ARC NIEVE & ADT Interact3D

Journées Scientifiques 2011

A. Bousseau, EPI REVES,
CRI Sophia-Antipolis Méditerranée

ARC NIEVE

- Navigation and manipulation in Virtual Environments (VEs)

- Virtual environment setup to study emotions

ADT Interact3D

- Software for experimentation in Virtual Reality
  - New audio-visual applications
  - Animated virtual animals (fear of dogs)

- Support for research at Sophia-Antipolis and INRIA at large
  - Extend and develop new features for VR platform

ARC NIEVE/ADT Interact3D

- ADT Interact3D:
  - 50% NIEVE
  - 50% Immersive Space (with DREAM)

- Bootstrap VR activities at REVES and in Sophia-Antipolis for their further development

Participants

- Partners (ARC NIEVE/ADT Interact3D):
  - REVES - Rendering (G. Drettakis)
  - IRCAM/CNRS - Neuroscience (I. Viaud-Delmon)
  - VR4I - Virtual Reality/Interfaces (A. Lecuyer, M. Marchal)
  - DREAM - Support (J-C Lombardo)
- Postdoc
  - P. Vangorp (REVES)
- Engineer
  - A. David (ADT Interact3D)
- Students
  - G. Cirio (VR4I)
  - M. Cabral, E. Chapoulie, G. Chaurasia (REVES)

ARC NIEVE

ARC NIEVE: Research Projects

1. A Multimode Immersive Conceptual Design System for Architectural Modeling and Lighting

2. Study of phobia of Dogs in an audiovisual immersive space

3. New navigation paradigms for restricted immersive spaces

4. Effect of gestures and lighting in the sense of presence

# 1. A Multimode Immersive Conceptual Design System for Architectural Modeling and Lighting

Marcio Cabral, Peter Vangorp, Gaurav Chaurasia, Emanuelle Chapolie, Martin Hachet, George Drettakis
INRIA Sophia Antipolis, INRIA Bordeaux

(presented at IEEE 3DUI 2011)

Overview

- Immersive interface to provide simple conceptual architectural design, including lighting
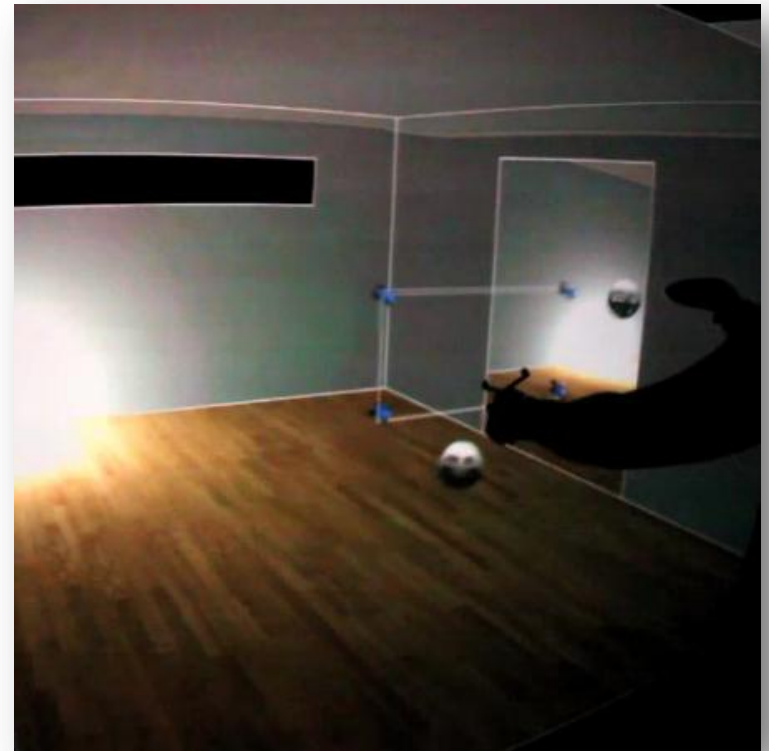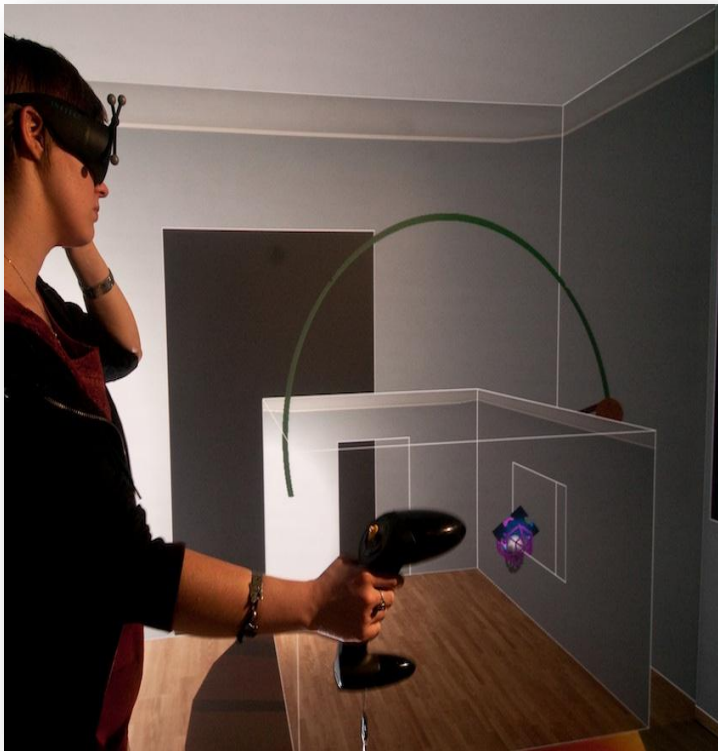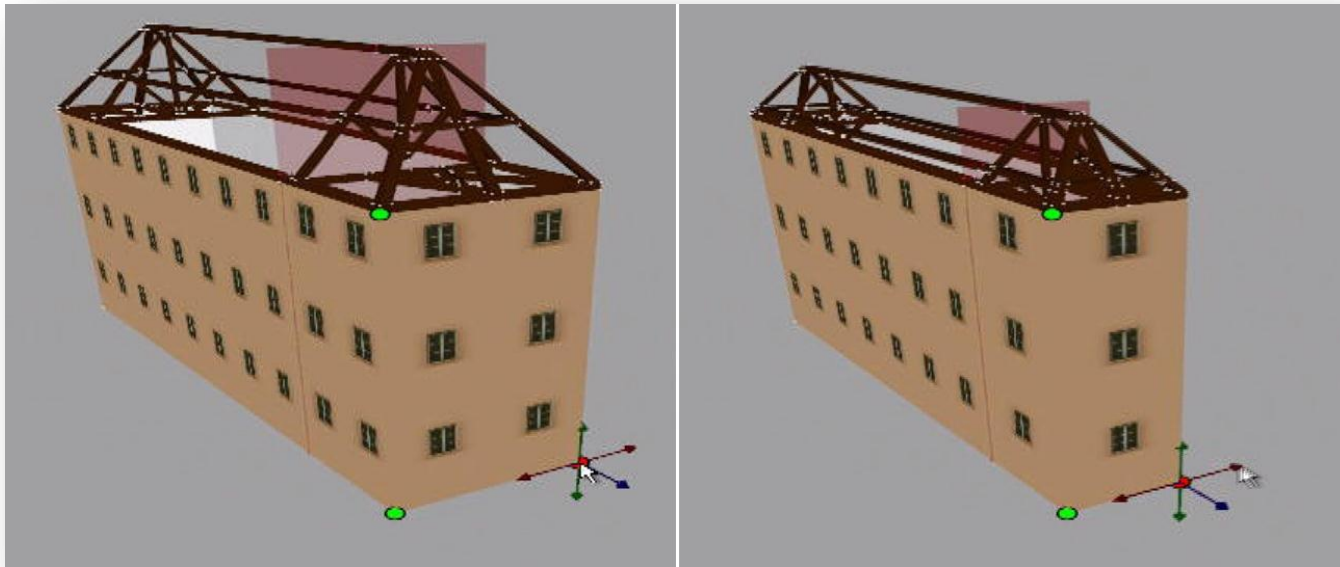
Inspiration

