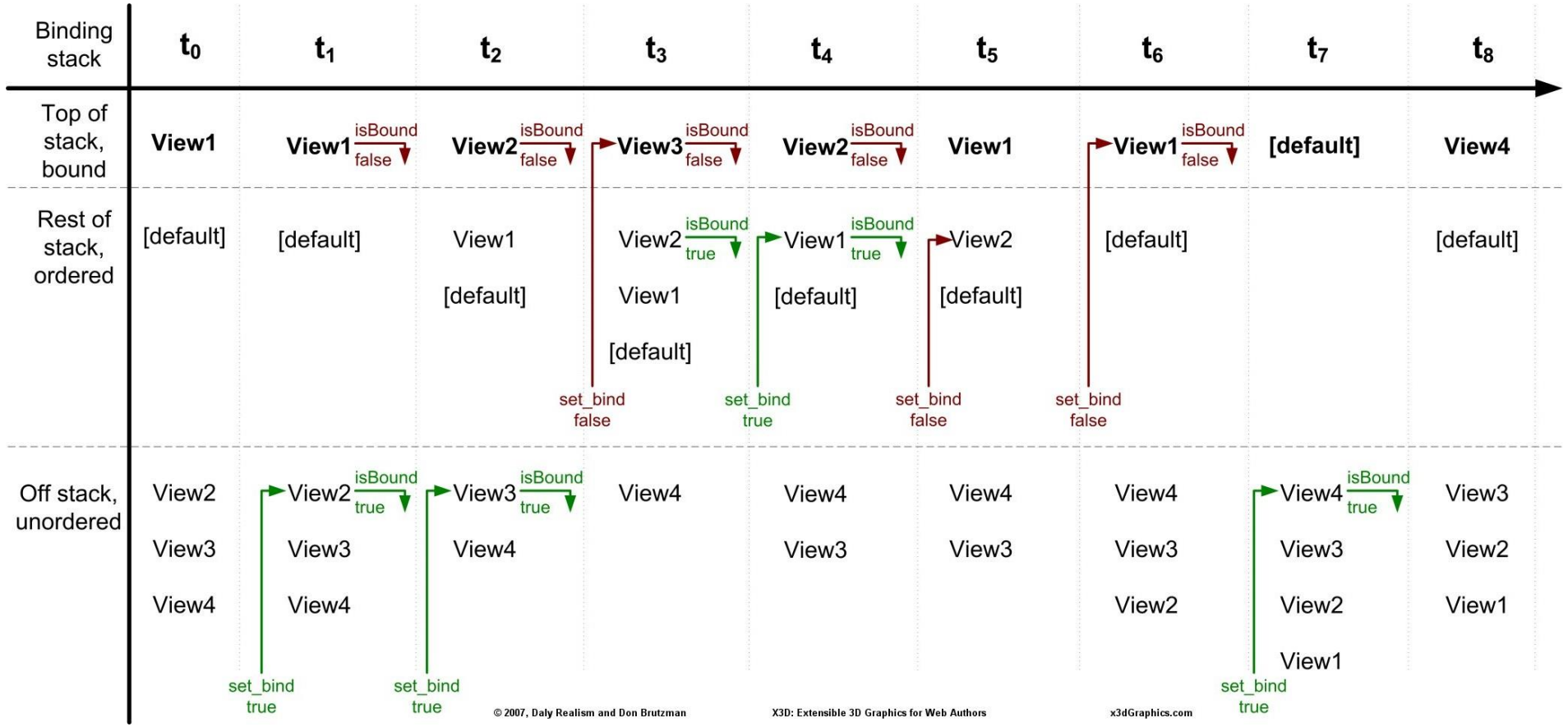
# Viewing and Navigation Nodes

- Abstract node types
  - X3DBindableNode type
- Nodes
  - Viewpoint
  - NavigationInfo
  - Anchor
  - Billboard
  - Collision

