Chapter IX

Introduction to Virtual Reality

Introduction to Virtual Reality

- 9.1 – Introduction
- 9.2 – Hardware
- 9.3 – Virtual Worlds
- 9.4 – Examples of VR Applications
- 9.5 – Augmented Reality
- 9.6 – Conclusions

CS 397 Course: *Introduction to Virtual Reality, Bill Sherman,* Beckman Institute, wsherman@ncsa.uiuc.edu

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9.1 – Introduction

- Immersion in another reality
- Medium
  - book
  - movies – television
  - computers
    - Games
    - Flight simulators
    - etc.
- Child of computer image generation

Definition of VR
(W. Sherman)

- a medium composed of interactive computer simulations that sense the participant's position and actions and replace or augment the feedback to one or more senses, giving the feeling of being mentally immersed or present in the simulation (a virtual world)

Media of VR

- Television
- Flight Simulators
- Video games
- Cameraphones
- Video conference
- Internet
- Theater for VR (CAVE)

Concepts

- Immersion (mental or physical)
- Virtual Environment
- Virtual Experience
- Virtual Presence
- Telepresence
- Avatar

Relations with cyberspace

| characteristics media	Where?			Who?		Physical Immersion?		Mental Immersion?		Computer Required?		Interactive?	
	RW Here	RW There	Virtual World	Me	We	Yes	No	Yes	No	Yes	No	Yes	No
✳ Virtual Reality			✓	✓	✓	✓		?		✓		✓	
Augmented Reality	✓			✓	✓	✓				✓		✓	
Telepresense		✓		✓		✓					✓	✓	
Teleoperation		✓		✓			✓				✓	✓	
✳ Telephone			✓		✓		✓	✓			✓	✓	
Novel			✓	✓			✓	✓			✓	✓	
Interactive Fiction			✓	✓			✓	✓	✓			✓	
✳ Online Chat			✓		✓		✓	✓	✓			✓	
Live TV Documentary		✓		✓	✓		✓	✓			✓		✓
TV Situation Comedy			✓	✓	✓		✓	✓			✓		✓
Cyberspace			✳		✳			✳				✳	

Augmented Reality

- A kind of virtual reality in which additional information, even imperceptible by humans becomes perceptible in the virtual physical world
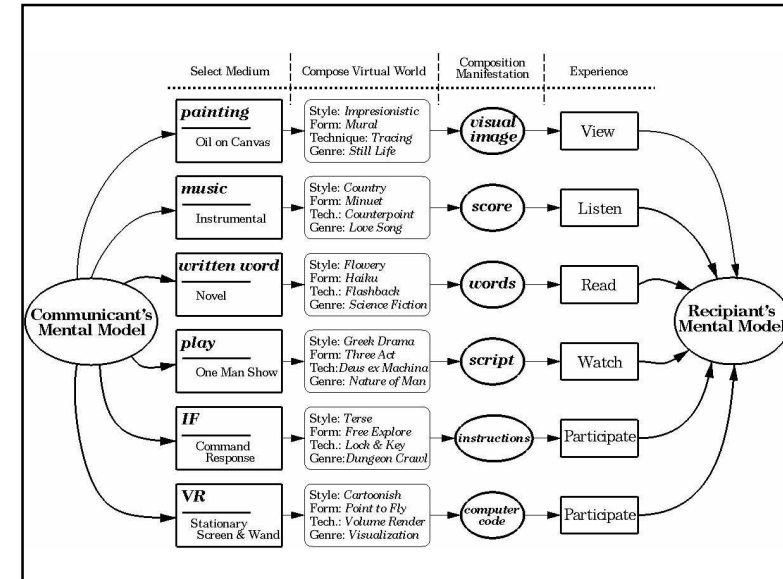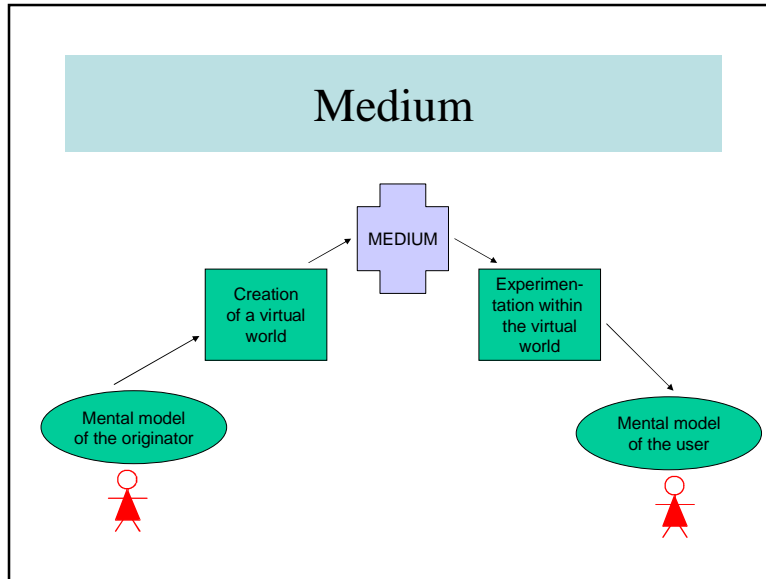
Medium

