

# Matlab's VR Toolbox

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MAE 574- Virtual Reality Applications

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# Why?

- Difficult part of VR
  - The Math!, equations, vectors, matrix operations for physics, dynamics and ....
  - Representation of complex geometries
  - Often a front end to a complicated simulation
    - FEA for example
- Difficult part of VR
  - Need to do graphics, maintain a camera position etc.
  - Get the input from various sources, process and use them properly
  - Render movements, lights etc. correctly
- If only something would do both the graphics and the math!

# Enter Matlab VR Toolbox

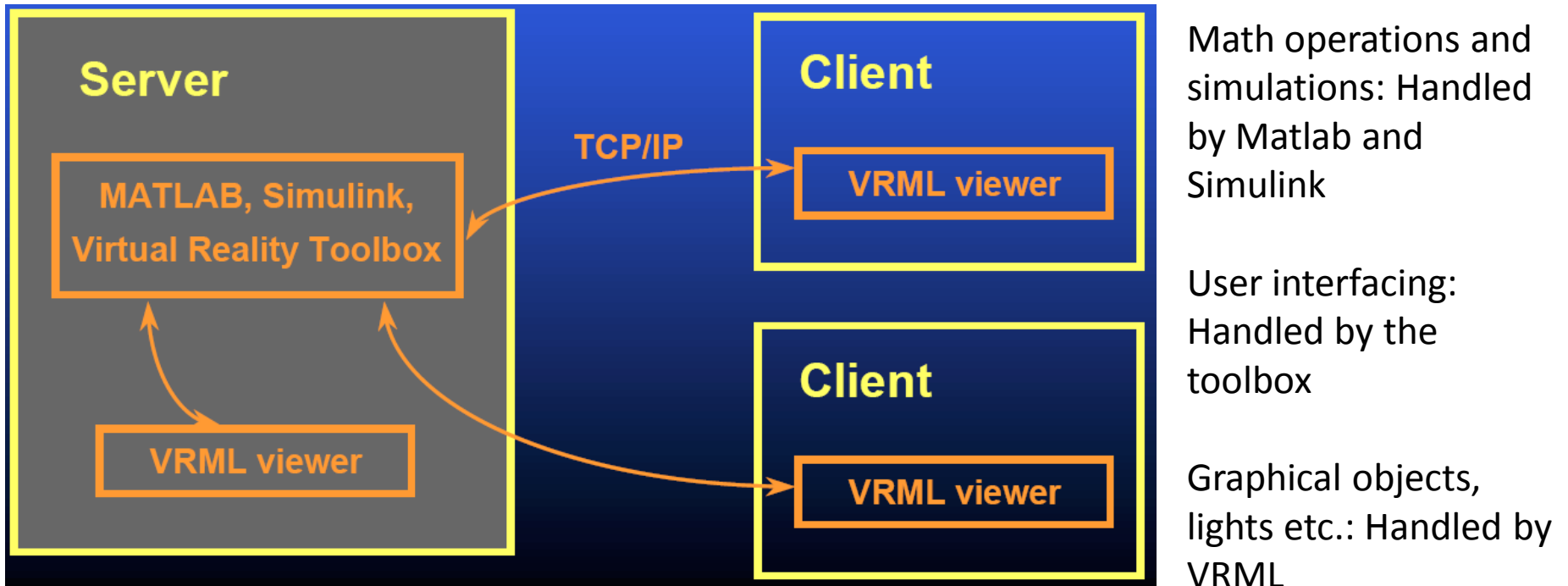
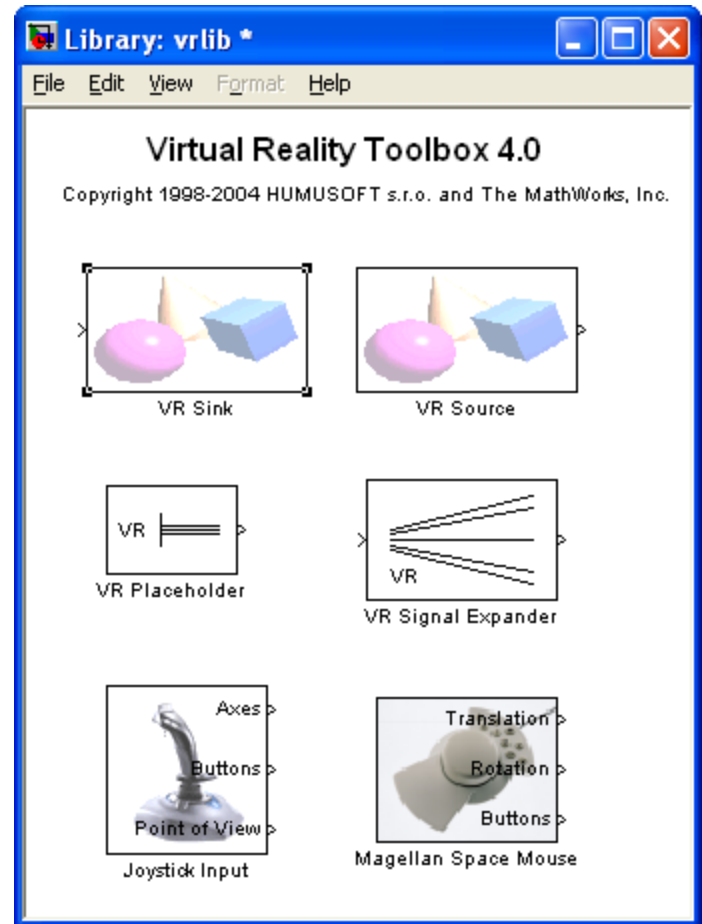


