

Multiple Views of a Virtual World Integrated With Real Images

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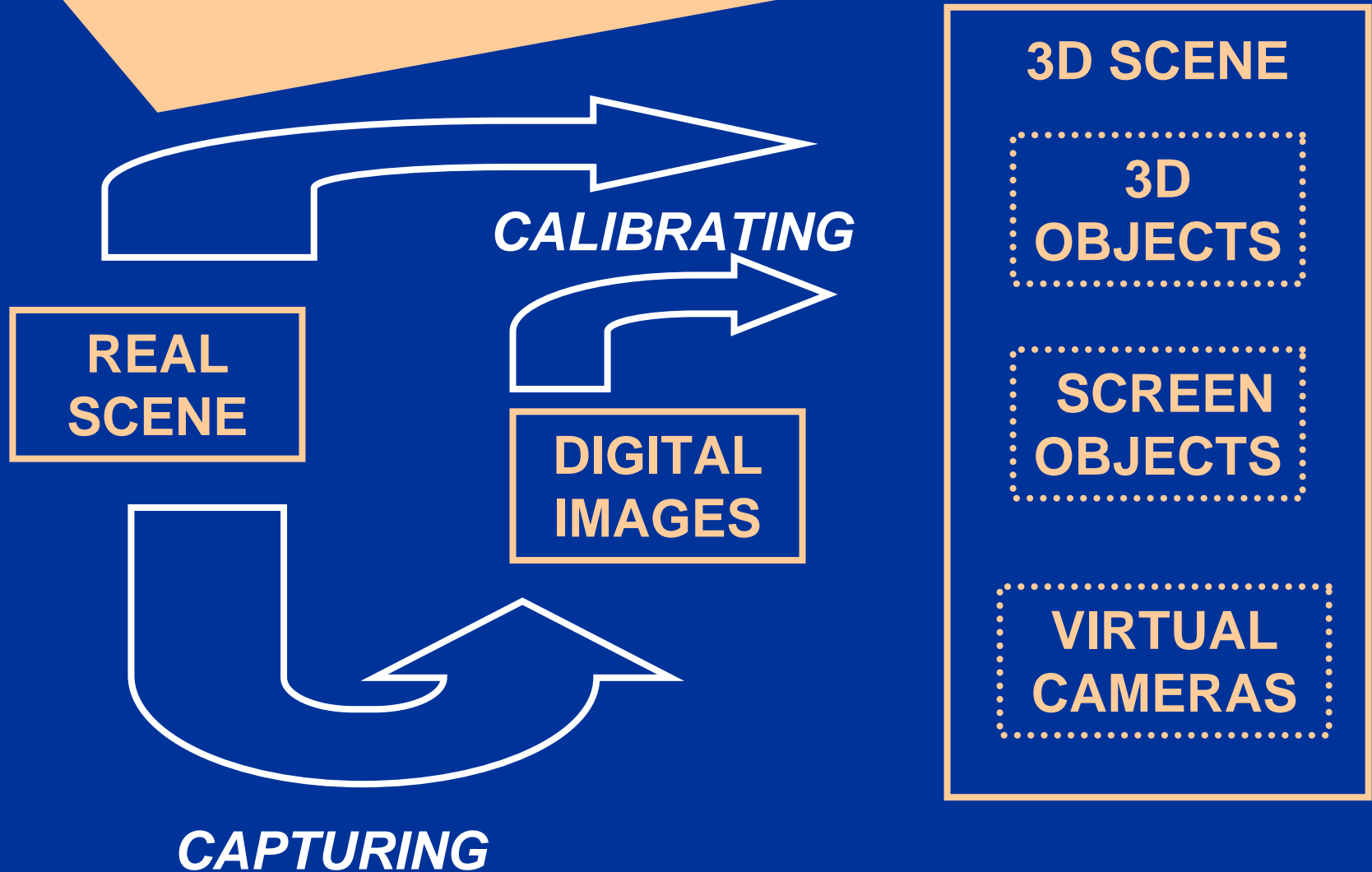
GOALS

- A standard system for generating a 3D scene with real images
- Coherent integration between synthetic objects and real images
- Multiple views and animations effects