"World Builder" by Bruce Branit

Architectural design

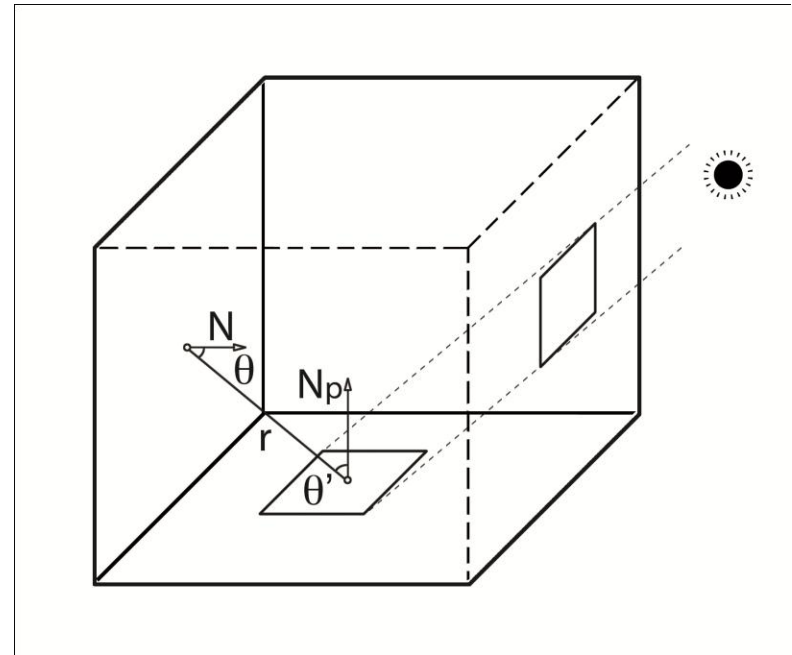*"Structure Preserving Reshape for Architectural Scenes"*
[Eurographics 2009]

The 3D shape is preserved by solving a constrained linear system which encompasses the characteristics of the model

Lighting Design

- Simple approximation to simulate global illumination

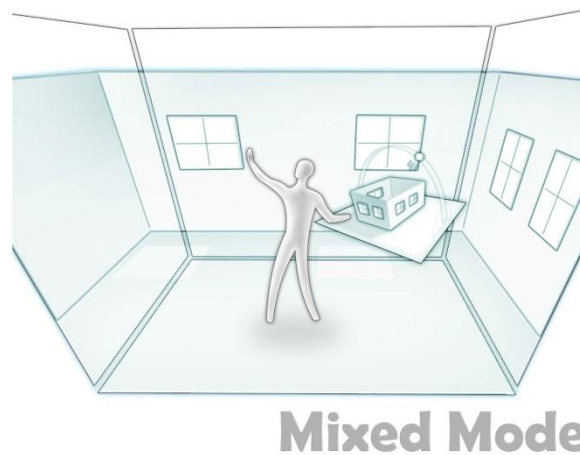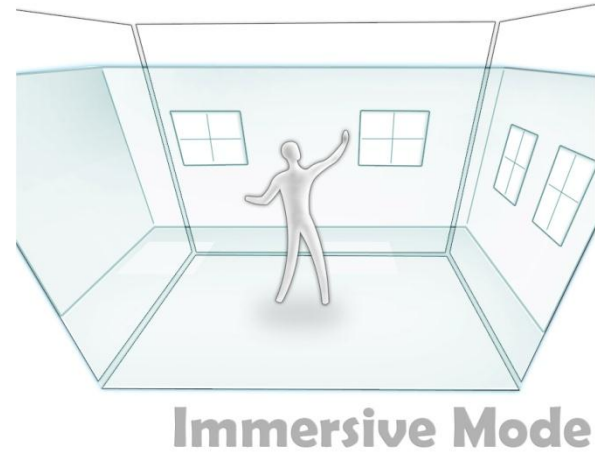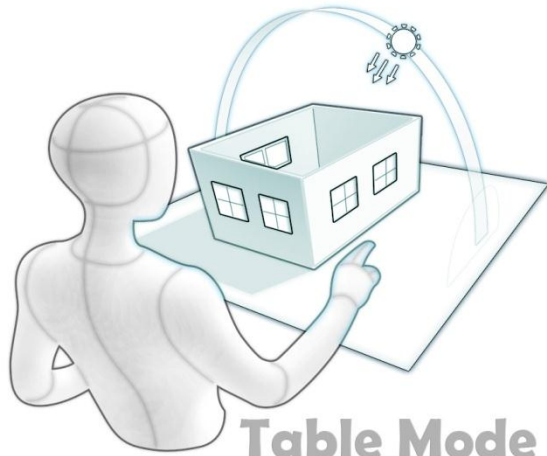$$F_{x,P} = \int_{y \in P} \frac{\cos\theta \cos\theta'}{\pi r^2} V(x,P) dy$$

Basic Usage

A Multimode Immersive
Conceptual Design System for
Architectural Modeling and Lighting