# X3DBindableNode type

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFBool | inputOnly | set_bind | | | Interactive |
| SFBool | outputOnly | isBound | | | Interactive |
| SFTime | outputOnly | bindTime | | | Interactive |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

# Binding node operations (σελ. 99)



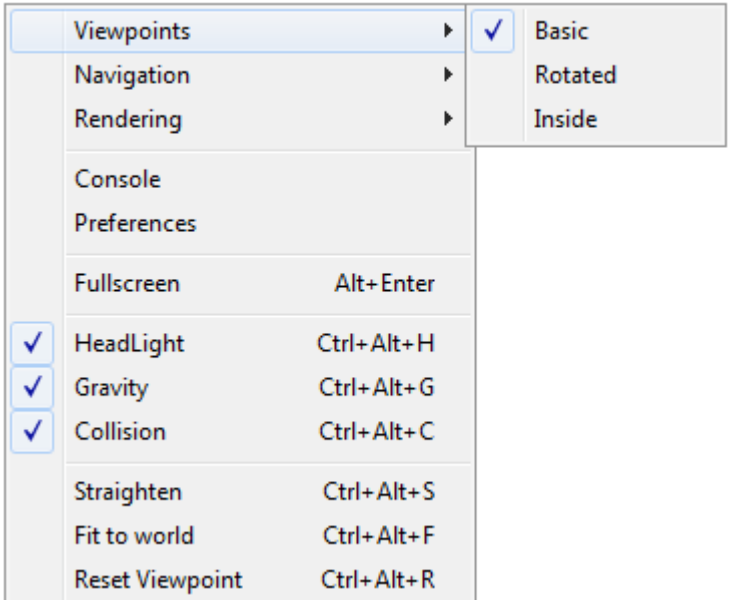
# Viewpoint Node

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFVec3f | inputOutput | centerOfRotation | 0 0 0 | (–∞, ∞) | Interactive |
| SFString | inputOutput | description | "" (null string) | | Immersive |
| SFFloat | inputOutput | fieldOfView | π/4 | (0,π) | Immersive |
| SFBool | inputOutput | jump | true | | Interactive |
| SFRotation | inputOutput | orientation | 0 0 1 0 | [-1, 1], (–∞, ∞) | Interactive |
| SFVec3f | inputOutput | position | 0 0 10 | (–∞, ∞) | Interactive |
| SFBool | inputOnly | set_bind | | | Interactive |
| SFBool | outputOnly | isBound | | | Interactive |
| SFTime | outputOnly | bindTime | | | Interactive |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

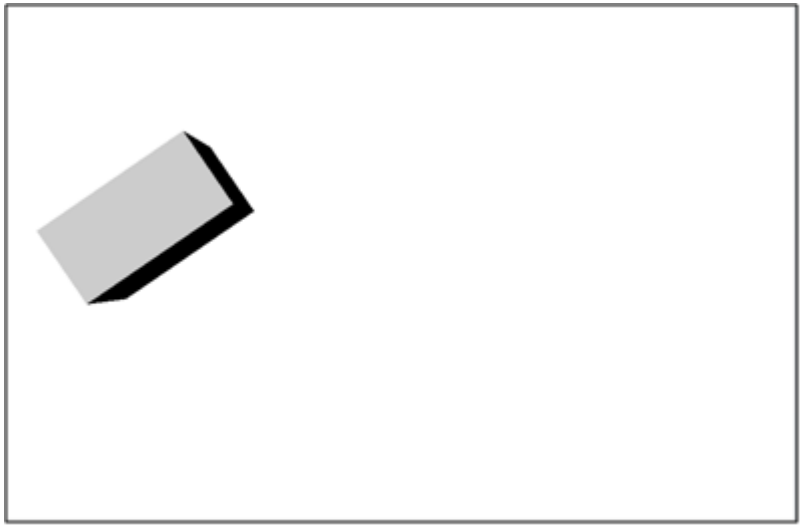
# Viewpoint Node (cont'd)

```
<Viewpoint DEF="MyViewpointNode"
  description="hello, world!"
  position="0 0 0"
  orientation="0 0 1 0"
  jump="true"
  centerOfRotation="0 0 0"/>
```

