HUMAN EMBODIMENT IN TELE-OPERATION DRIVING TASKS

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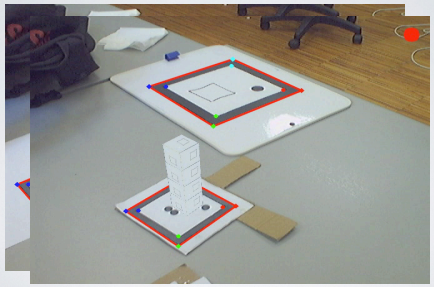
TELE-OPERATION & IMMERSIVE SYSTEMS

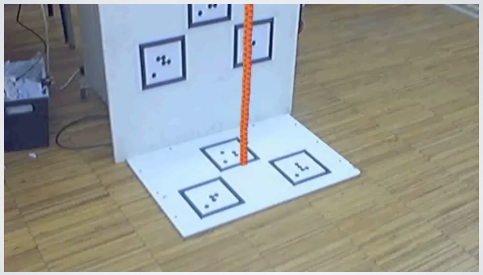
IMMERSIVE SYSTEMS

- Immersion can also be defined as the state of consciousness where a "visitor" (Benayoun)'s awareness of physical self is transformed by being surrounded in an artificial environment;
- Augmented Reality brings virtual objects or characters to the user's physical space.

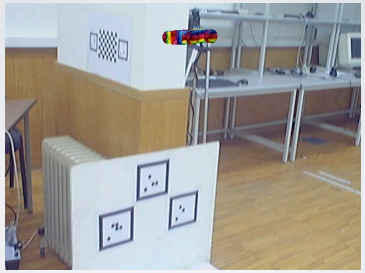
PHYSICAL INTERACTION



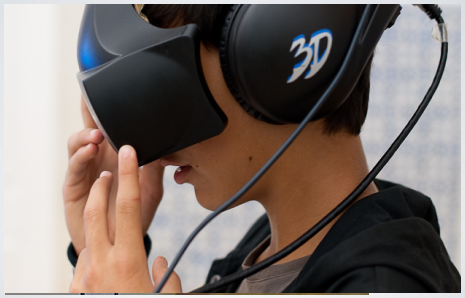
CREATING THE FEELING OF HAVING NEARBY VIRTUAL OBJECTS



CAN HAVE DYNAMIC OBJECTS AROUND



CREATING SENSATIONS OF BEING **CLOSE** TO SOMETHING



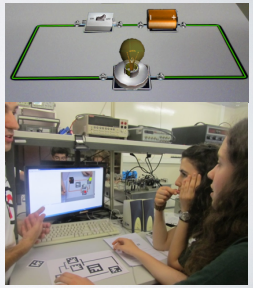
APPLICATIONS

- If people feel that virtual objects that appear in nearby places are really there,
- and they react to those presence feelings, then
- **this can be exploited in applications like the treatment of post-traumatic stress, phobias, or any condition whose therapeutic practices are based on exposure to the disturbing elements.**

LEARNING APPLICATIONS

Learning is another important field that may benefit from virtual or augmented reality support. Examples are:

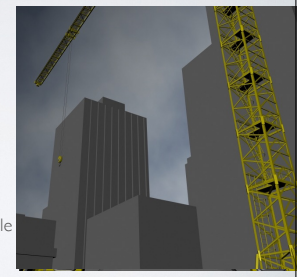
- Virtual laboratories
- Virtual visits
- Virtual setups/environments



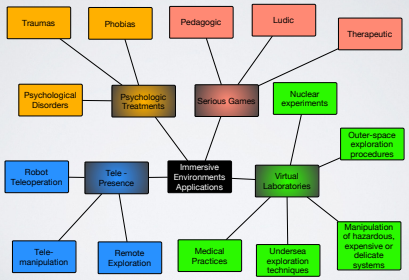
TRAINING

Advantages

- No injury risks
- No damaging risks
- Can still provide the sensation of having seen, done, or being there.
- The possibility of doing multiple tentatives till perfection.

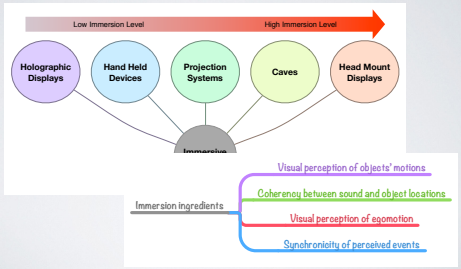


A GROWING FIELD OF APPLICATIONS



FOOLING OUR SENSES. HOW?