M. Cabral[1], P. Vangorp[1], G. Chaurasia[1],
E. Chapoulie[1], M. Hachet[2] and G. Drettakis[1]

[1]REVES/INRIA Sophia-Antipolis
[2]IPARLA/INRIA Bordeaux

Interaction Modes

Table Mode

Immersive Mode
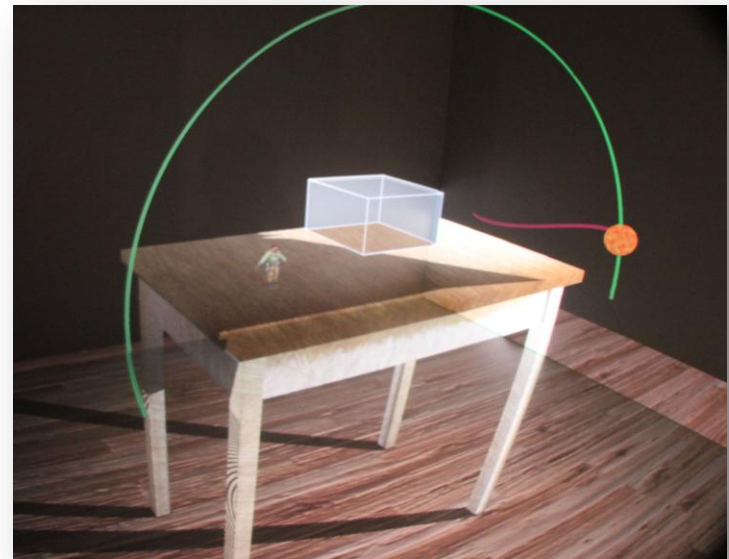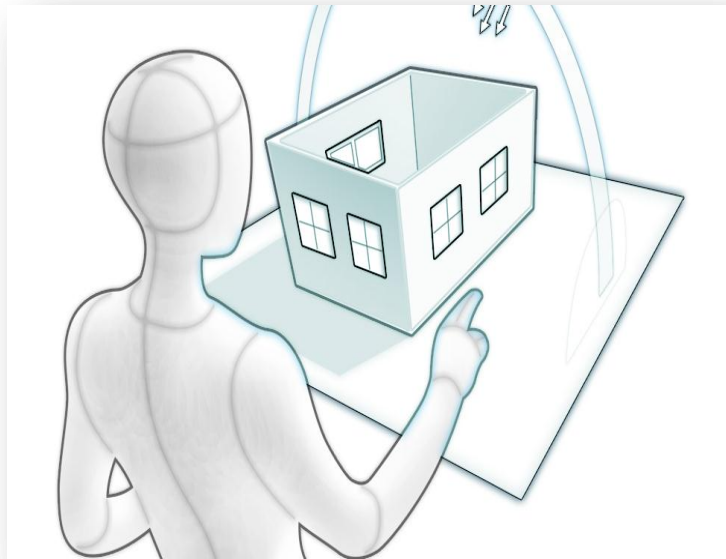
Mixed Mode

Table Mode

- Exocentric view / interaction
- Table top design: the user stands in front of a table

Immersive Mode

- Egocentric mode
- The world is displayed at a 1:1 scale
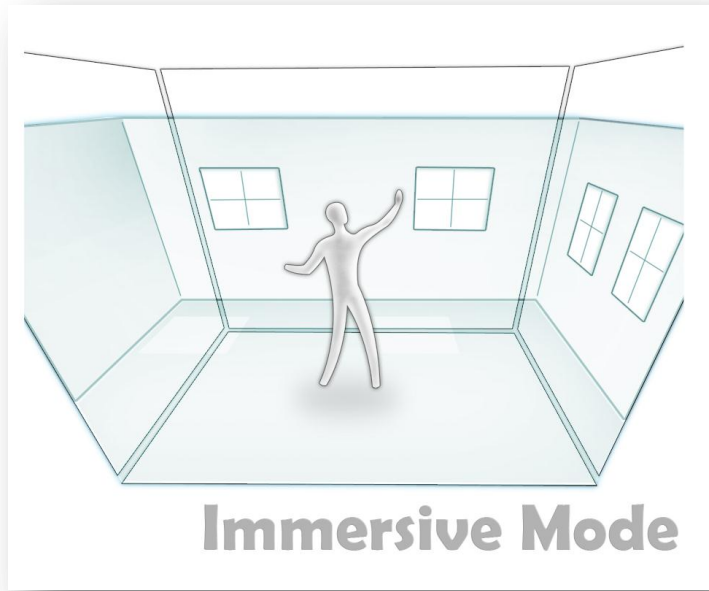
Mixed Mode

- Combination of the two previous modes

Mixed Mode
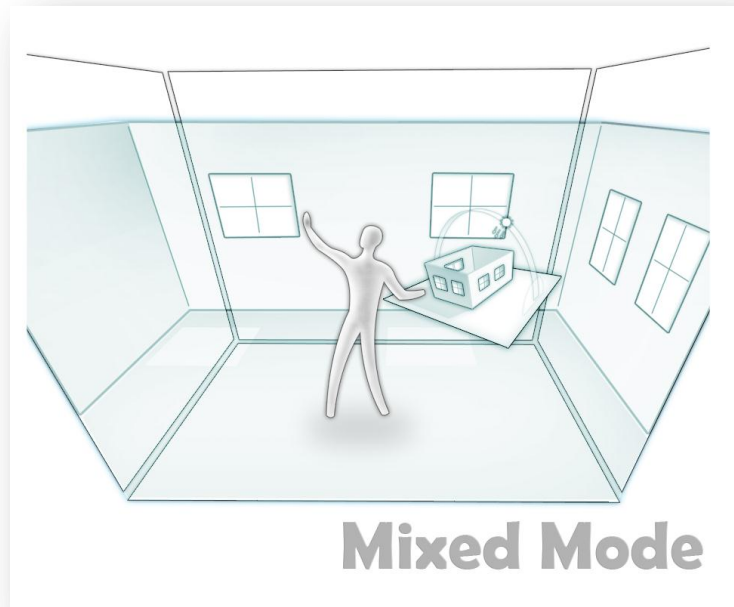
Changing modes and interacting

Pilot Study

- Objectives
  - *What is the general feeling about such a system ?*
  - *Can users perform basic tasks easily ?*
  - *Which mode should be preferred ?*

Experimental Results

- Subjects enjoyed using the system

- Users had a slight preference for Table mode

- No particular mode proved to be superior
  - Immersive was more accurate for area operations
  - Editing was mainly performed in exocentric mode
  - Immersive mode was used for inspection

Future work

- Improve interaction techniques and features

- More accurate real time global illumination for interactive lighting design

- Conduct comprehensive user studies

ARC NIEVE: Research Projects

1. A Multimode Immersive Conceptual Design System for Architectural Modeling and Lighting

2. Study of phobia of Dogs in an audiovisual immersive space ➔ more details in the 2nd part

3. New navigation paradigms for restricted immersive spaces

4. Effect of gestures and lighting in the sense of presence

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# 3. Navigation Paradigms in Spatially restricted immersive spaces

G. Cirio, P. Vangorp, E. Chapoulie, M. Marchal, A. Lecuyer, G. Drettakis

VR4I, INRIA Rennes, REVES, INRIA Sophia-Antipolis

Context

- Real walking in a virtual environment
  - Natural, intuitive, immersive

- …within restricted real workspaces…
  - CAVE
  - HMD with tracking

- …for different applications
  - Industry
  - Training
  - Entertainment
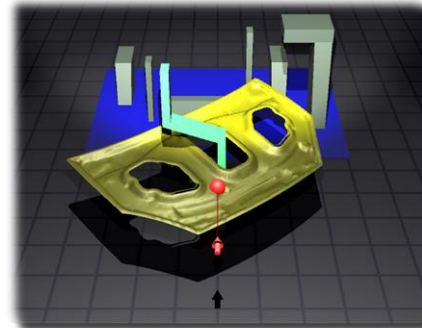
Context

- Restricted workspaces have limits…
  - In translation (walls)
  - In rotation (missing screens)

