

# Augmented Reality

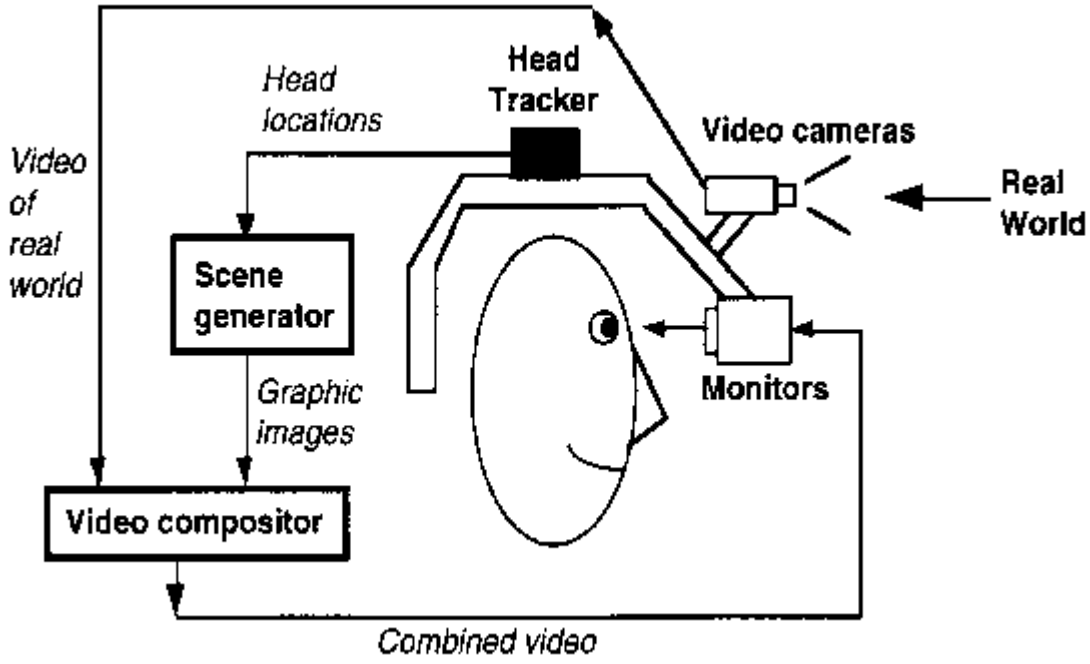
- The importance of object registration:
  - The computer generated virtual objects must be **accurately registered** with the real world in all dimensions.
  - Errors in this registration will prevent the user from seeing the real and virtual images as fused.
  - The **correct registration** must be maintained while the user moves about within the real environment.
  - Discrepancies or changes in the apparent registration will range from distracting (difficult to work with), to physically disturbing (unusable system).

# Augmented Reality

- There are basically three ways to visually present an augmented reality.
  - **Video see-through:** the virtual environment is replaced by a video feed of reality and the AR is overlaid upon the digitised images
  - **Optical see-through:** Leaves the real-world perception alone but displays only the AR overlay by means of transparent mirrors and lenses.
  - **AR projection** onto real objects.

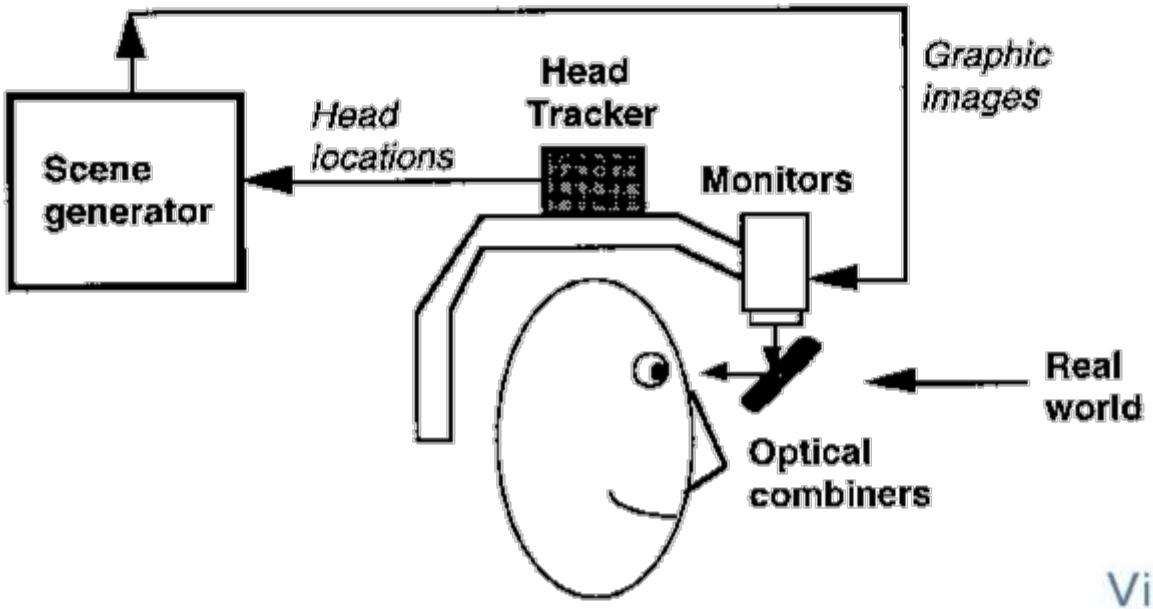
# Video see-through HMDs

- Video see-through
  - Use closed-view HMDs.
  - Combine real-time video from head-mounted cameras with virtual imagery.