Image courtesy: Humusoft.

# What's in the box?

- Simulink block library
- VR Sink and Source
  - Provides degrees of freedom connection to other nodes
  - Integrated with VRML editor
- Simulink model
- Joystick (or other user input device)



**Parameters: VR Sink**

VR Sink  
Writes Simulink values to virtual world node fields. Fields to be written are marked by checkboxes in the tree view. Every marked field corresponds to an input port of the block.

World properties

Source file

Output  
 Open VRML Viewer automatically  
 Allow viewing from the Internet

Description:

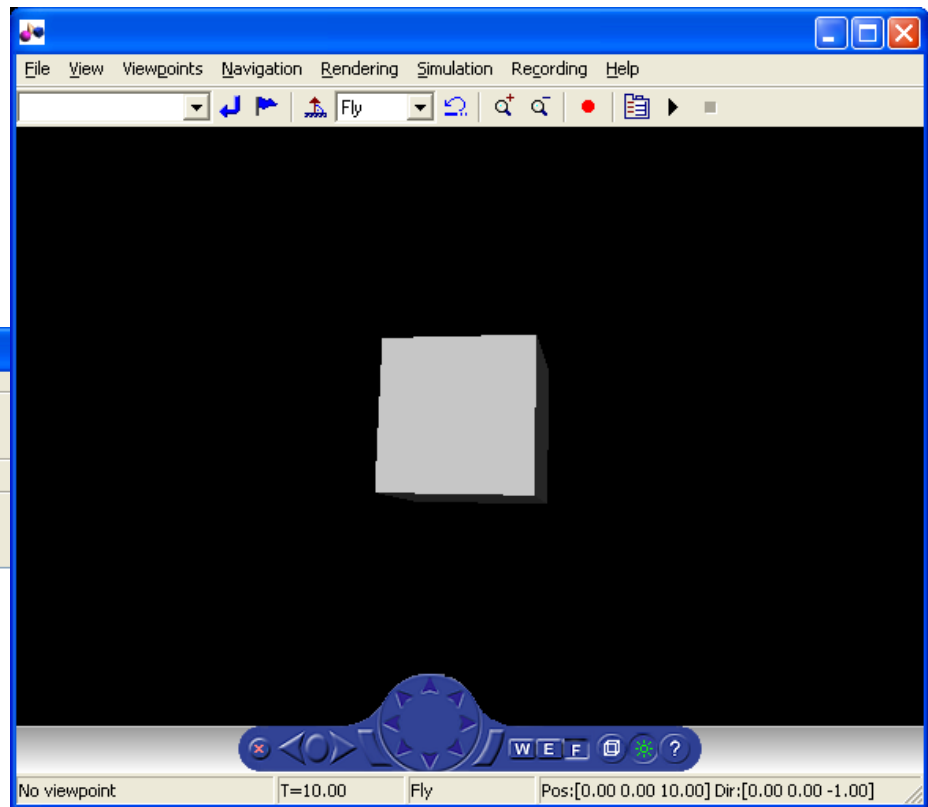
Block properties  
 Sample time (-1 for inherit):