- …so walking raises several issues
  - Safety problems
  - Blocking situations
  - Breaks of immersion

- Objectives
  - Keep the user **safe**
  - **Walk** whenever possible
  - Provide an **enjoyable** and ecological paradigm
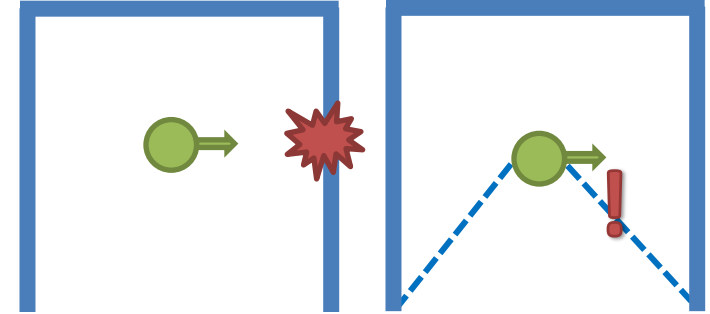
Three novel navigation techniques

- Three novel metaphors
  - Constrained Wand & Signs
  - Extended Magic Barrier Tape
  - Virtual Companion

- A common approach with 2 components
  - A warning technique
    - Visual cues
  - A navigation technique
    - Hybrid position/rate control

- Constrained wand & signs

Three novel navigation techniques

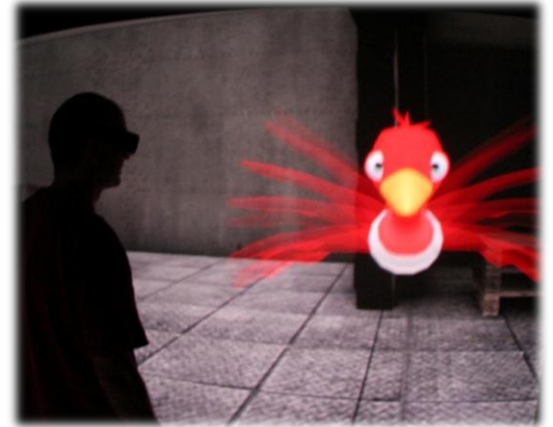- Extended Magic Barrier Tape

Three novel navigation techniques

- Virtual Companion

- Two different tasks
  - Pointing task: move to a target
  - Path following task: follow a path (circle, zigzag)
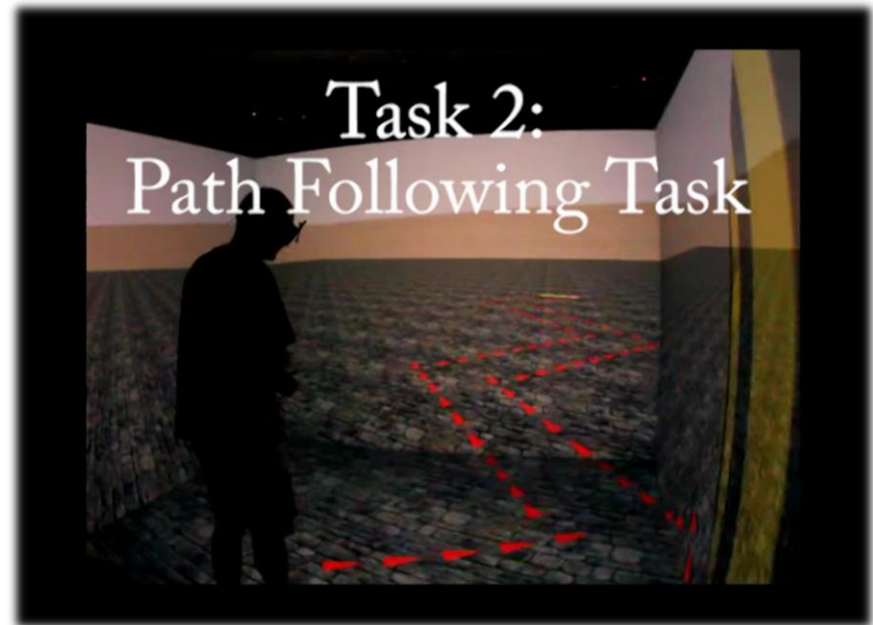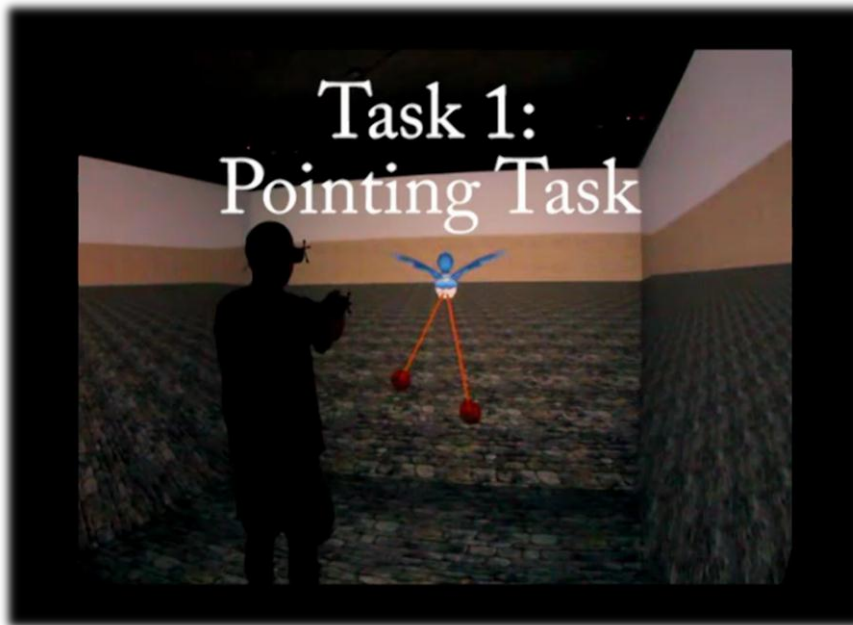
Main findings

- Virtual Companion spent more time away from boundaries (safe)…

- … but lower physical walking distance

- Virtual Companion more fun than others

Future Work

- Developing the Virtual Companion paradigm
  - More « intelligent » companion, with contextual reactions
  - A human-like creature for further interaction and immersion

- Adding modalities to the metaphors
  - Acoustic feedback
    (Warning sounds, oral feedback from the Virtual Companion)
  - Haptic feedback
    (When pushing on the Magic Barrier Tape)

- Further evaluations
  - In different VR setups
    - Larger CAVEs
    - Head-Mounted Displays
  - For different concrete VR applications
    - Industry, medicine, architecture
    - Context-based metaphors adapted to the field

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4. Study of gesture-based interaction in Immersive Environments

- Project currently starting
- Goals:
  - Study if natural gestures help the sense of presence
  - Study the relative effect of gestures and lighting realism
- First steps:
  - Interior design application with simple gestures (pushing, lifting, dropping objects etc.)

Questions ?