INTEGRATION ASPECTS

- CONSISTENCY OF GEOMETRY
- CONSISTENCY OF ILLUMINATION
- CONSISTENCY OF TIME

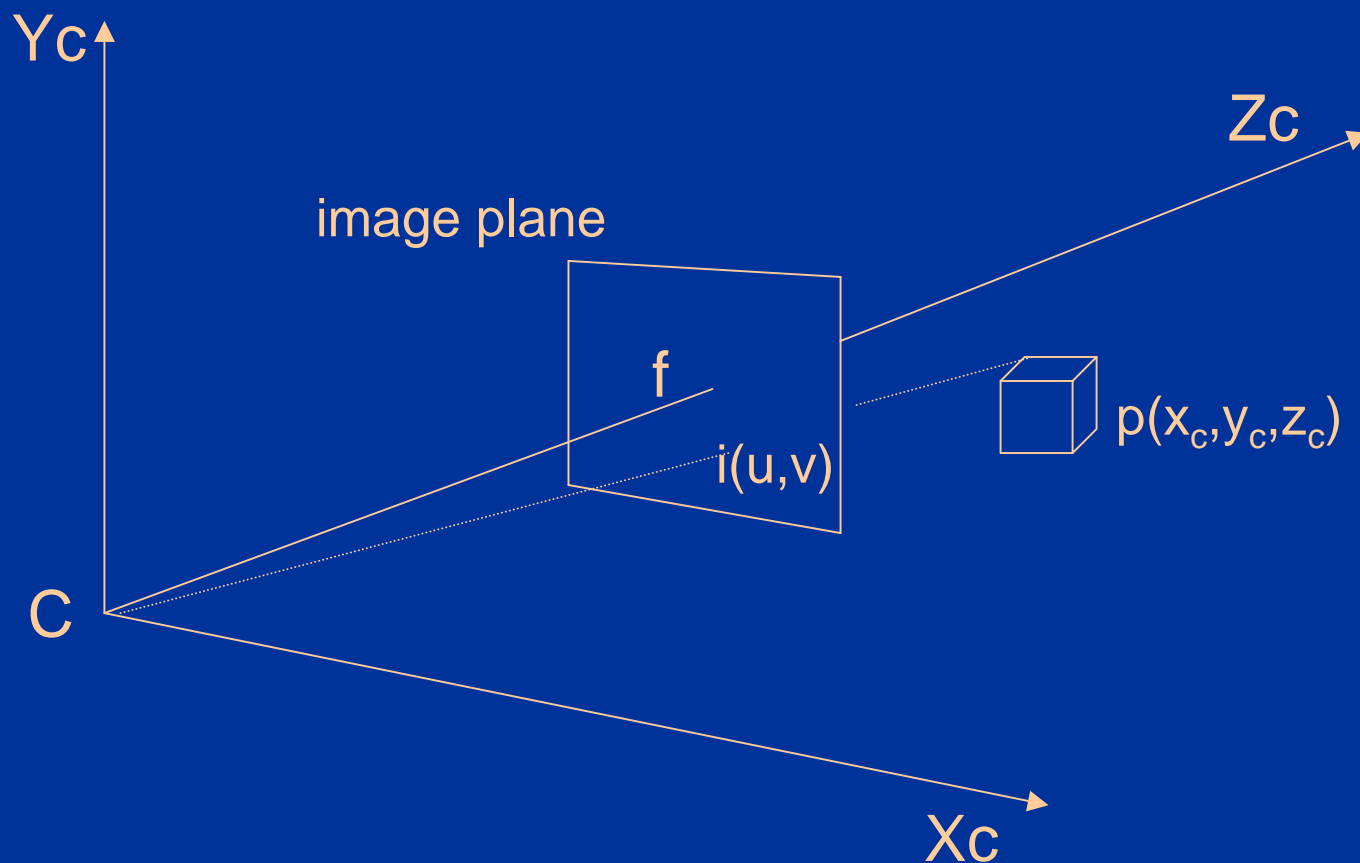
INTEGRATION SYSTEM



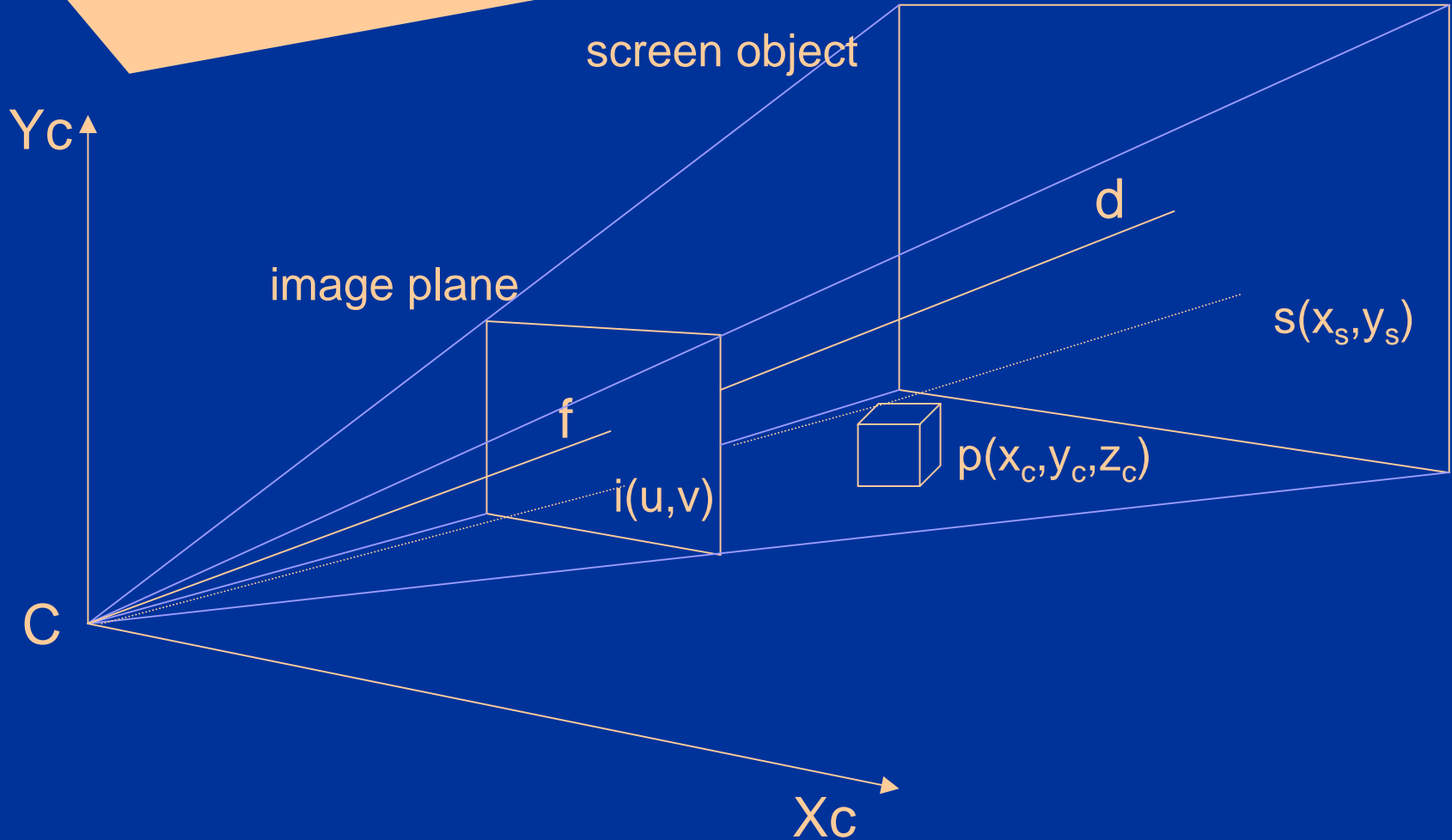
INTEGRATION SYSTEM

- Capturing a SEQUENCE OF IMAGES
- CALIBRATING camera parameters
- Creating 3D SYNTHETIC OBJECTS
- Adding a 3D SCREEN OBJECT
- Adding a VIRTUAL CAMERA

CAMERA MODEL



CAMERA MODEL



CALIBRATION

- Deduce the real camera position and orientation
- We need to know real points and its corresponding points in the image to know internal and external parameters

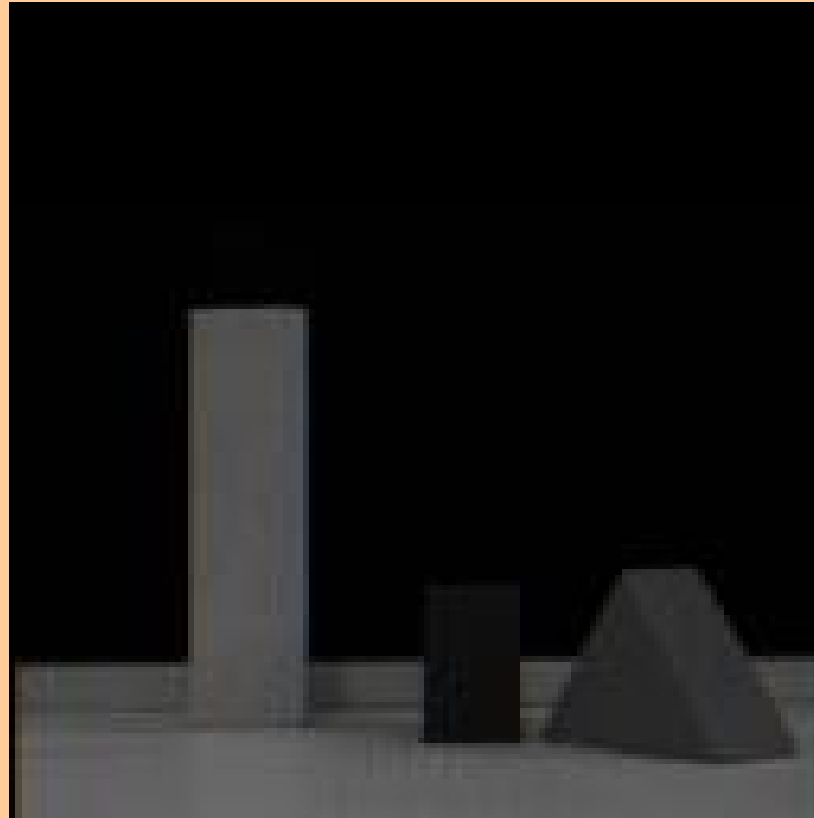
CALIBRATION

- We assume *pinhole* model (ideal camera)
- We have matching points $p(x,y,z)$ and $i(u,v)$ with

$$p(x_c, y_c, z_c) = R(T(p(x, y, z))) \quad \text{and} \\ i(u, v) = P(p(x_c, y_c, z_c))$$