VRML Tree

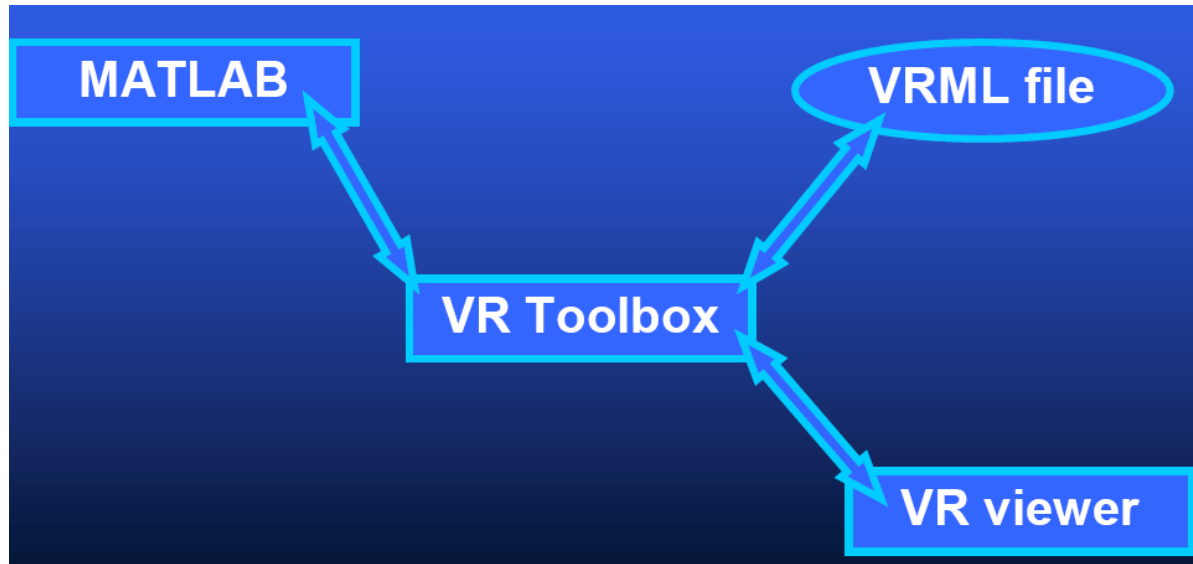
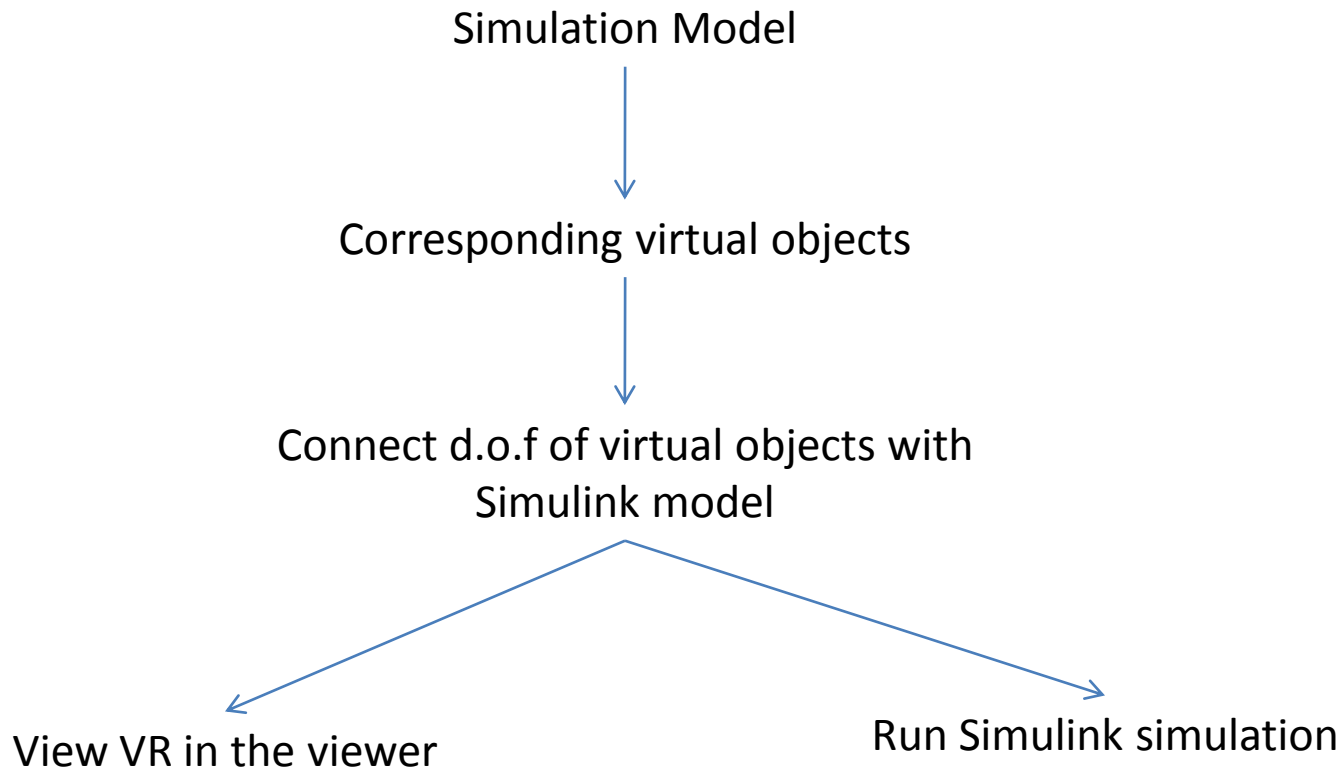
Show node types  Show field types