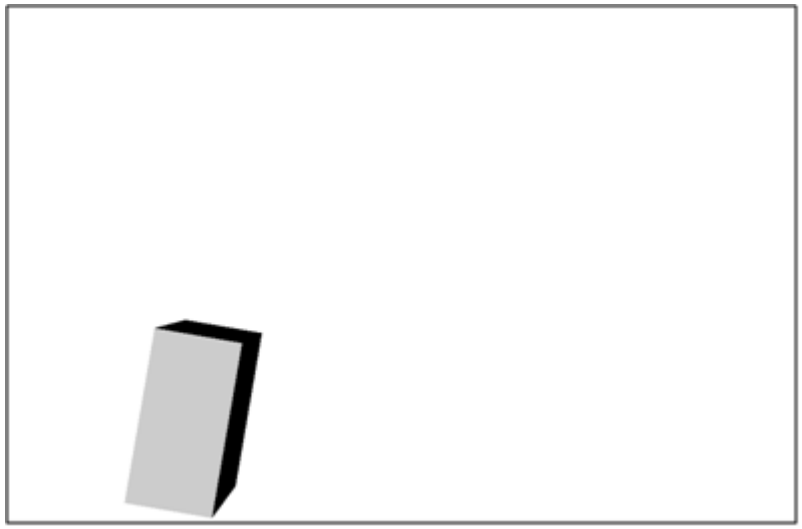
```
<Background skyColor="1 1 1"/>
<Viewpoint description="Basic"
        position="0 0 15 " />
<Viewpoint description="Rotated"
        position="0 0 15"
        orientation="0 0 -1 0.8" />
<Transform translation="-6 1 0" rotation="0 0 1 0.6 ">
        <Shape>
                <Box size="4 2 2" solid="false"/>
                <Appearance>
                        <Material/>
                </Appearance>
        </Shape>
        <Viewpoint description="Inside"
                position="0 0 1"
                orientation="0 1 0 0.7"/>
</Transform>
```