End of ARC NIEVE presentation

ADT Interact3D

ADT Interact3D

- ## 50% for ARC NIEVE
  Support software for research described previously

- ## 50% for Immersive Space support
  Provide stable platform for VR experimentation

ADT Interact3D

- Initial tasks
  - Add functionality to existing platform to allow first experiments (inauguration demo)
  - Augment 3D audio spatialization capacities of APF – audio processing framework (previous ADT)

- Change of technology
  - From Ogre3D to OpenSceneGraph (cleaner code, better software engineering principles)

- Development of a generic VE platform for neuroscience/psychology applications
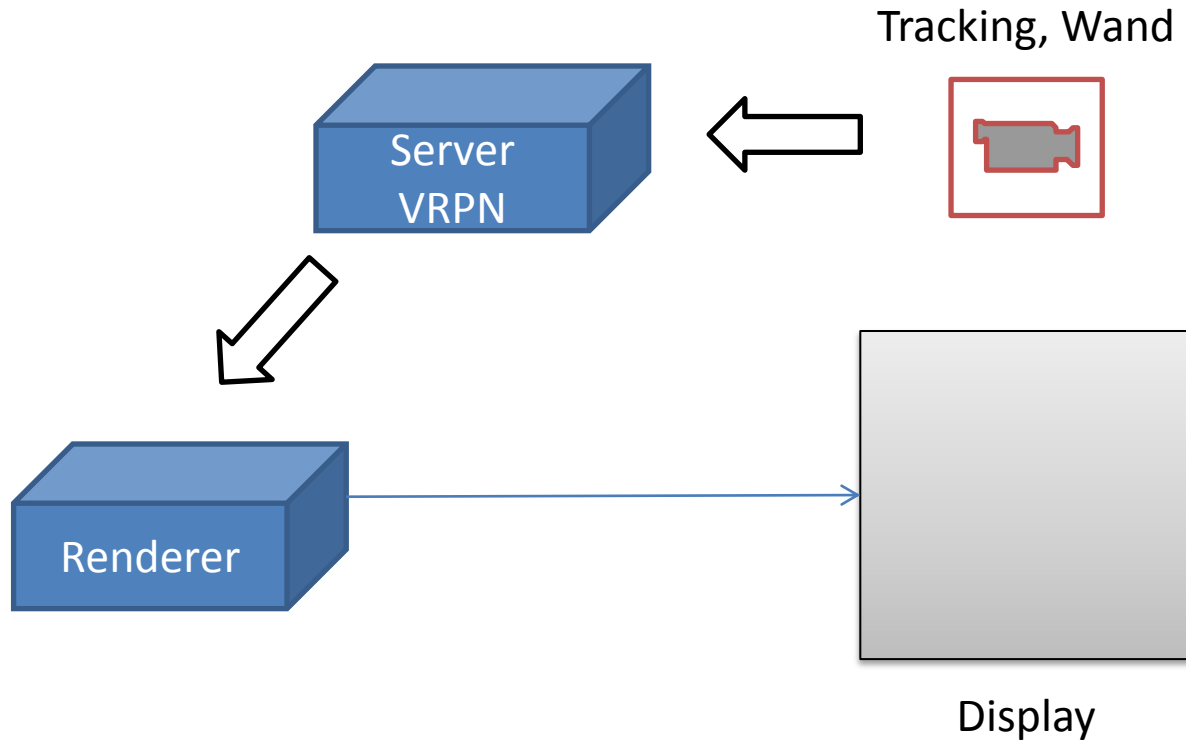
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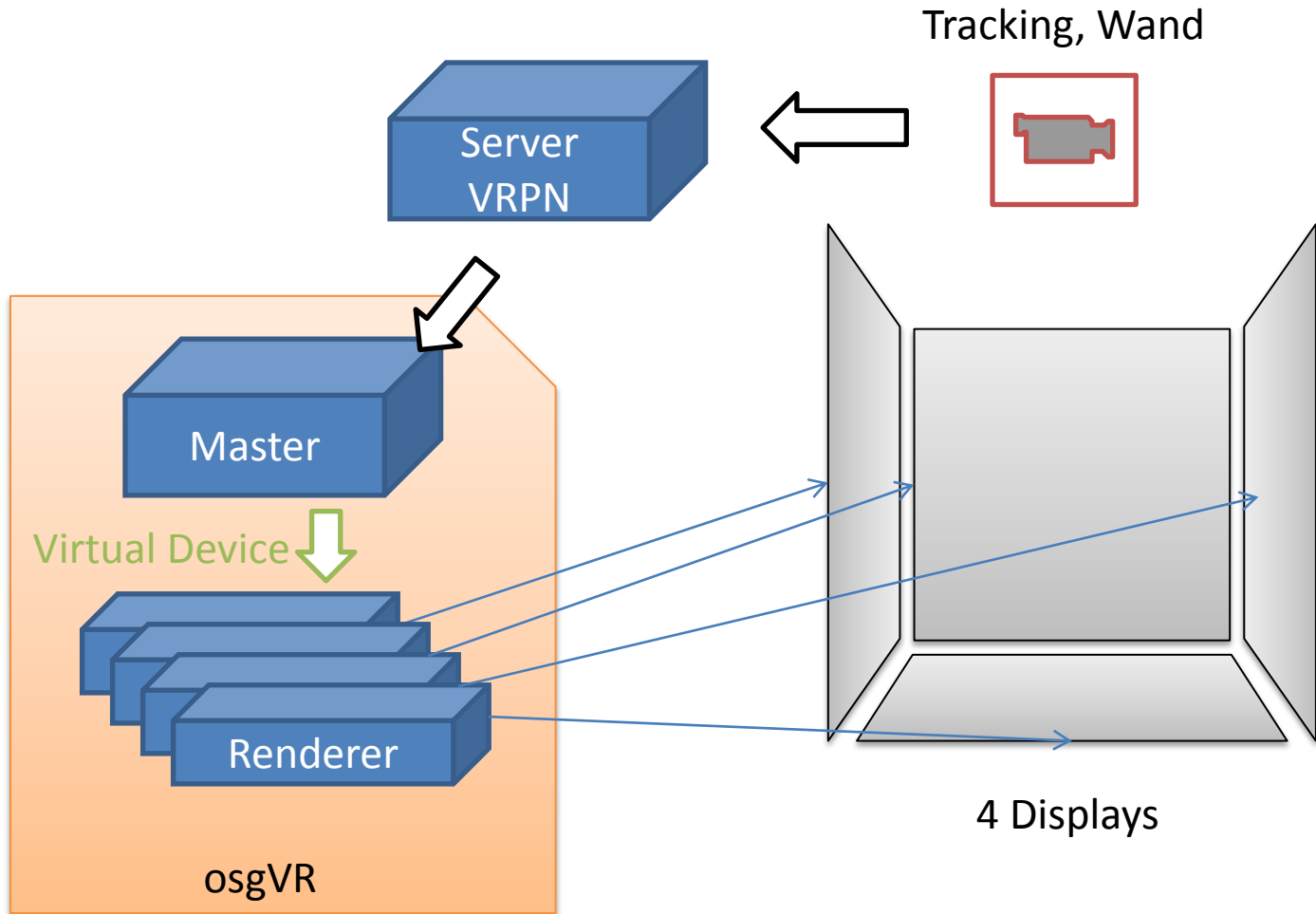- Development of a generic VE platform for neuroscience/psychology applications