- ROOT
  - [-] (Transform)
    - addChildren (MFNode)
    - removeChildren (MFNode)
    - center (SFVec3f)
    - rotation (SFRotation)
    - scale (SFVec3f)
    - scaleOrientation (SFRotation)
    - translation (SFVec3f)
    - bboxCenter (SFVec3f)
    - bboxSize (SFVec3f)
    - children (MFNode)
      - [-] (Shape)
        - geometry (SFNode)
          - [-] (Box)
            - size (SFVec3f)
        - appearance (SFNode)
          - [-] (Appearance)
            - texture (SFNode)
            - textureTransform (SFNode)
            - material (SFNode)

OK Cancel Help Apply

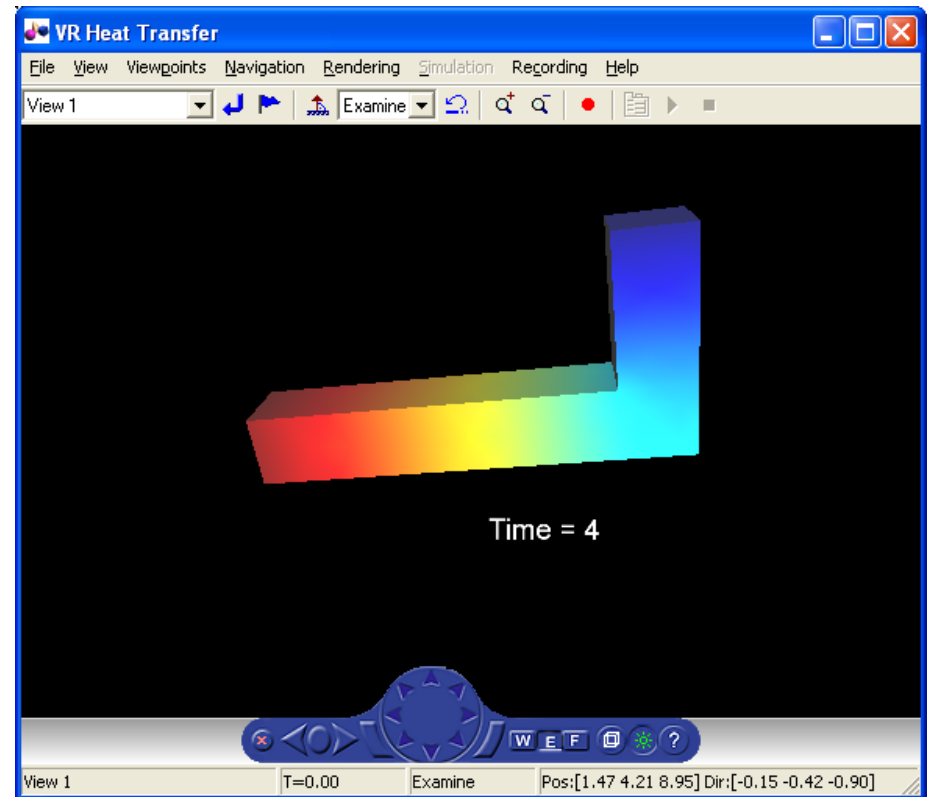


- Integrated with VRML 97
- Comes with a model editor
- Final output is a viewer or a simulation .. Depending
- Can load our own models?