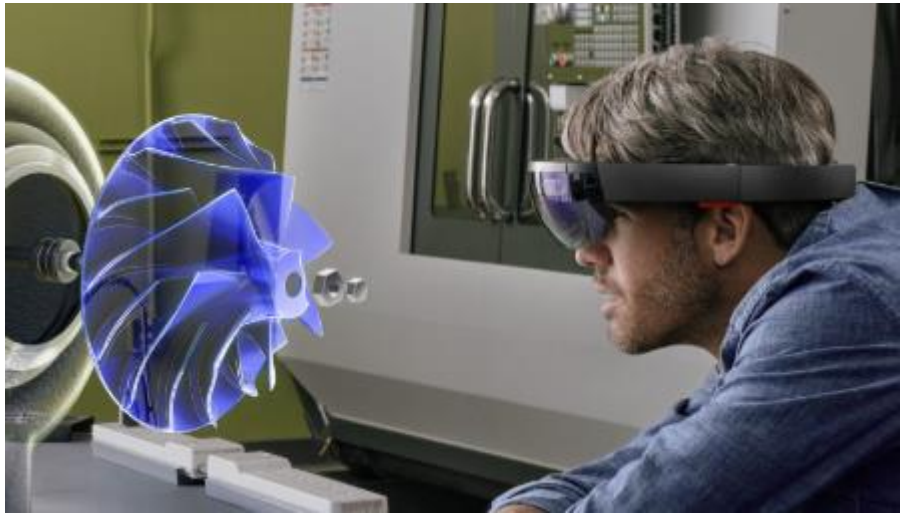


# Optical see-through HMDs

- The user sees the real world **directly**
- Make use of optical combiners:
  - Half-silvered mirrors (partially transparent, partially reflective)
  - Transparent LCD



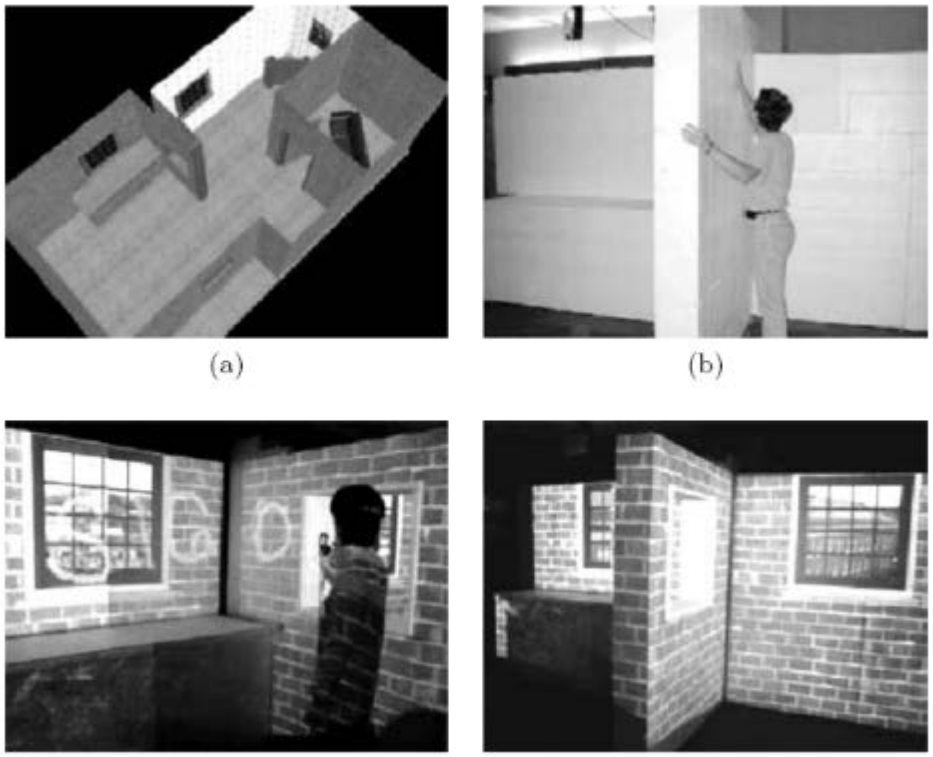
# Optical see-through HMDs

# Augmented Reality


# Projection-based spatial displays

- Images are projected directly into physical objects.
- Single static, single steerable or multiple projectors.



# Augmented Reality

- Projective displays. Advantages:
  - They do not require special eye-wear
    - Eye accomodation not required
  - They can cover large surfaces for a wide field-of-view

# Augmented Reality

- Projective displays. Disadvantages:
  - Projectors need to be calibrated each time the environment or the distance to the projection surface changes (crucial in mobile setups).
    - Fortunately, calibration may be automated
  - Limited to indoor use only due to low brightness and contrast of the projected images.
  - Occlusion or mediation of objects is also quite poor.

# RA: Videos

- Robust high speed feature tracking: ./RobustHighSpeedTracking_PC_v2.avi
- https://www.youtube.com/watch?v=UWXictuNowI

Professors d'IDI - UPC

# Interacció i Disseny d'Interfícies