OsgVR for the Immersive Space

Tracking, Wand

Server
VRPN

Renderer

Display

OsgVR for the Immersive Space

Server
VRPN

Tracking, Wand

Master

Virtual Device

Renderer

osgVR

4 Displays

OsgVR for the Immersive Space

Tracking, Wand

Server
VRPN

Master

Virtual Device

Renderer

osgVR

4 Displays

OsgVR Simulator

- Allow development without access to the Immersive Space

- Simulate tracking, Wand

- Display the 4 walls on a single monitor

OsgVR Simulator

OsgVR Simulator
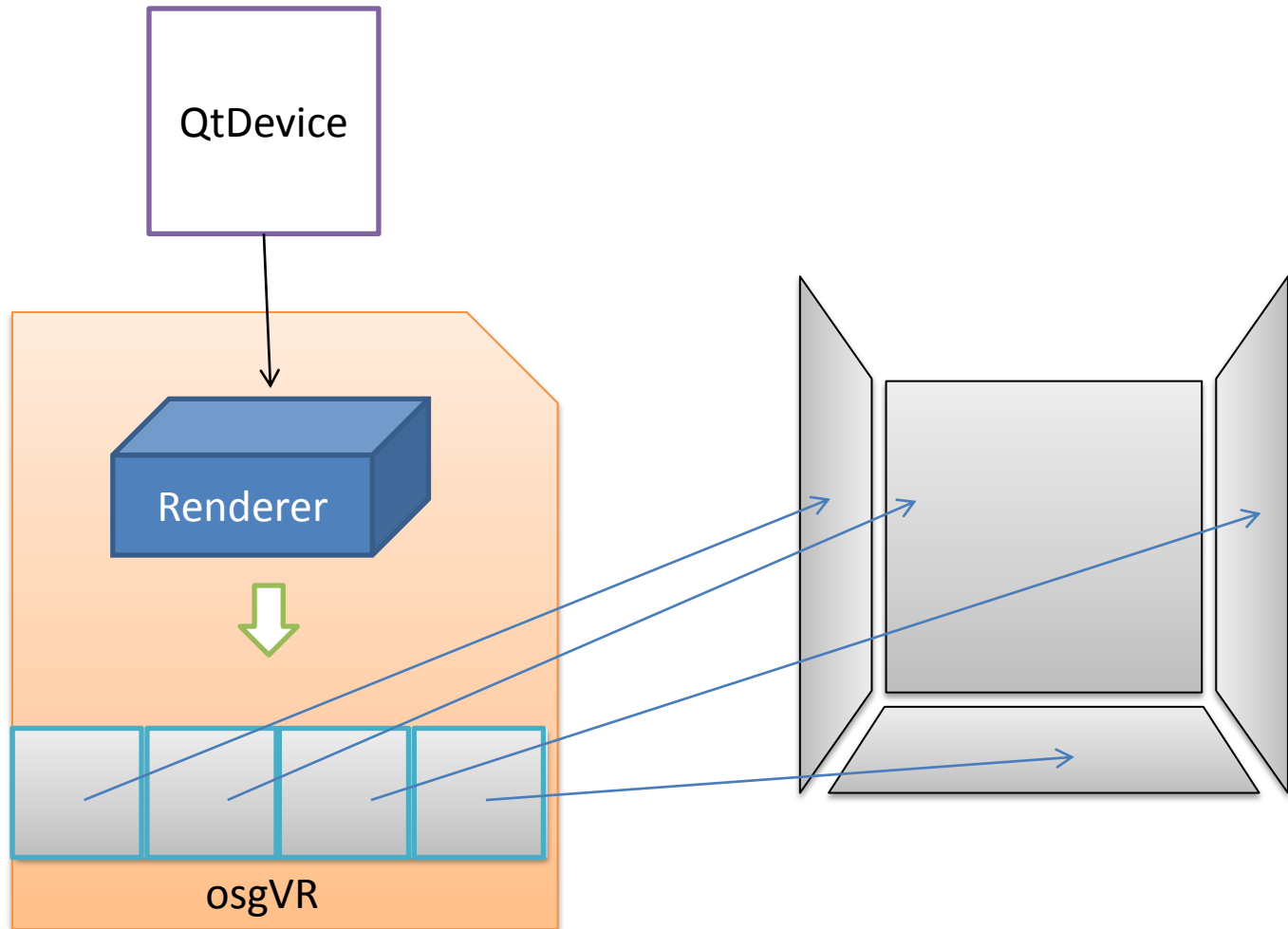
QtDevice

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Virtual Device

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osgVR

OsgVR Simulator

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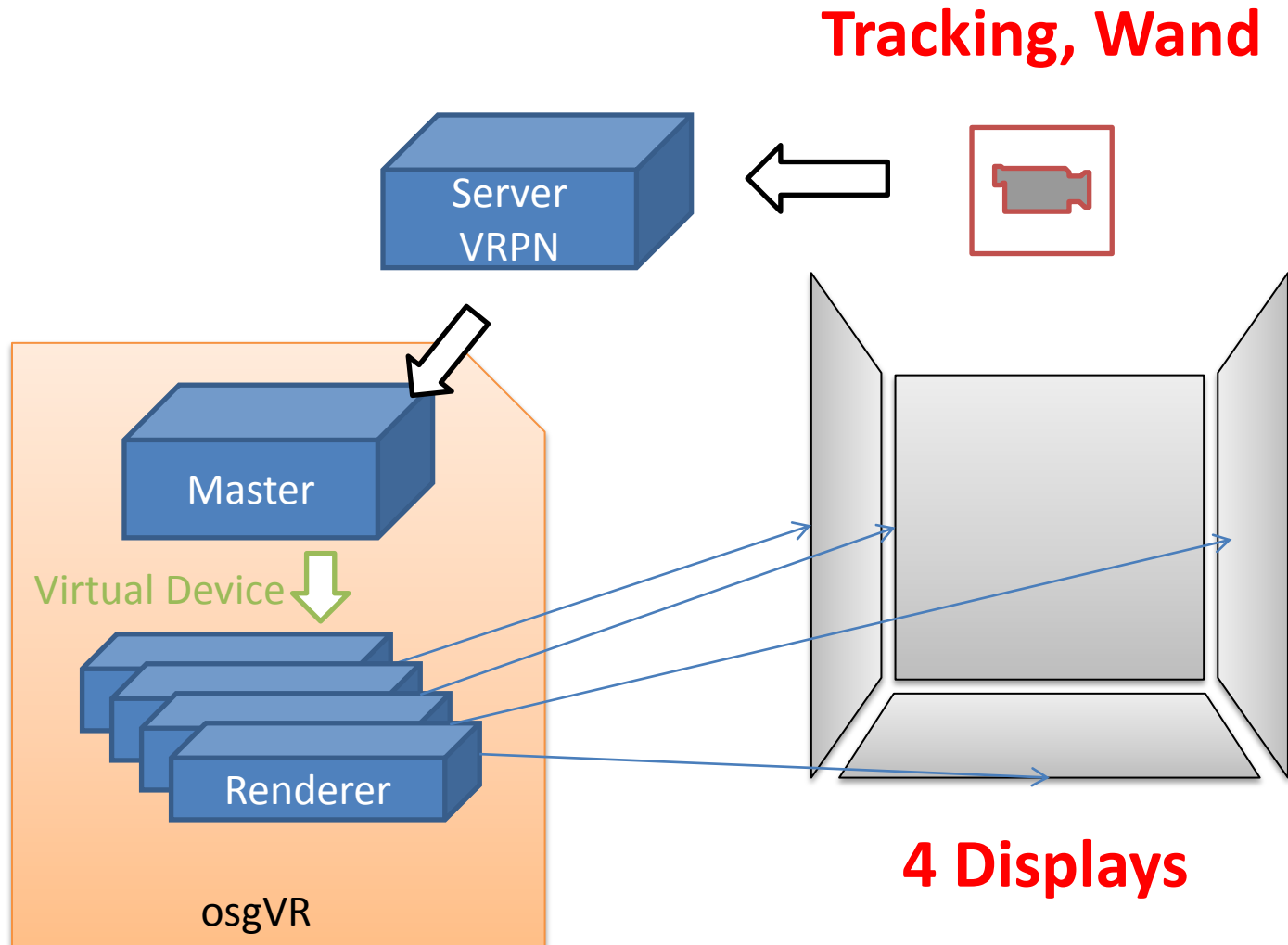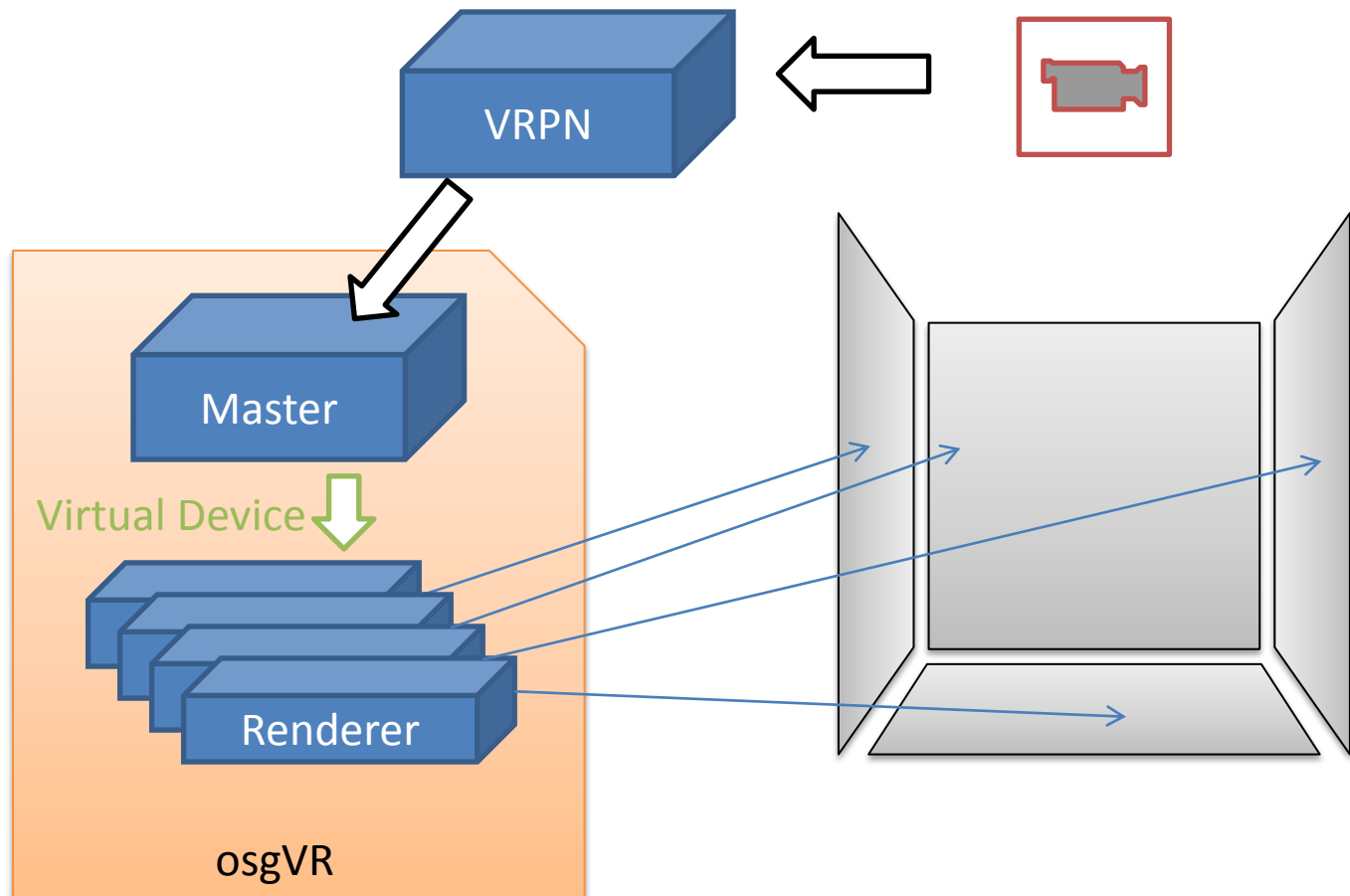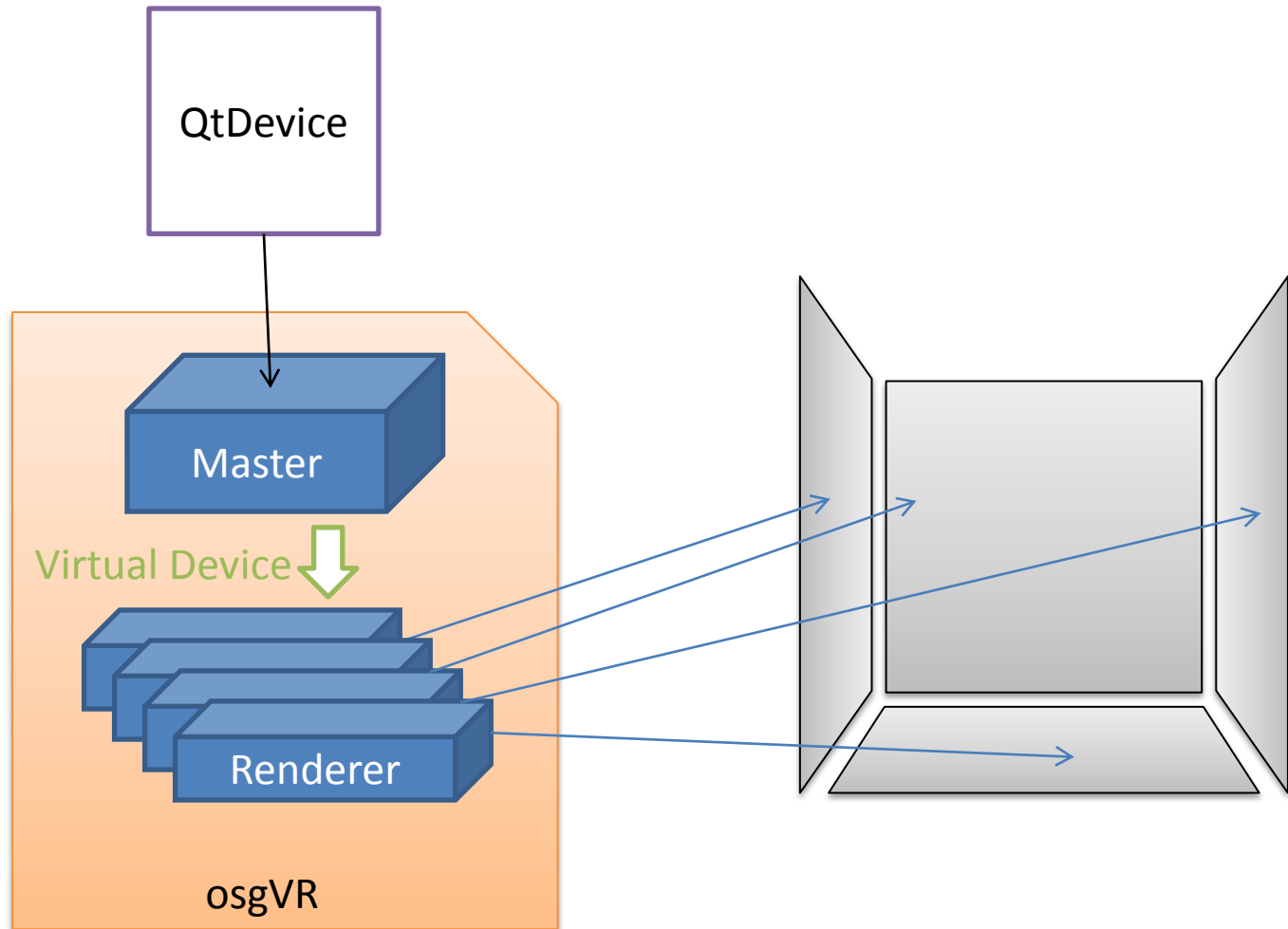
DogPhobia