Interfaces with the virtual world

- A medium must allow the access to the real world thru an interface
- This interface must be effective
- Any virtual world can be accessed via various types of interfaces
- Some modifications can be possible on the virtual world and on the interfaces
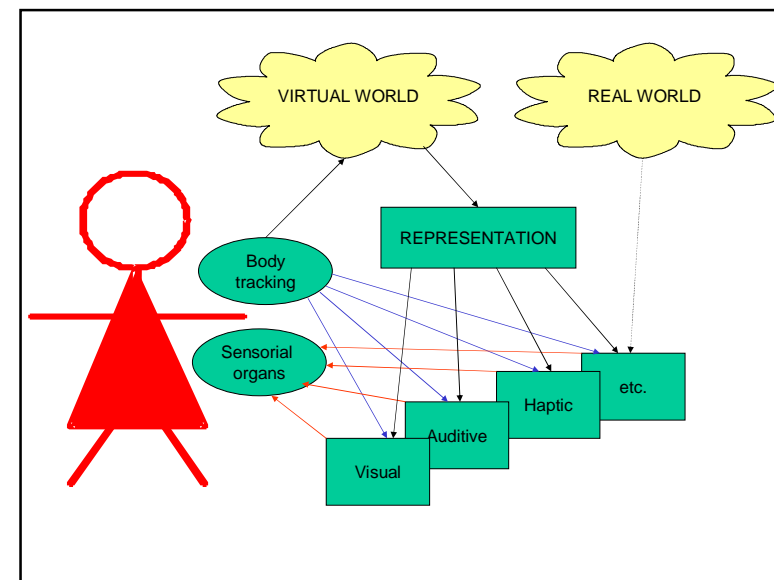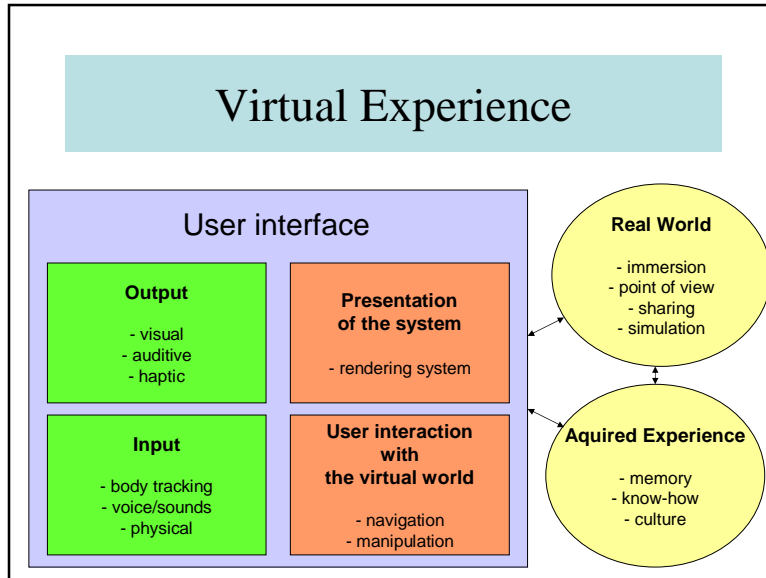
Example
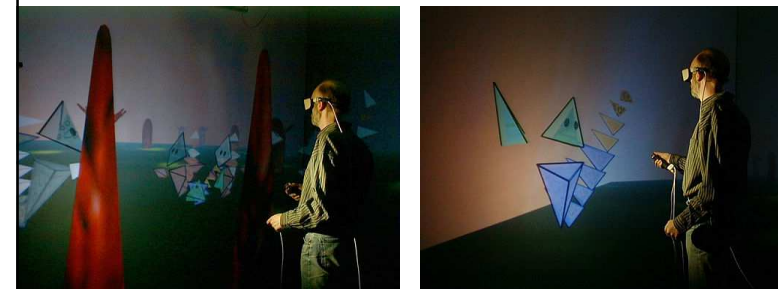
Other examples