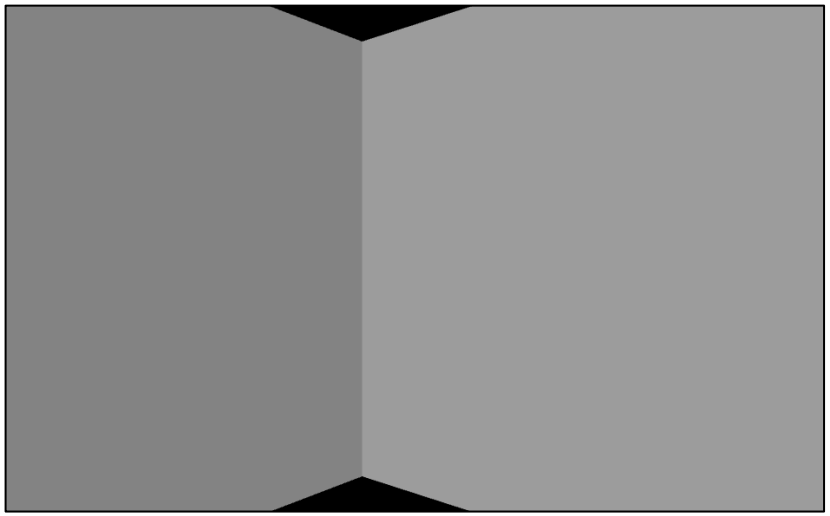

Basic



Rotated



Inside



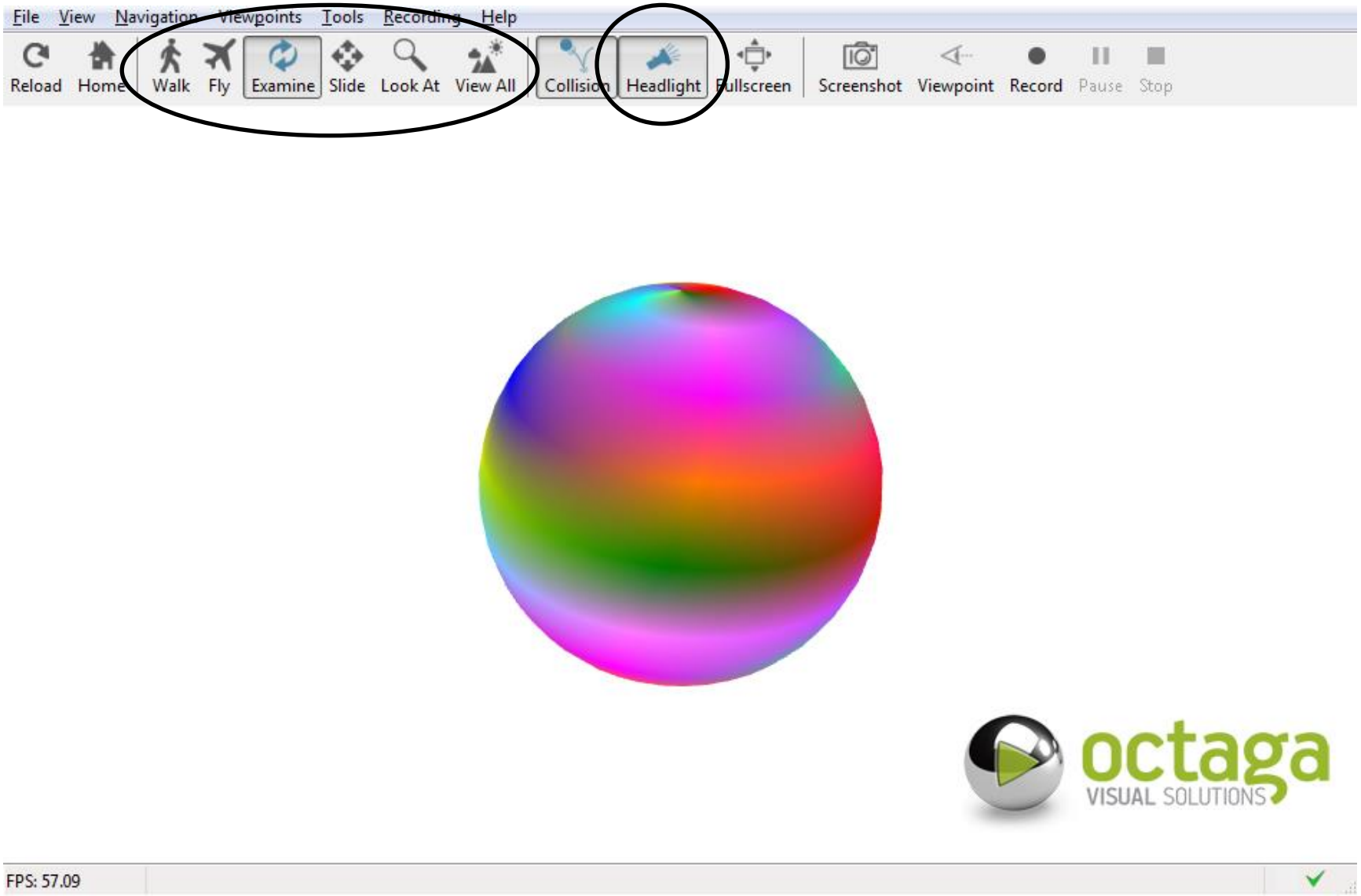
# NavigationInfo Node

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| MFString | inputOutput | type | ["EXAMINE", "ANY"] | "ANY" "FLY" "EXAMINE" "LOOKAT" "WALK" "PAN" "PLAY" "SLIDE" "ROLL" "NONE" | Interactive ("ANY" "FLY" "EXAMINE" "LOOKAT"), Immersive |
| SFFloat | inputOutput | speed | 1.0 | [0, ∞) | Immersive /Interactive |
| SFBool | inputOutput | headlight | true | | Interactive |
| MFString | inputOutput | transition Type | ["LINEAR"] | ["TELEPORT", "LINEAR", "ANIMATE"] | Interactive |
| SFBool | outputOnly | transitionComplete | | | Immersive |