we can deduce the translation and rotation

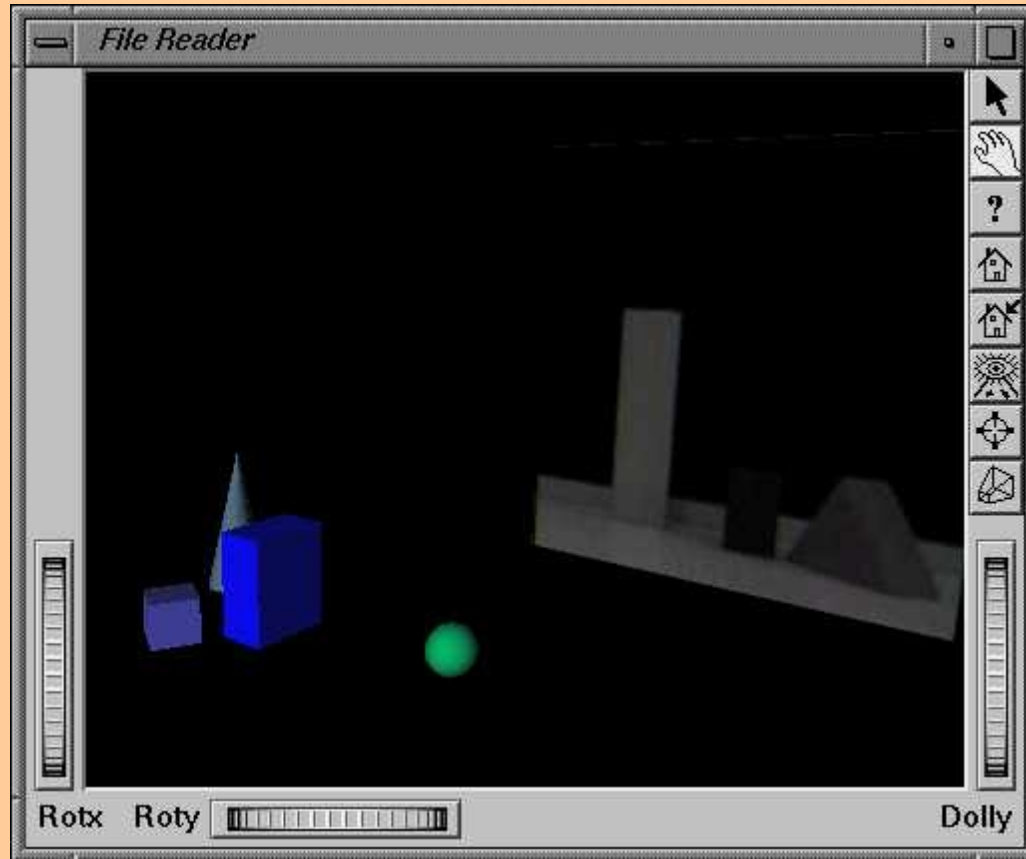
Integration



Captured Image

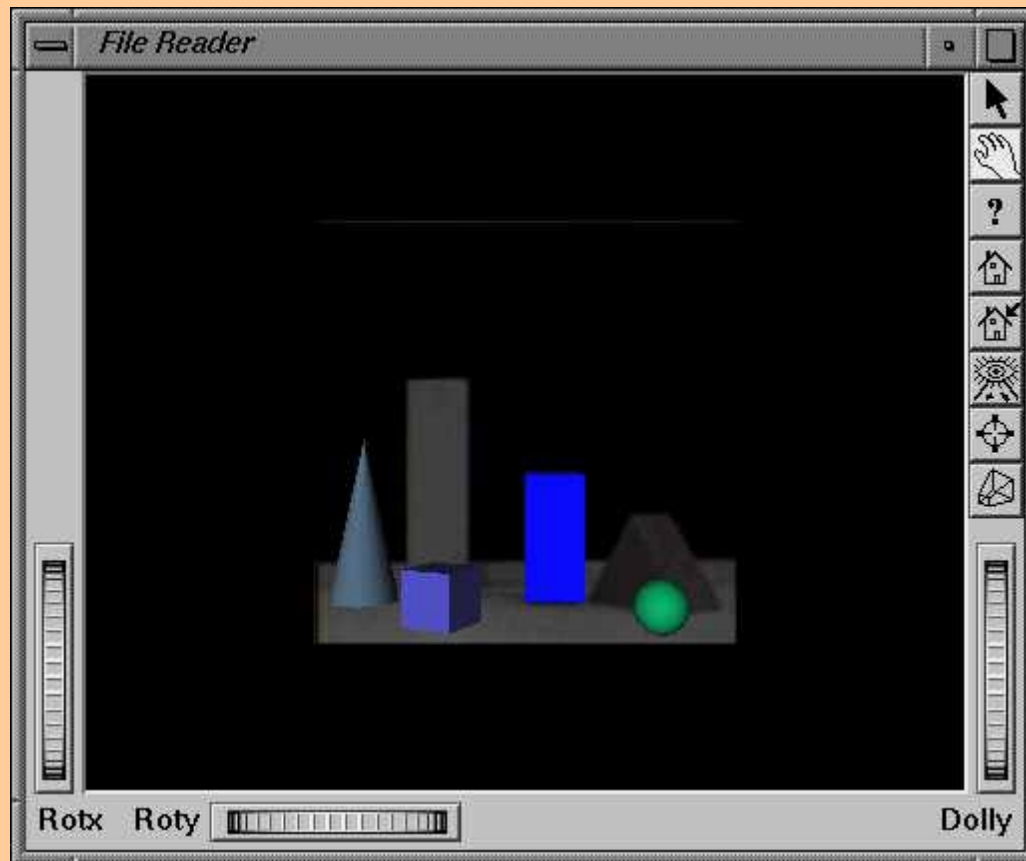
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Integration