Common applications

- Scientific visualization
- Game
- Training (ex flight, medicine, etc.)
- Analysis of production processes
- Prototyping
- Interactive history
- Archeology

Software aspects

- Determination of the scene by a set of primitives (terrain, objects, etc.)
- Interface with devices (inputs, outputs)
- Simulation of the physical world
- Rendering computation in real time

Virtual Experience

User interface

Output
- visual
- auditive
- haptic

Presentation of the system
- rendering system

Input
- body tracking
- voice/sounds
- physical

User interaction with the virtual world
- navigation
- manipulation

Real World
- immersion
- point of view
- sharing
- simulation

Aquired Experience
- memory
- know-how
- culture

9.2 – Hardware

- Tracking
  - Head movement
  - Hand and finger movement
  - Eye movement
  - Torso movement
  - Leg and foot movement

Equipment

VR Systems

Virtual workbench (Stanford)

CAVE (Mechdyne company)
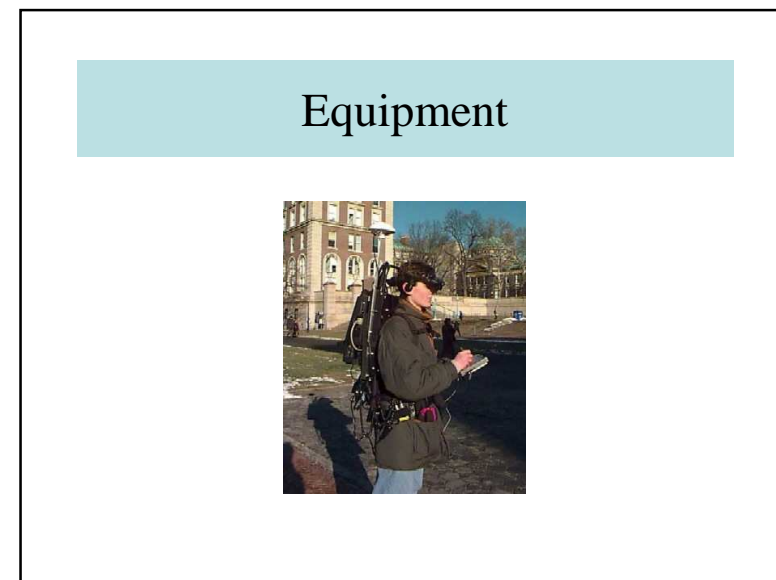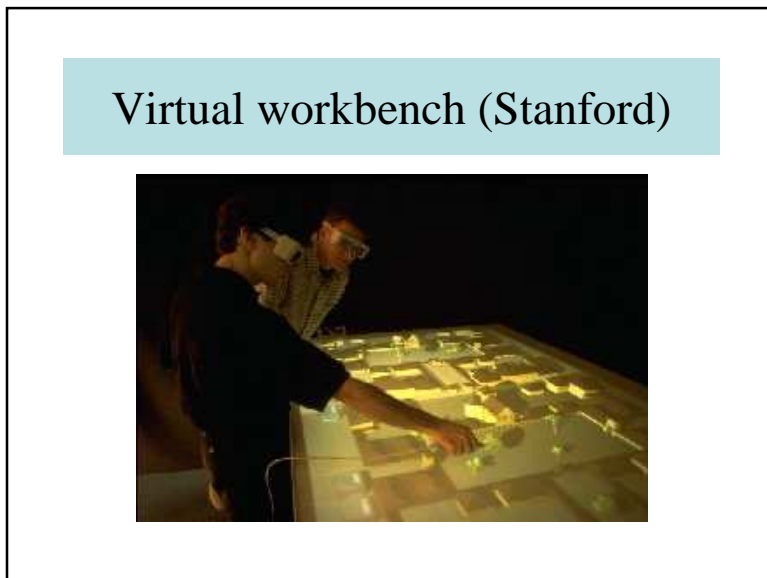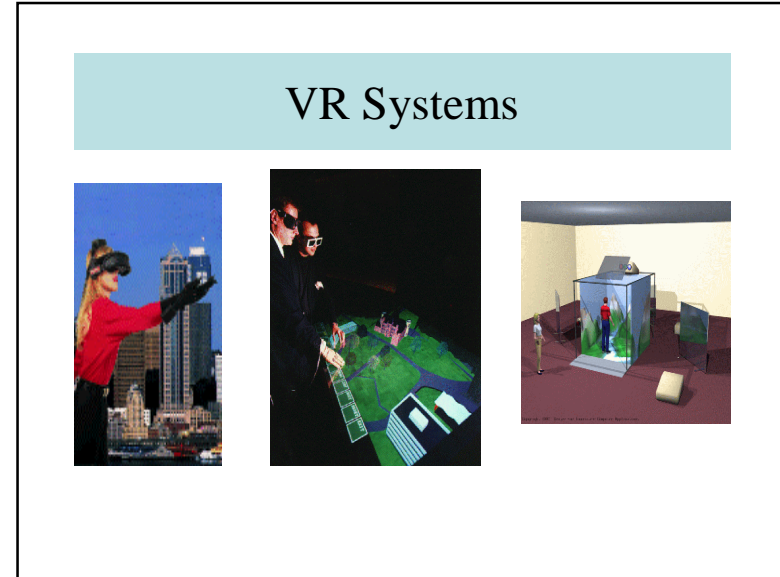
9.3 – Virtual Worlds