| MFTime | inputOutput | transitionTime | 1.0 | [0,∞) | Immersive |
| SFFloat | inputOutput | visibilityLimit | 0.0 | [0,∞) | Immersive/ Interactive |
| MFFloat | inputOutput | avatarSize | [0.25 1.6 0.75] | [0,∞) | Immersive/ Interactive |
| SFBool | inputOnly | set_bind | | | Interactive |
| SFBool | outputOnly | isBound | | | Interactive |
| SFTime | outputOnly | bindTime | | | Interactive |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

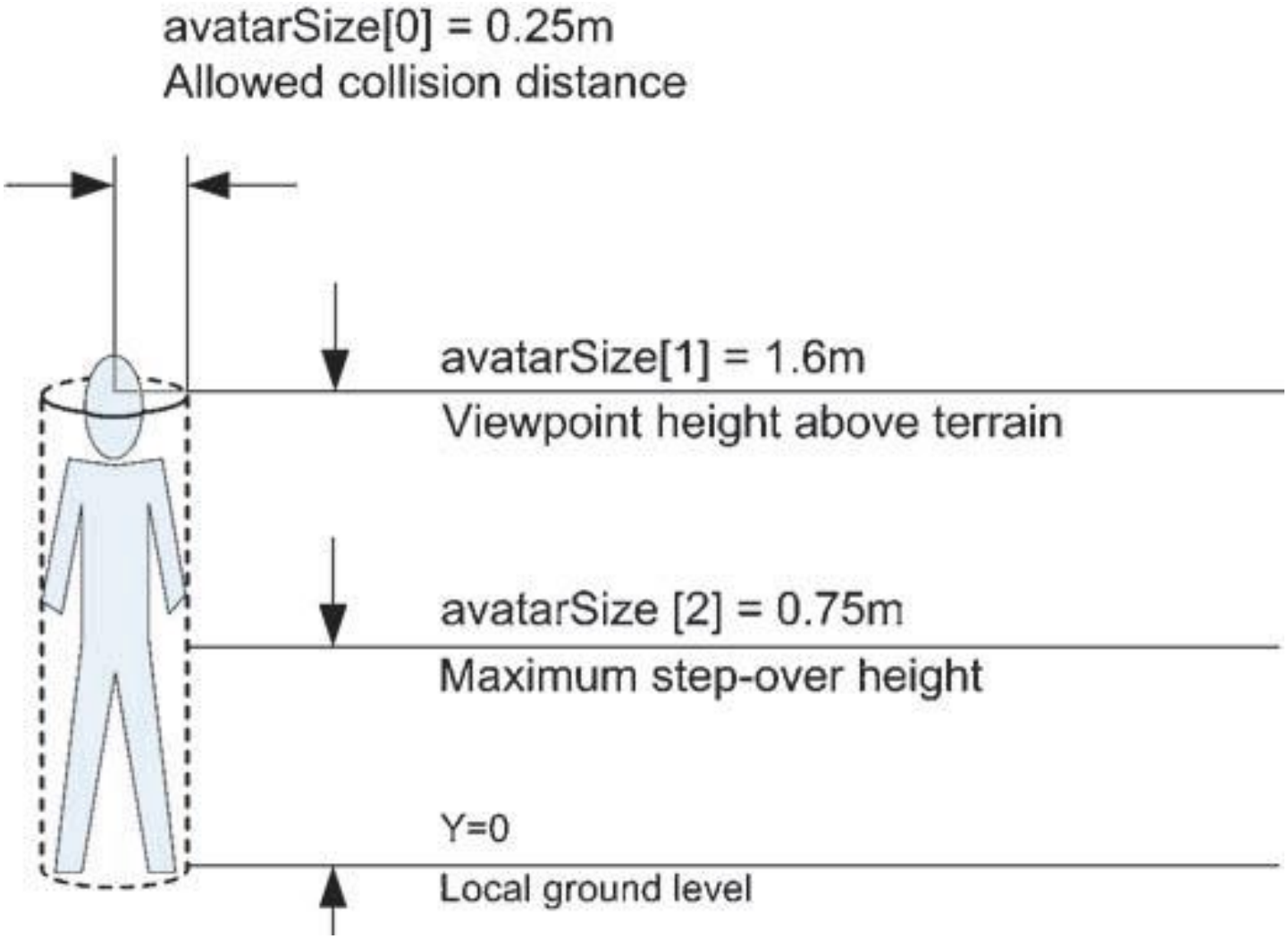
# NavigationInfo Node (cont'd)

```
<NavigationInfo
  DEF="MyNavigationInfoNode"
  avatarSize="0.25 1.6 0.75"
  headlight="true"
  speed="1"
  type='"EXAMINE" "ANY" '
  visibilityLimit = "0"
  transitionTime = "1"
  transitionType = "LINEAR"
/>
```