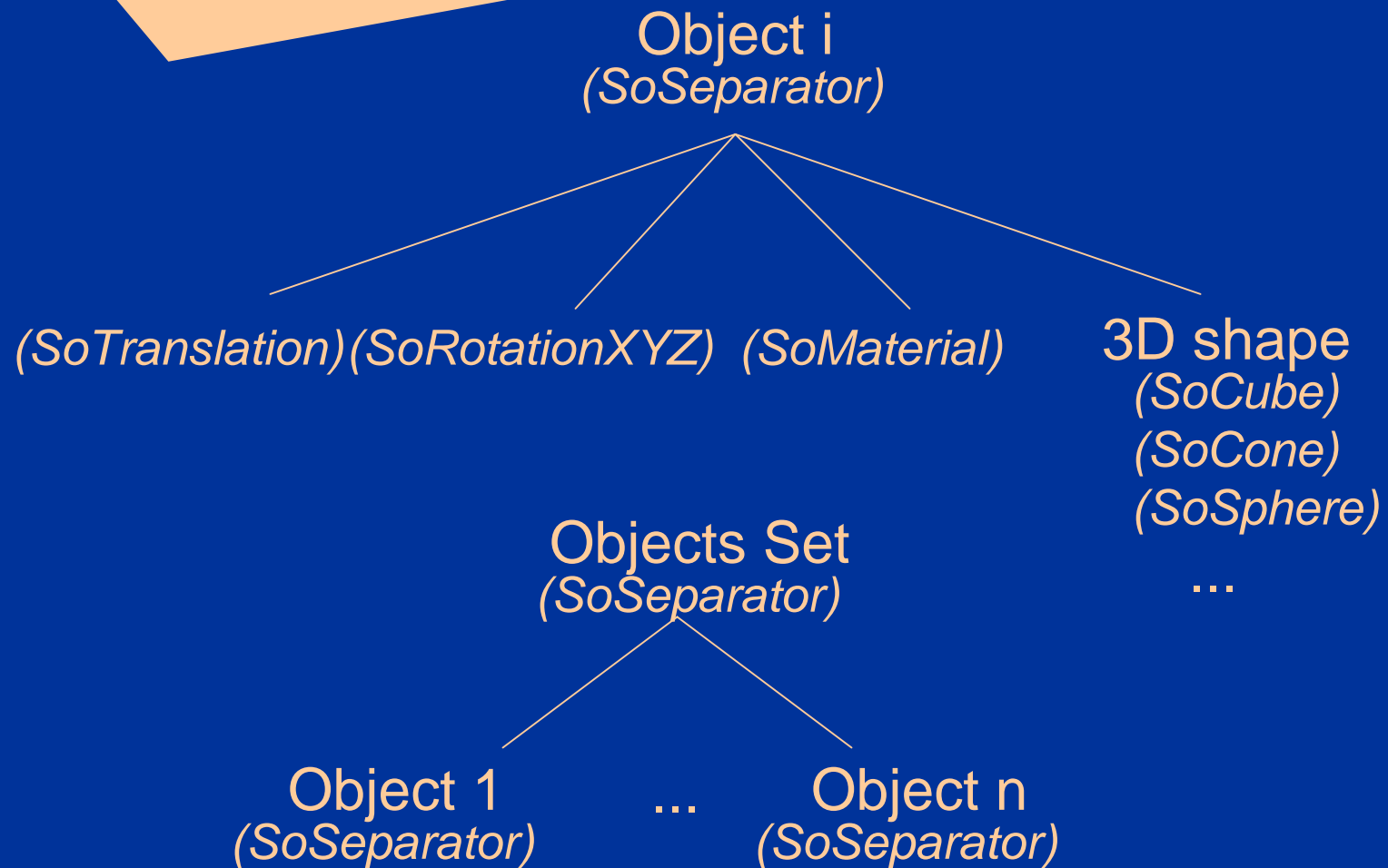
3D Scene + Screen Object

Integration

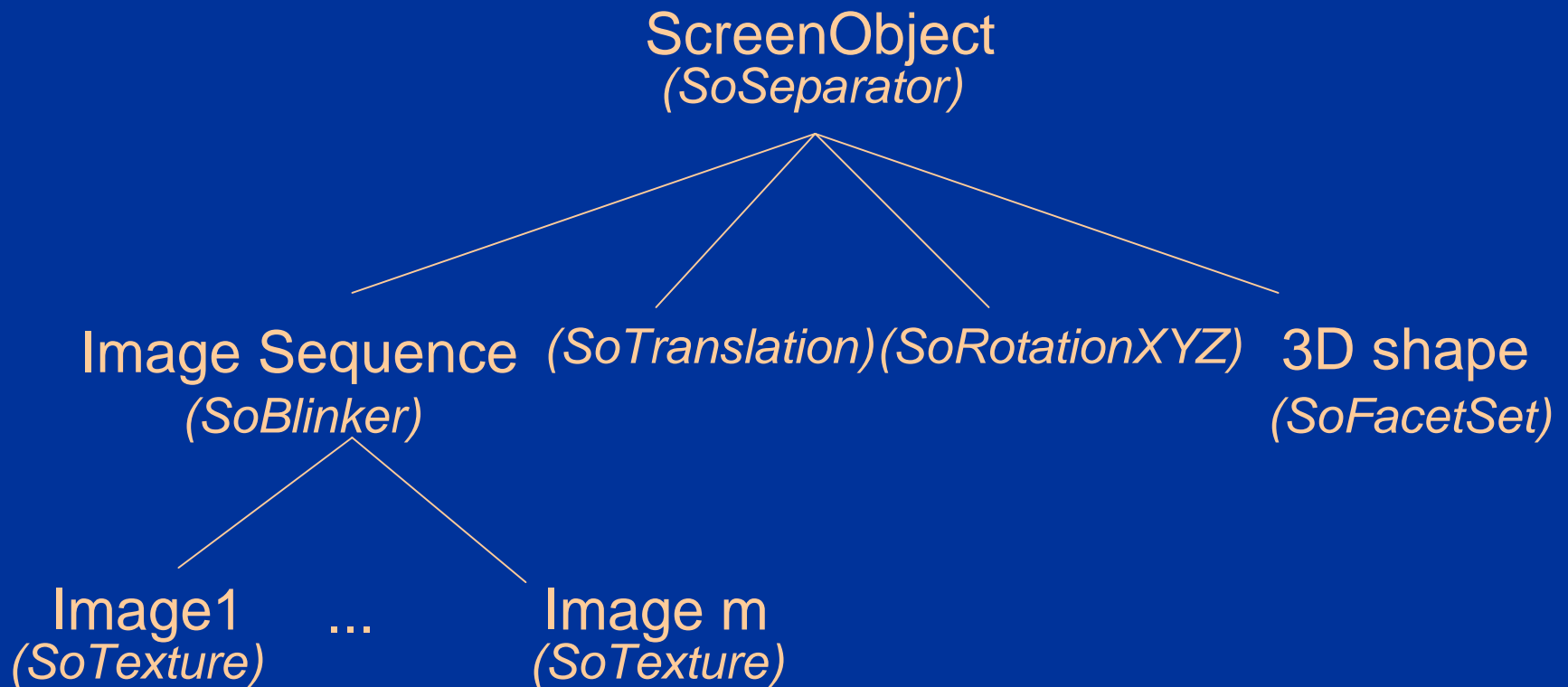


View of the Integrated Scene

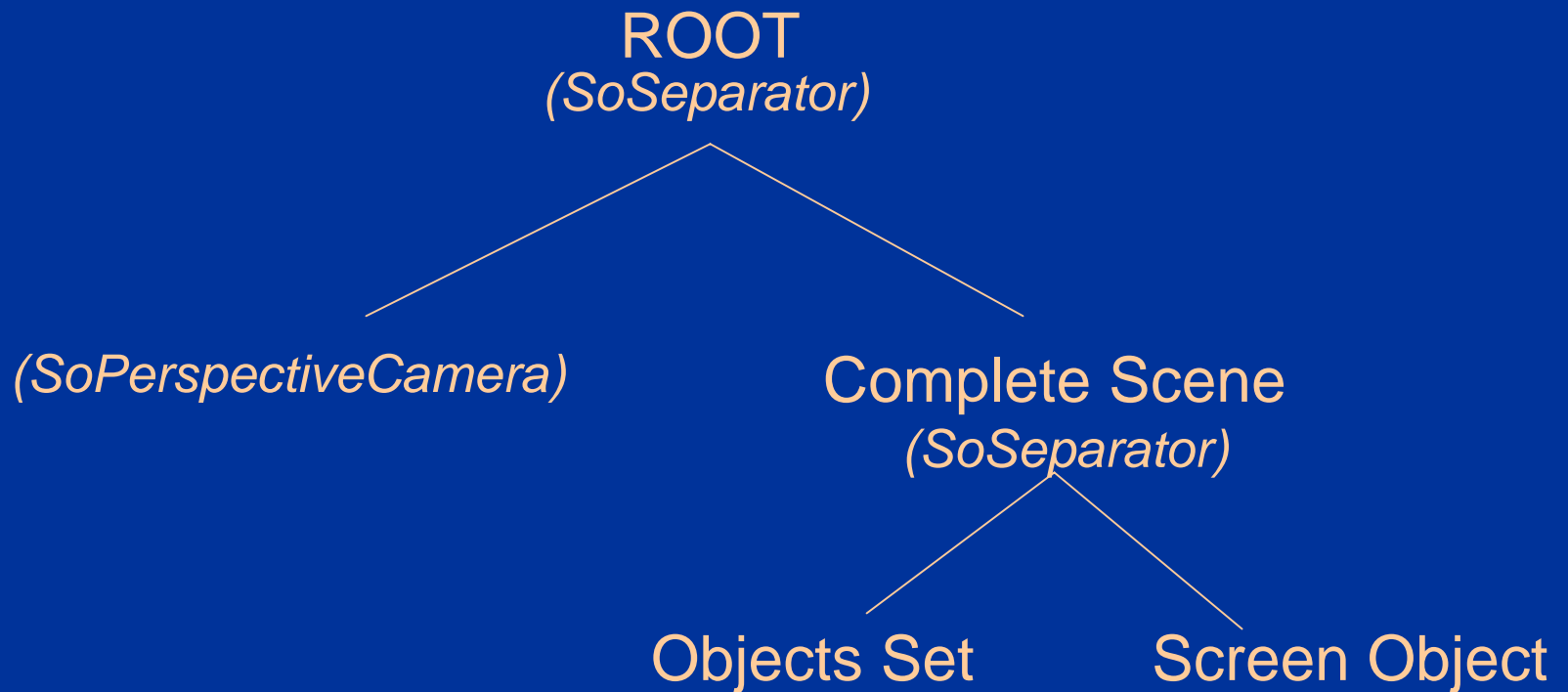
SYNTHETIC OBJECTS



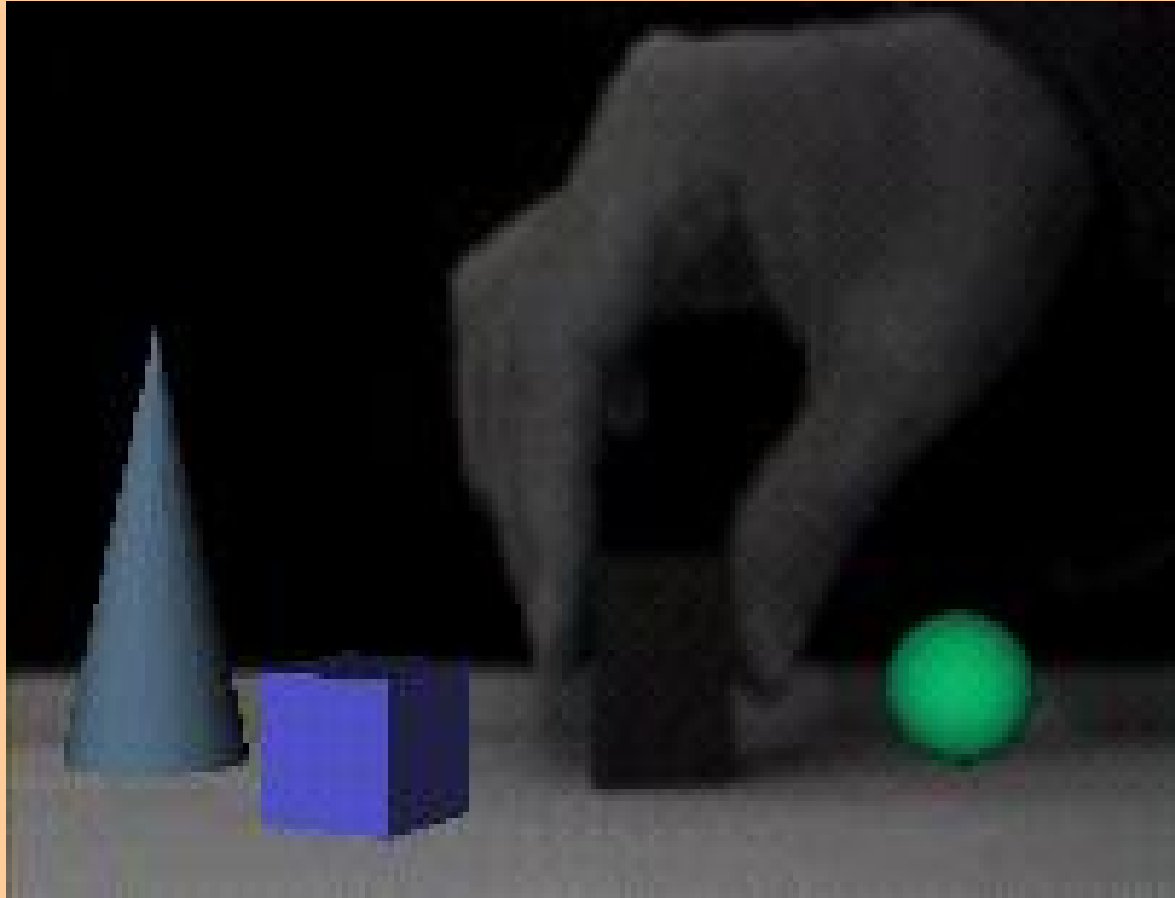
SCREEN OBJECT



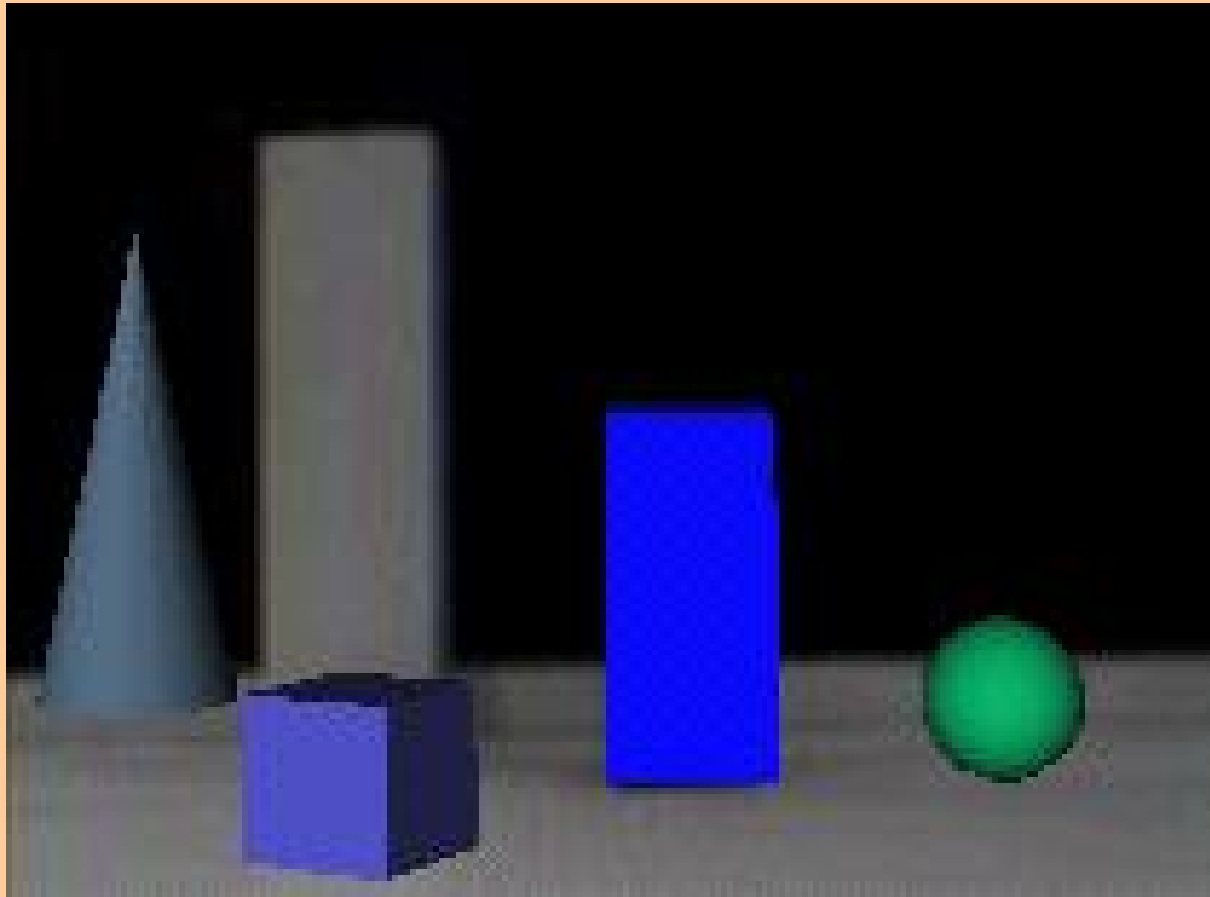