- Representation of a virtual world
  - Choice of representation
  - Human perception
  - Likelihood
  - Semiology
  - Substitution of sensations

Human Perception

- Filtering
- Air vibration (sounds, etc.)
- Speed of image changes
- Other sensations

Likelihood

- Appearance of truth

- Avoid user's disappointment

- Consistent world

From likelihood to language
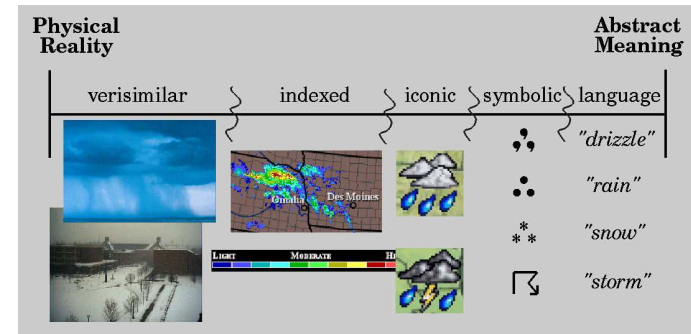
From real world to virtual reality

Physical Reality				Abstract Meaning
verisimilar	indexed	iconic	symbolic	language

Auditive Representation

- Importance of sounds and noise
- Voice
- Ambient sounds
- Jingles
- etc.

Haptic Representation

- Difficulty of Abstraction
- Temperature
- Sensation of hardness, of strength, etc.
- Odors ?
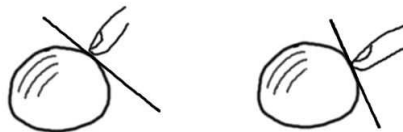
Sensations
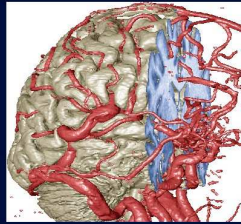
9.4 – Examples of VR Applications