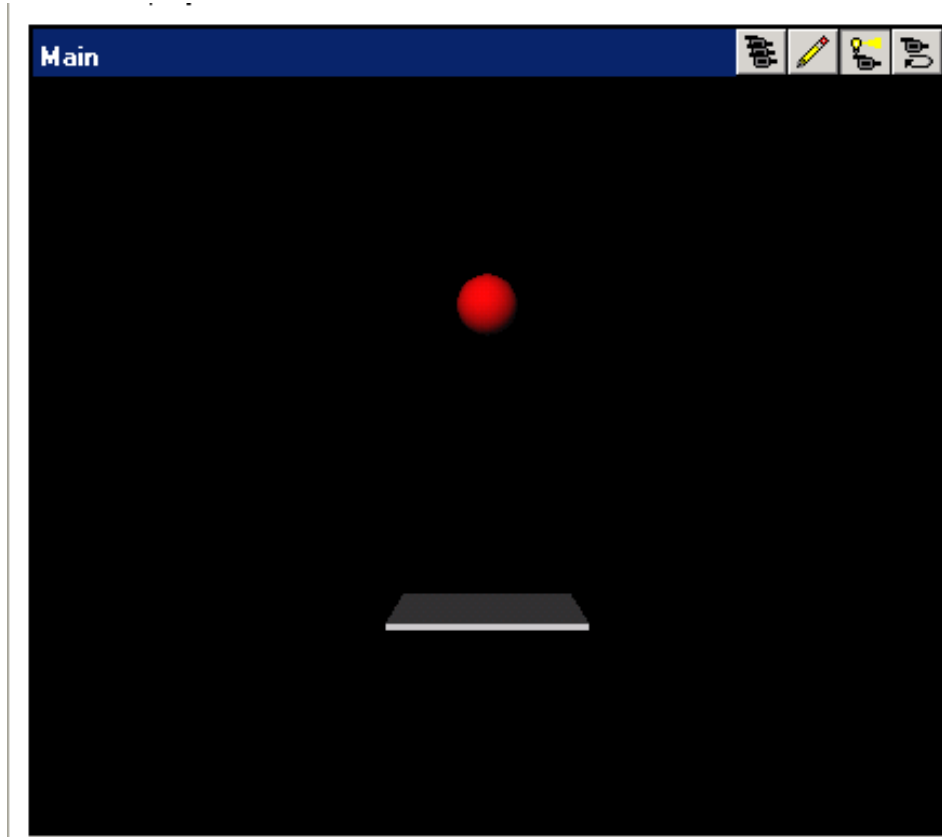


# VR Heat – Matlab demo

- Visualization of pre-computed heat data
- Load vertices (of a predefined test object)
- Create a mesh and load mesh into VRML
- Create a 3D colormap on object based on computed temperature values
- Adjust temperature values to obtain a smooth animation
- Create the virtual world
- Load colormap and object into virtual world
- Run animation and view



```
#VRML V2.0 utf8
# This is a comment line
WorldInfo {
  title "Bouncing Ball"
}
Viewpoint {
  position 0 5 30
  description "Side View"
}
DEF Floor Box {
  size 6 0.2 6
}
DEF Ball Transform {
  translation 0 10 0
  children Shape {
    appearance Appearance {
      material Material {
        diffuseColor 1 0 0
      }
    }
  }
  geometry Sphere {
  }
}
}
```



# Simulink demo(s)

- How to deform a sphere?
  - Blocks squeeze a sphere to 40% in one dimension, maintaining volume
- Create a simulink simulation for movement of two blocks and subsequent scaling of the sphere (vrtut3)
- Create spheres (rad 0.9 @ center) and blocks (@ +/-3 scaled at statically in VRML)
- Load VRML models into simulink through VR tool box
- Simulate, sit back and enjoy the visualization