INTEGRATED 3D SCENE



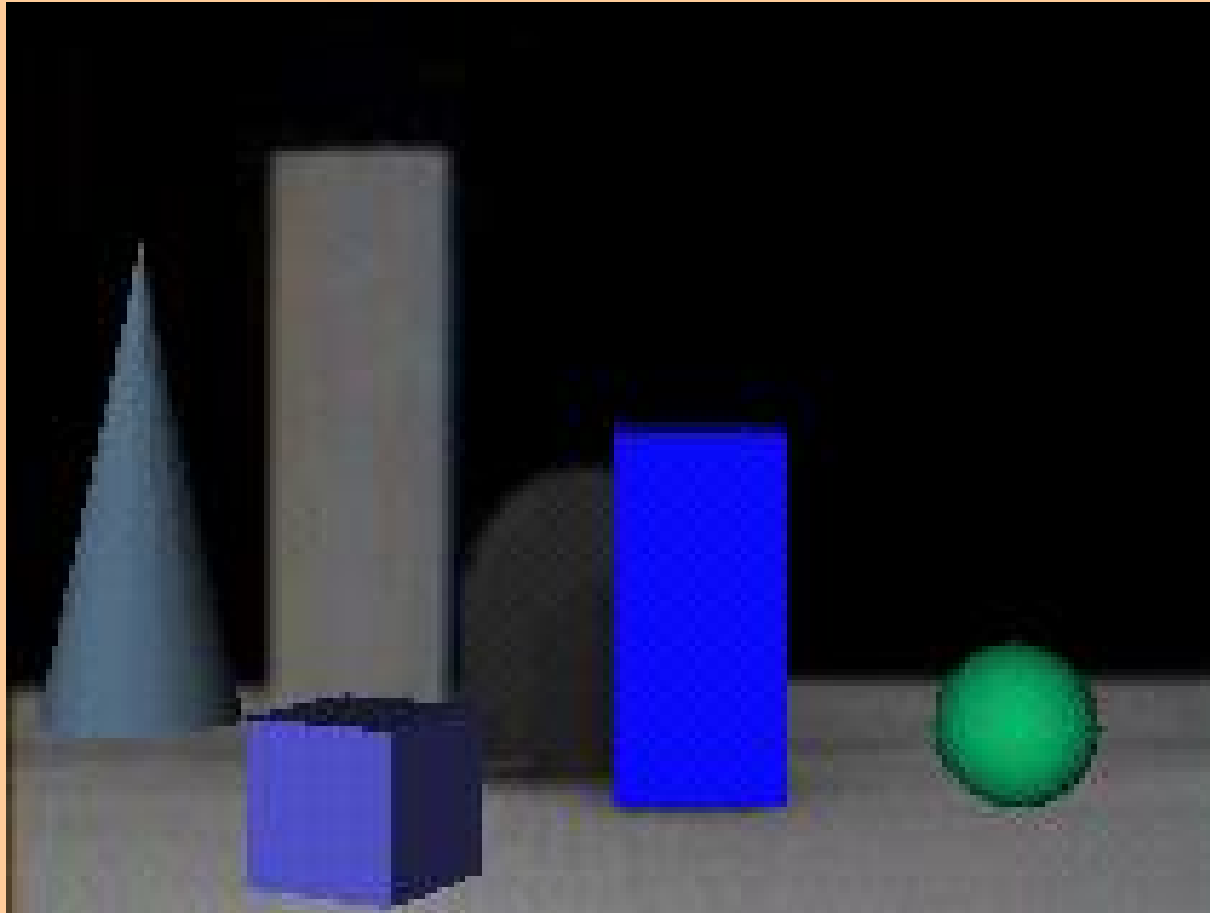
Video Integration



Video Integration



Video Integration



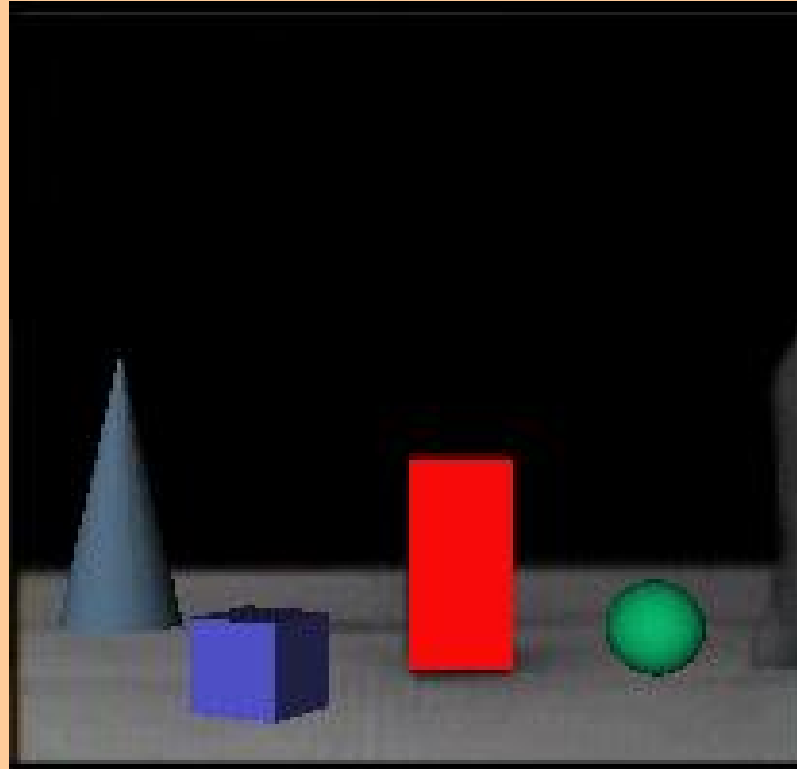
Interactions



Image sequence

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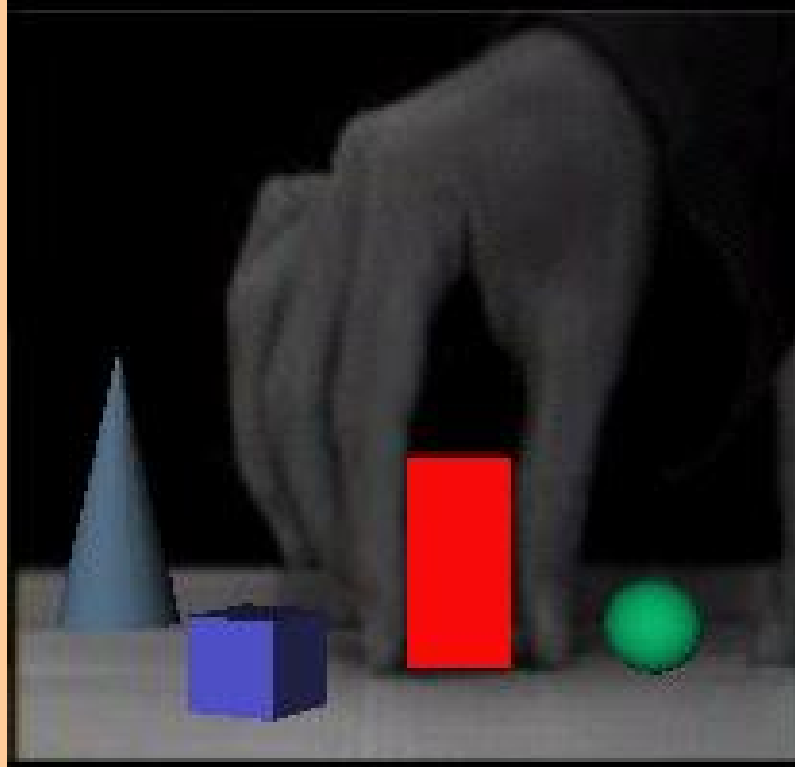
Interactions