- Port the application to OsgVR

- Generic library *Imerse*

- Support for animation automata

```
1   digraph {
2       graph [name="DogBodyAnim"] ;
3
4       jump->stand [weight=1];
5
6       lay_to_sit->sit_to_stand [weight=1];
7       lay_to_sit->sit_to_lay [weight=1];
8
9       run->run_to_stand [weight=1];
10
11      run_to_stand->stand [weight=1];
12
13      sit_to_lay->lay_to_sit [weight=1];
14      sit_to_stand->stand [weight=1];
15
16      stand->jump [weight=1];
17      stand->stand_to_sit [weight=1];
18      stand->stand_to_run [weight=1];
19      stand->stand_to_walk [weight=1];
20
```
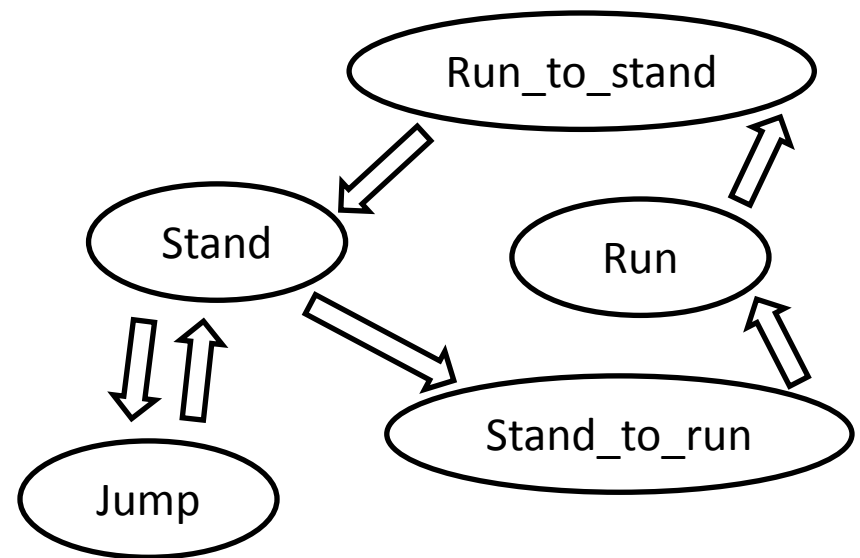

Dijkstra for shortest path

DogPhobia

DogPhobia

- Port of application in 4 months (8 at 50%)
- Experimentation will now be in context of recently awarded EU project
  - Ethical rules and delays based on CHU Nice ethics protocols
  - Experimentation planned for 2012

Conclusion

NIEVE Research Results

- **A Multimode Immersive Conceptual Design System for Architectural Modeling and Lighting**, *Marcio Cabral, Peter Vangorp, Gaurav Chaurasia, Emmanuelle Chapoulie, Martin Hachet, George Drettakis*, Proceedings of IEEE 3DUI (technote) – 2011
- **Perception of Visual Artifacts in Image-Based Rendering of Façades**, *Peter Vangorp, Gaurav Chaurasia, Pierre-Yves Laffont, Roland Fleming, George Drettakis* Computer Graphics Forum (Proceedings of the Eurographics Symposium on Rendering), Volume 30, 2011
- **Walking in a Cube: Novel Metaphors for Safely Navigation Large Virtual Environments in Restricted Real Workspaces**, *G. Cirio, P. Vangorp, E. Chapoulie, M. Marchal, A. Lecuyer, G. Drettakis* (conditional accept IEEE VR/IEEE Trans. on Vis. & Comp. Graphics)
- **Study of viewing angle for Image based rendering**, *P. Vangorp, M. Banks, A. Bousseau, G. Chaurasia, G. Drettakis.* (in preparation)
- **Material perception for stereo rendering**, *P. Vangorp, J. O'Shea, M. Banks, A. Bousseau, G. Chaurasia, G. Drettakis.* (in preparation)
- **Natural Gestures and Lighting for presence in VR**. *E. Chapoulie, E. Dimara, M. Roussou, G. Drettakis* (in preparation)

Software platform

- OsgVR now a robust and usable platform for experimentations in VE

- Many new features being added for navigation and interaction

- *Imerse* library provides extensive support for animated and complex virtual environments

Inter site Collaboration

- Research collaborations
  - Between VR4I and REVES
  - Planned collaboration between MINT and REVES
- Development collaborations
  - Established close contact between research groups and development groups
  - Between support groups for immersive spaces in Rennes and Sophia-Antipolis
    (site visit of DREAM in Rennes)

New activities

- Development of research activity in VR in Sophia-Antipolis

- Central component in submission and success of EU proposal VERVE (5M€ funding overall)
  - Use of VR for groups in risk of social exclusion
  - Partnership with hospitals (including CHU of Nice)

Thank you for your attention