# NavigationInfo Node



# AvatarSize field



# Anchor Node

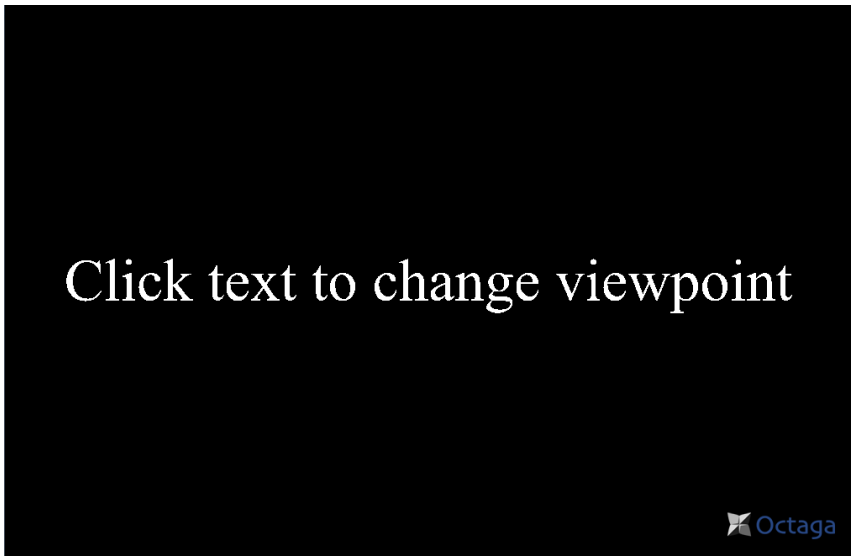
| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFString | inputOutput | description | "" (null string) | | Interactive |
| SFString | inputOutput | url | "" (null string) | | Interactive |
| SFBool | inputOutput | parameter | "" (null string) | | Interactive |
| MFString | inputOutput | children | [ ] | [X3DChildNode] | Interactive |
| SFBool | inputOnly | addChildren | [ ] | [X3DChildNode] | Interactive |
| MFTime | inputOnly | removeChildren | [ ] | [X3DChildNode] | Interactive |
| SFBool | initializeOnly | bboxCenter | 0 0 0 | (–∞, ∞) | Interactive |
| SFTime | initializeOnly | bboxSize | -1 -1 -1 | [0, ∞) or –1 –1 –1 | Interactive |
| SFNode | inputOutput | Metadata | NULL | [X3DMetadataObject] | Core |