3D Synthetic Scene

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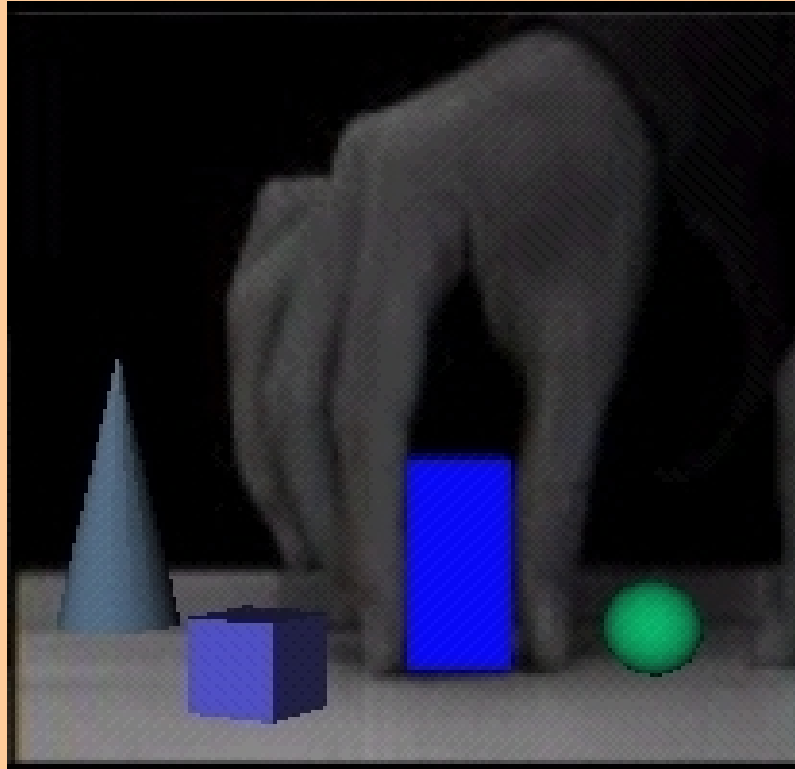
Interactions



Integration

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Interactions



Object's response

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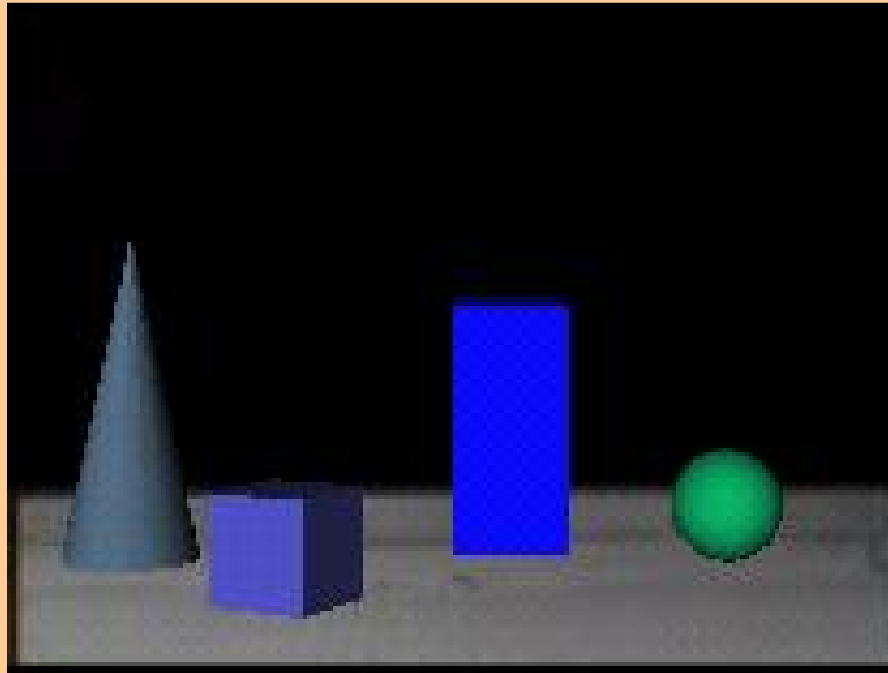
Changing reference



Image sequence

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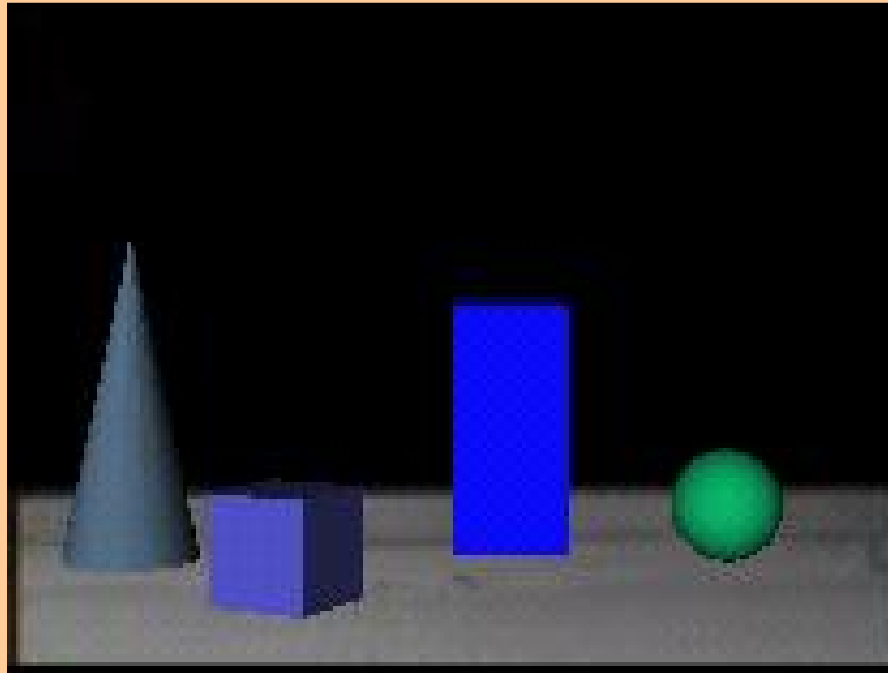
Changing reference



3D Synthetic Scene

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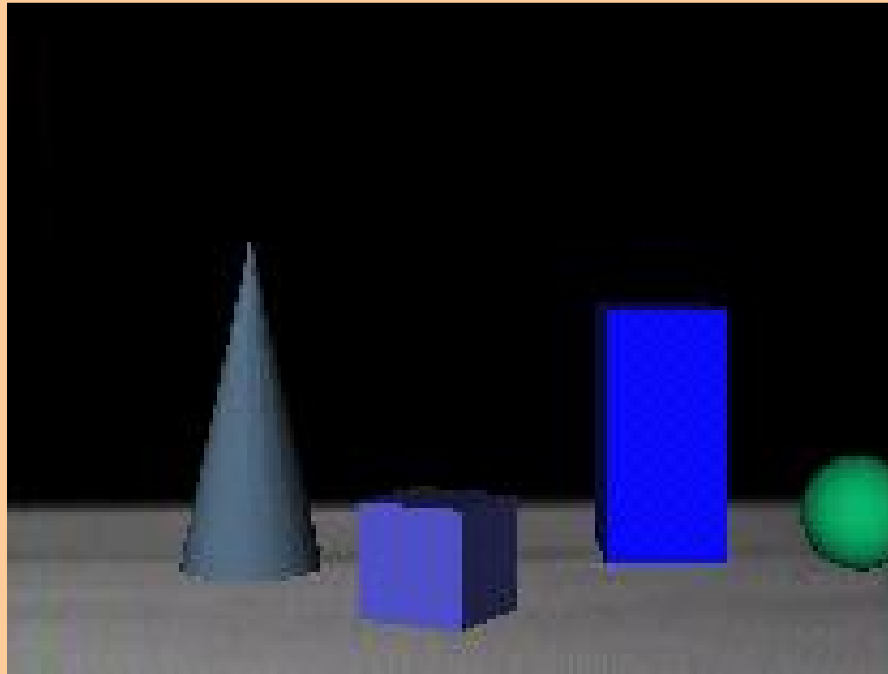
Changing reference