- Flight simulators

- Medicine

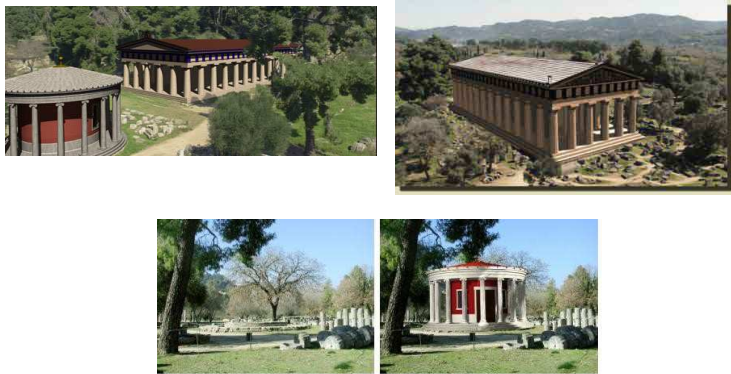- Archeology
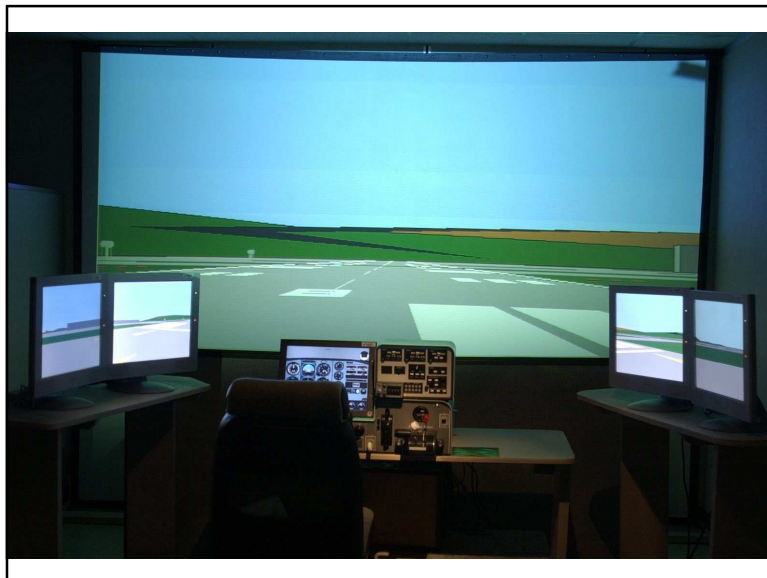
Archeoguide
http://archeoguide.intranet.gr/

© 2001 Archeoguide

ARCHEOGUIDE (Augmented Reality based Cultural Heritage On-site GUIDE)
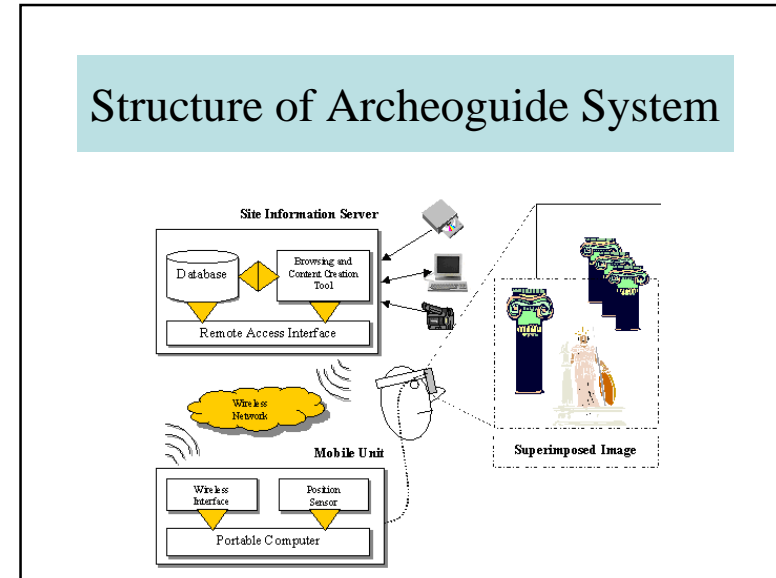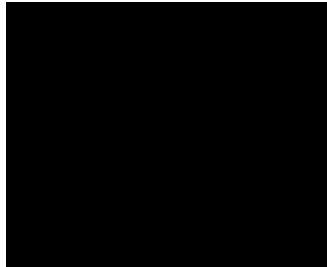
Structure of Archeoguide System
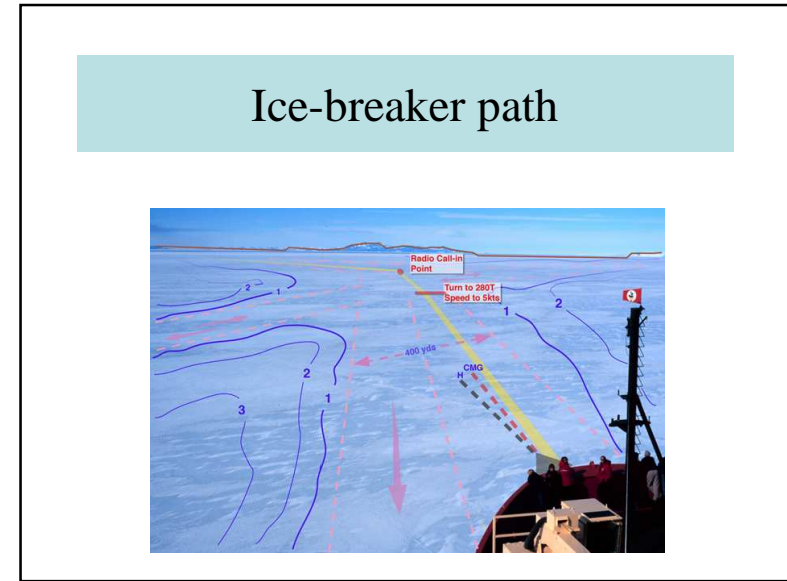