IMMERSION LEVELS

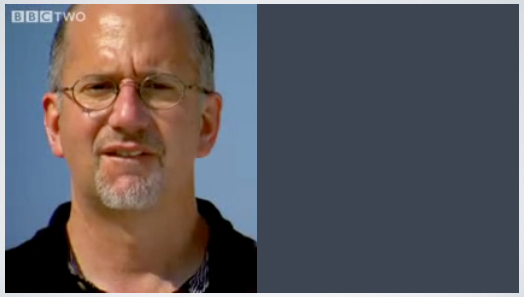


HOW TO CREATE

EVEN MORE

CONVINCING EXPERIENCES?

MC GURK EFFECT



FOOLING OUR SENSES

- The McGurk effect shows that we can fool our senses,
  - by combining the appropriate stimuli.
- But there is more…

RUBBER HAND ILLUSION

EMBODIMENT IN TELE-OPERATION

- Trying to make the user control the robot as if controlling his own body.
- Two tentative approaches:
  - Deictic gestures,
  - Intention from body poses.

EMBODIMENT IN TELE-OPERATION

Detecting Deictic Gestures

EMBODIMENT IN TELE-OPERATION

The robot motion is controlled using natural deictic gestures and the camera orientation is directly controlled using user's head pose (HMD)

EMBODIMENT IN TELE-OPERATION

Detecting intentions from body expression (pose)

EMBODIMENT IN TELE-OPERATION

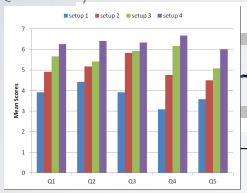
The robot motion is controlled using natural body posture intentions and the camera orientation is directly controlled using user's head pose (HMD)

EVALUATION

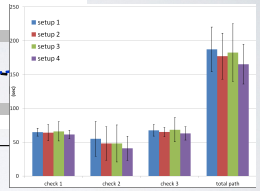
- Is the proposed interaction mechanism any good?
- Which is better?
- How to Evaluate?
  - Questionaries
  - Measuring User Performance

RESULTS

Questionary



Performance



1- screen + joystick
2- HMD + joystick
3- HMD + deictic gestures
4- HMD + body intention

FROM EMBODIMENT TO EMBARKMENT

- The aim is to virtually place the user onboard of the tele-operated vehicle.
- This will have the benefits that the user can have similar sensations to those experimented while driving a car.
- The experienced "first person view" will also simplify the learning phase.

FROM EMBODIMENT TO EMBARKMENT

- Using Augmented Reality principles.
- The user, wearing an HMD, will see the images stemming from an onboard remote camera.
- The **Camera pointing direction** is controlled directly from the **head movements**.
- A Virtual Cockpit will be superimposed.

IN A IMMERSIVE COCKPIT

- That enables to create Telepresence feeling that enables the user to:
- Pilot the robot (virtually) from its cockpit
- as naturally as driving his/her own car

VIEWING THROUGH A CAMERA ON A PTU

EGOCENTRIC VIEW CONTROL

THE HEAD'S MOVEMENTS ARE APPLIED TO THE PAN AND TILT UNIT CREATING A SENSE OF IMMERSION

VIRTUAL COCKPIT

- A Virtual Cockpit will show the camera images as if they are the view seen through a virtual "windshield".
- This windshield may also contain informative elements related with the mission.
- And virtual control panels can be mixed with the real control devices such as joysticks, buttons, and more.

VIRTUAL INFORMATIVE ELEMENTS

IMMERSIVE VIRTUAL COCKPIT

WE CAN CREATE ANY TYPE OF INDICATOR OR WARNING TO TAILOR THE INTERFACE AS REQUIRED

THE USER CAN STILL SEE THE CONTROLS

INTUITIVE NAVIGATION CONTROLS

EXTENDING USER PERCEPTION

- The immersion can be completed by including:
  - Spatial audio
  - Haptic feedback
- This can be used to extend the user perception of any obstacles or to attract his attention to warning signs.

HAPTICS FOR SPATIAL AWARENESS

NEXT STEP

- Hopefully integrate with Prof. Pedro Sanz's Underwater Robots.
  - (trying to convince him)

DO NOT FORGET

- Interactive systems are meant for users not for the designers.
- You need to know
  - which are the user real needs?
  - which are the user abilities?
  - the details of the activities to be performed. What & how?

KNOWING THE USER

- Cognitive processes
  - Attention
  - Perception and Recognition
  - Memory
  - …
- Dexterity
- Natural gestures or postures
- …

IN CONCLUSION

- Interactive systems and in particular Interactive Robotics goes far beyond automated responses to human commands.
- That's why we see more and more specialists from other areas such as psychology, linguistics, philosophy, etc., in conferences on robotics.