Original reference point

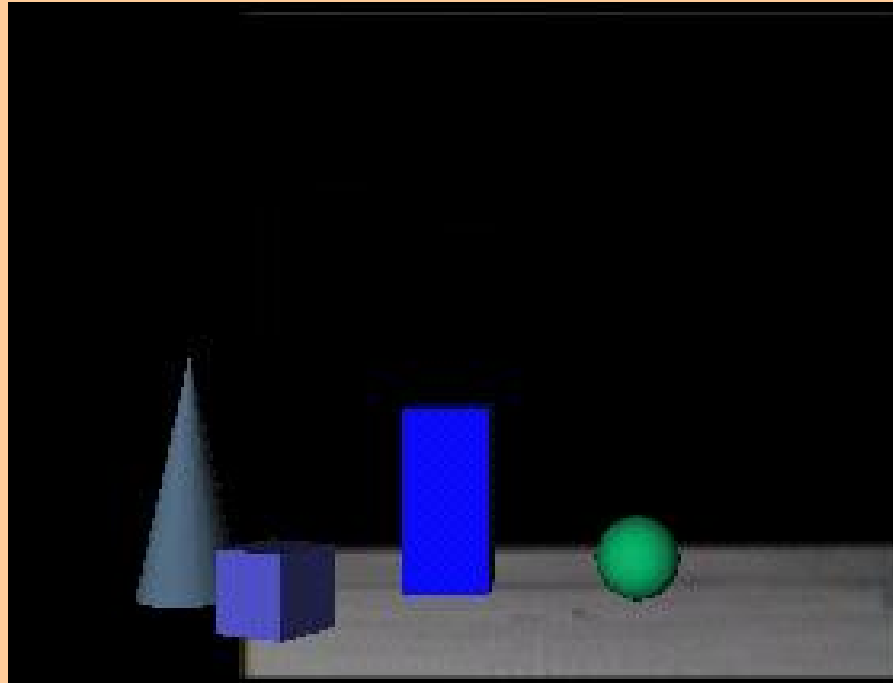
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Changing reference



Other reference point

Animations



Synthetic object animation

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Multiple Views



Camera 1

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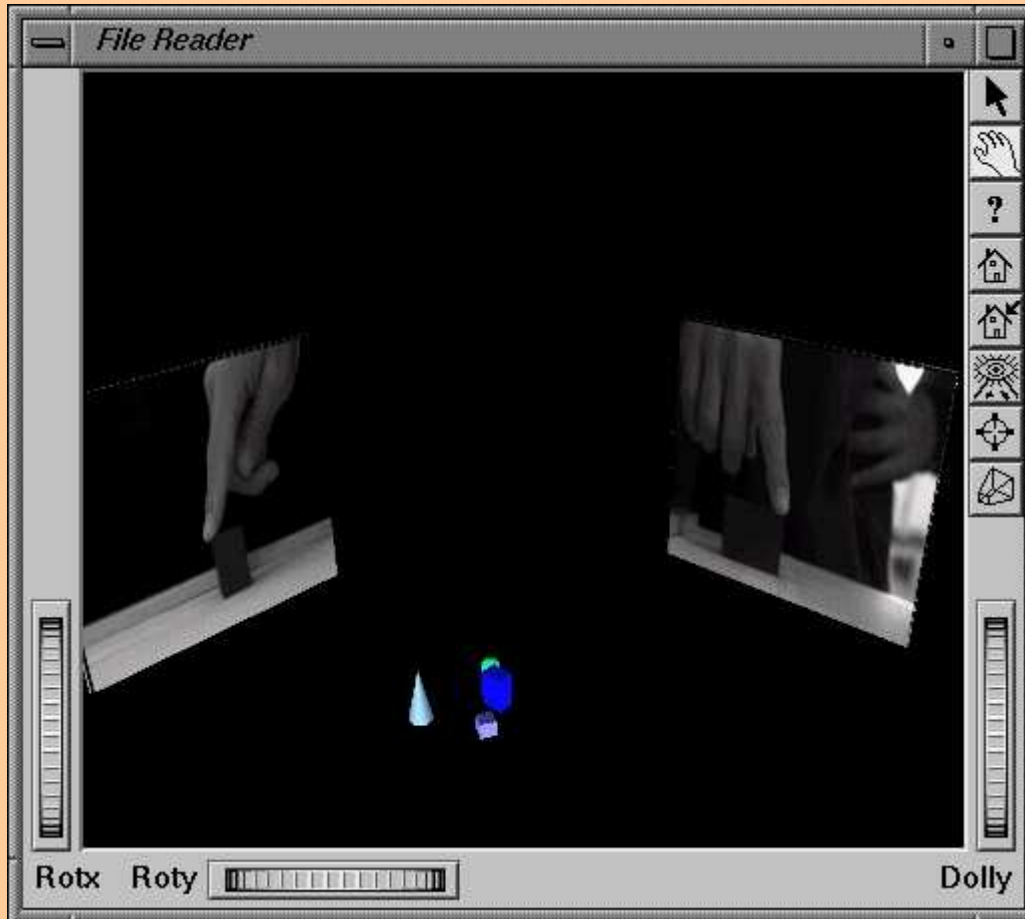
Multiple Views



Camera 2

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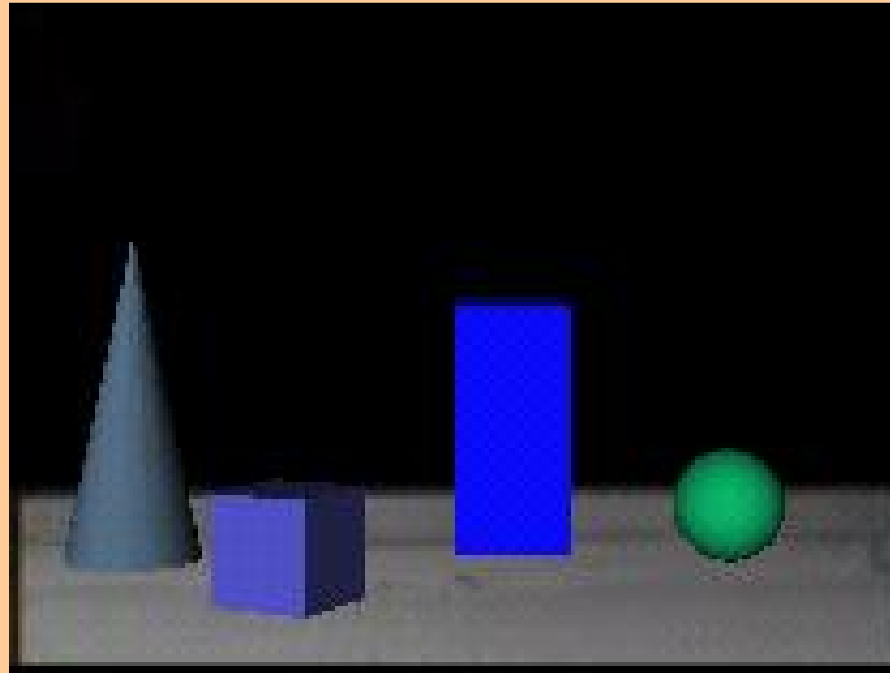
Multiple Views



3D Scene + Screen Object

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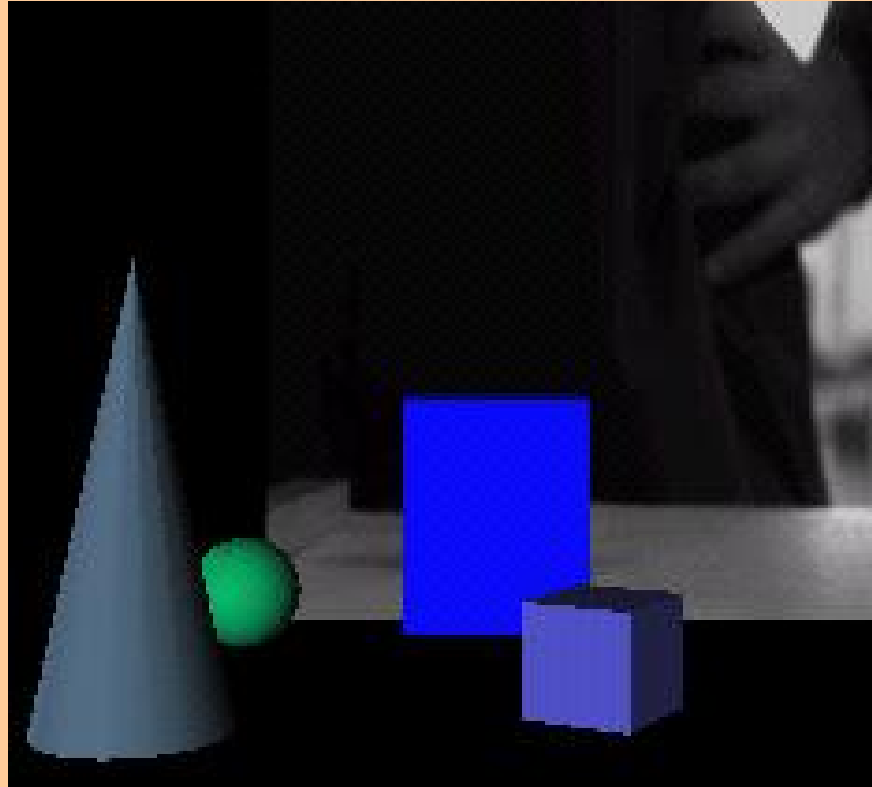
Multiple Views