Examples

Virtual Pompei
http://www.virtualpompei.it/homepage.htm

Virtual Pompei

- http://video.google.com/videosearch?um=1&hl=fr&lr=&q=virtual%20reality%20pompei&ie=UTF-8&sa=N&tab=iv#

9.5 – Augmented Reality

- Addition of elements which are imperceptible or invisibles
  - Various information
  - Textual, graphic, etc.
  - Mixture of past/future

http://www.howstuffworks.com/augmented-reality.htm

Reality and augmented reality

http://www.nottingham.ac.uk/aims/ar-seminar/imain.htm

Ice-breaker path

Reconstitution of an object

Visualization of Possibilities issued from Land Use Plan
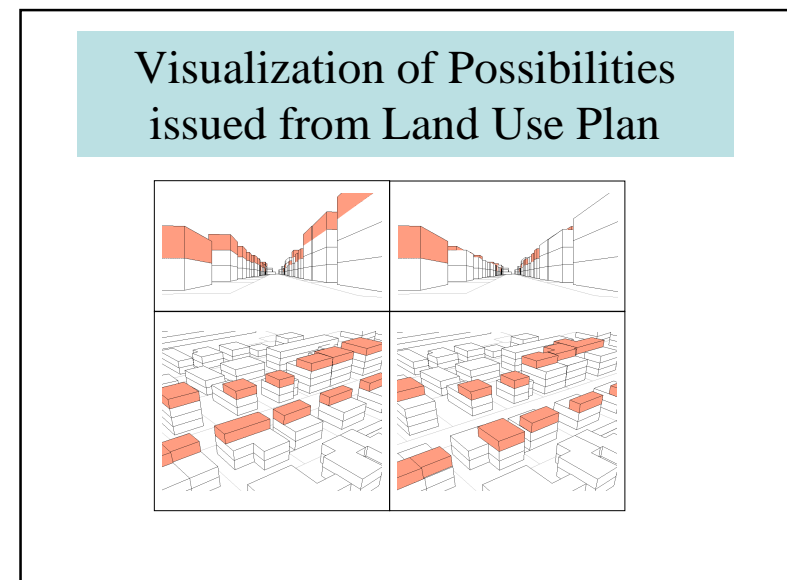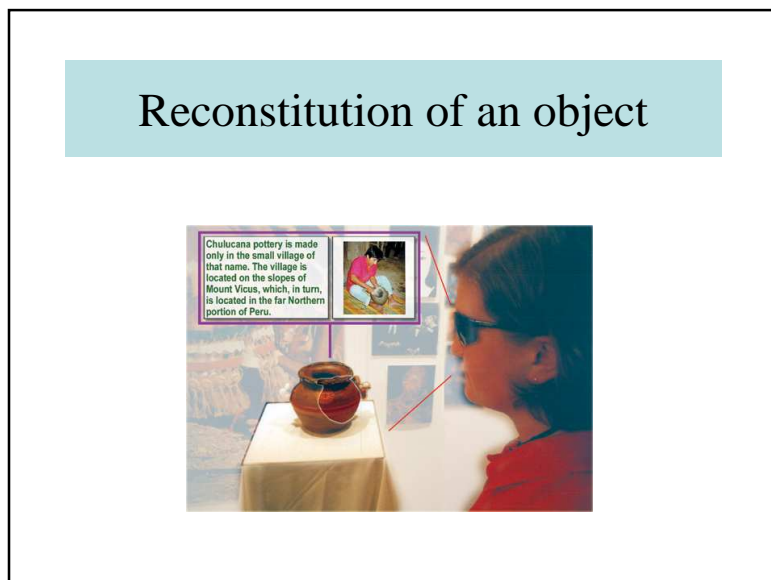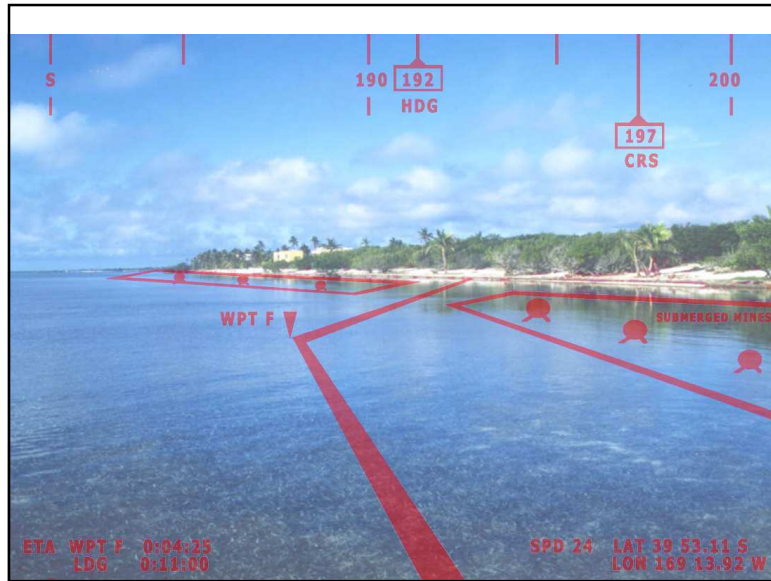
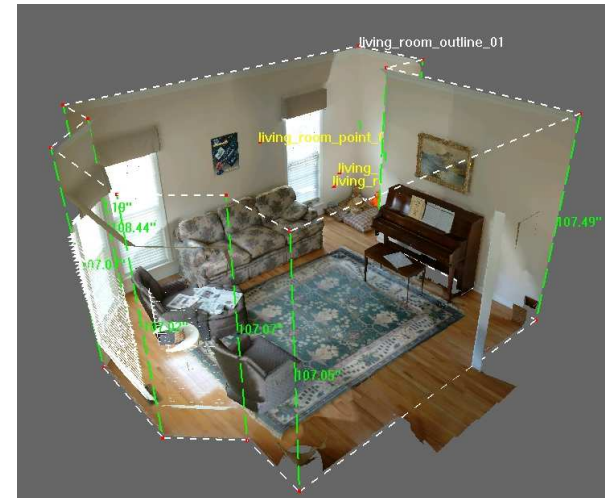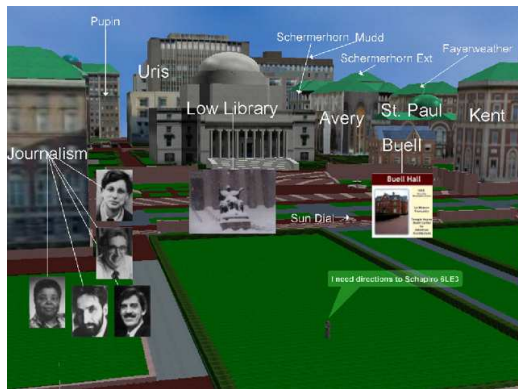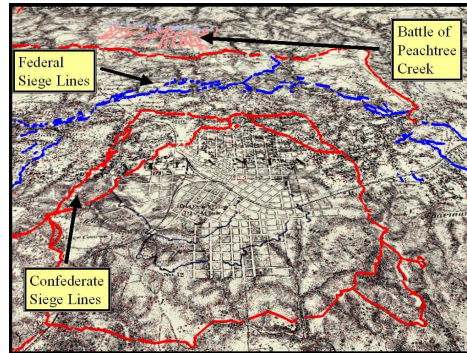## URL anchored on a building

3D annotations

3D annotations

Reconstitution of a battle

9.6 – Conclusions

- From computer image generation to virtual reality

- Not only visual, but also other sensations

- Addition of complementary information