View 1 of the integration

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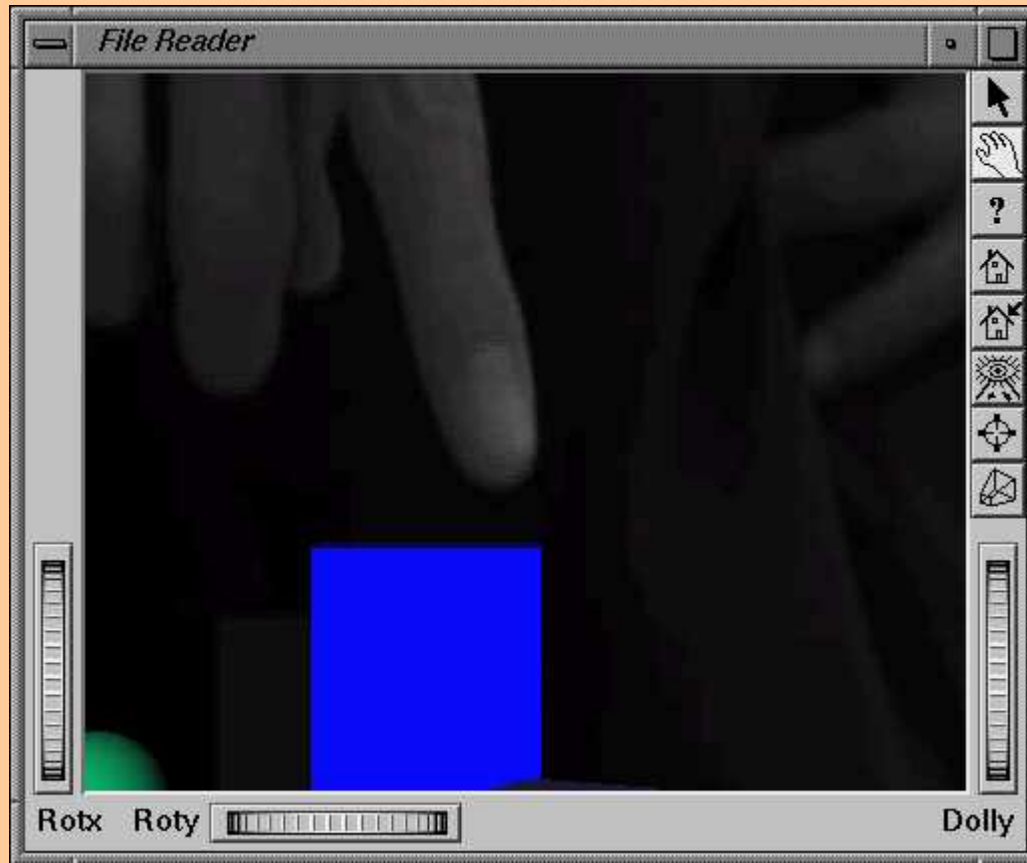
Multiple Views



View 2 of the integration

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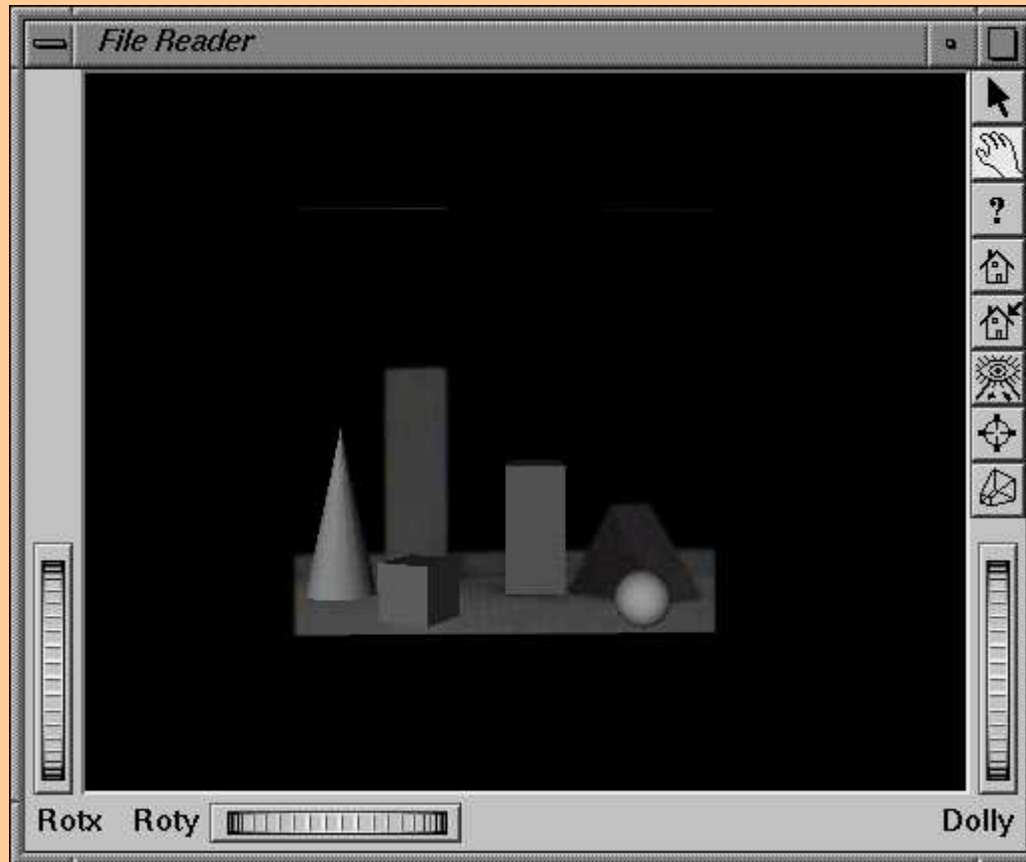
Virtual camera movement



Zoom

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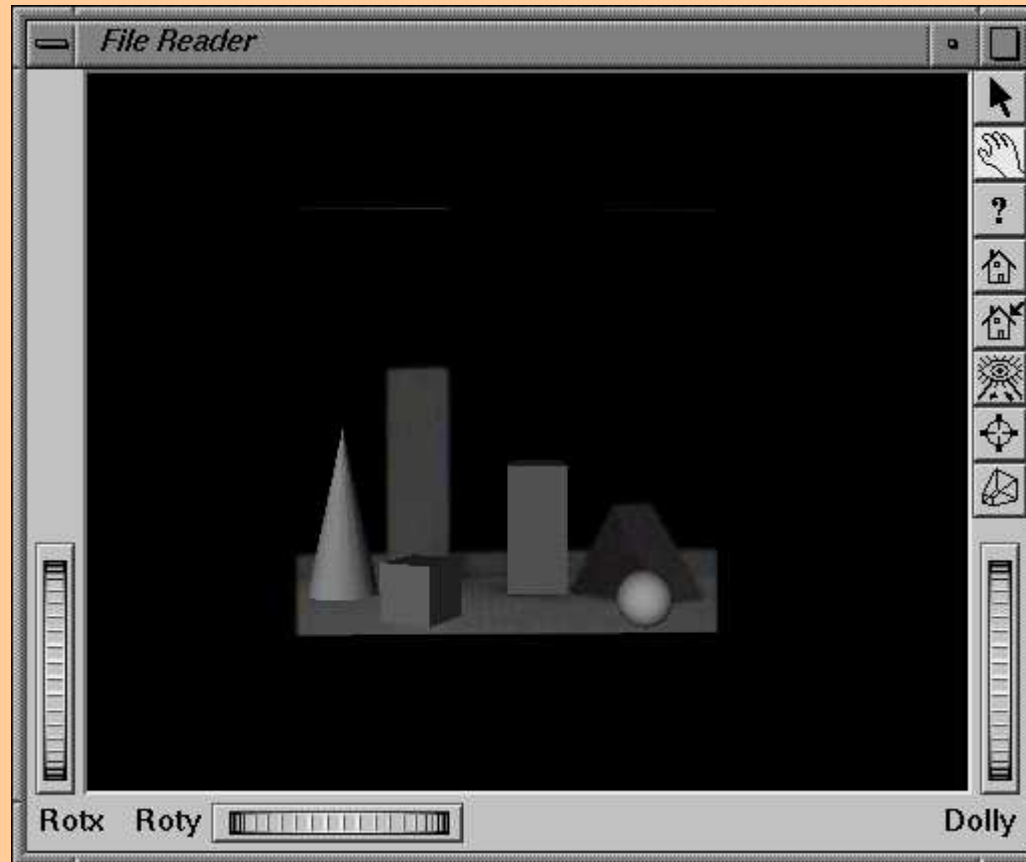
Virtual camera movement



Zoom

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Virtual camera movement



Tilt

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CONCLUSIONS & FUTURE WORK

- Domestic production of virtual worlds
- Standard Tools (Open Inventor, VRML, ...)
- Simple calibration process with pinhole camera model
- Good degree of geometry coherence

CONCLUSIONS & FUTURE WORK

- 3D Navigation: multiple cameras, virtual shooting
- Time Coherence in Animations (interactions between real and synthetic objects)
- Illumination Coherence (Lighting, shadows, ...)
- Study of more complex objects (deformable)
- More sophisticated mathematical tools (trilinear tensors, etc..)



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