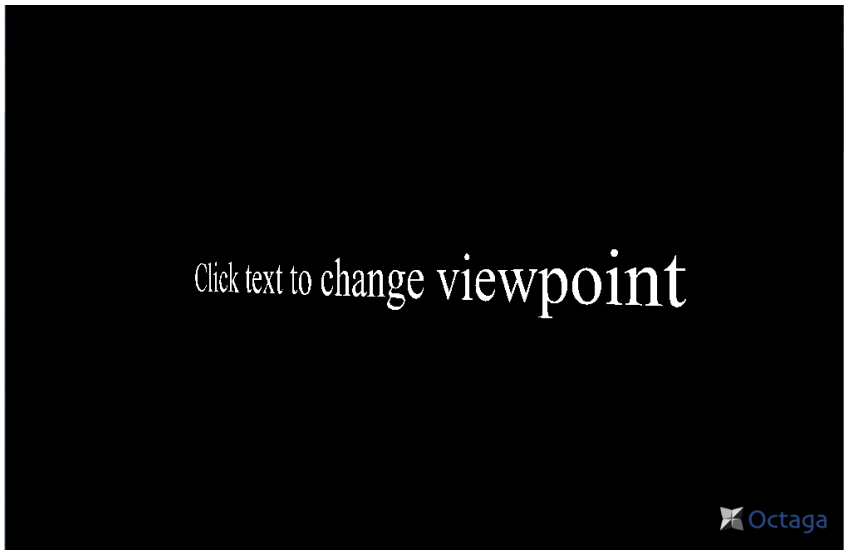
# Anchor Node (cont'd)

```
<Anchor DEF="MyAnchorNode"
  description="click to jump!"
  url="#LocalViewpointName"
  bboxCenter="0 0 0"
  bboxSize="-1 -1 -1">
  <Group DEF="MySelectableGroup"/>
</Anchor>
```

```
<Viewpoint DEF='FrontView'
        description='Front'
        position='0 0 6'/>
<Viewpoint DEF='AngledView'
        description='Side'
        orientation='0 1 0 0.7854' position='5 0 4'/>
<Anchor description='Move view to diagonal Viewpoint'
        url=' "#AngledView" '>
        <Shape DEF='AnchorMessage2'>
                <Text string='"Click text to change viewpoint"'>
                        <FontStyle justify='"MIDDLE" "MIDDLE"' size='0.6'/>
                </Text>
        </Shape>
        <Shape DEF='TransparentBoxForEasierUserSelection'>
                <Box size='7 2 0.02'/>
                <Appearance>
                        <Material transparency='1'/>
                </Appearance>
        </Shape>
</Anchor>
```

# Anchor Node (cont'd)



# Billboard Node

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFVec3f | inputOutput | axisOfRotation | 0 1 0 | (-∞.∞) | Immersive |
| MFNode | inputOutput | children | [ ] | [X3DChildNode] | Immersive |
| MFNode | inputOnly | addChildren | [ ] | [X3DChildNode] | Interactive |
| MFNode | inputOnly | removeChildren | [ ] | [X3DChildNode] | Interactive |
| SFVec3f | initializeOnly | bboxCenter | 0 0 0 | (-∞.∞) | Interactive |
| SFVec3f | initializeOnly | bboxSize | -1 -1 -1 | [0, ∞) or -1 -1 -1 | Interactive |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

```
<Billboard DEF="MyBillboardNode"
  axisOfRotation="0 1 0"
  bboxCenter="0 0 0"
  bboxSize="-1 -1 -1">
  <Group DEF="WatchMeRotate"/>
</BillBoard>
```

# Collision Node

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFBool | inputOutput | enabled | | true | Immersive |
| SFTime | inputOutput | collideTime | | | Immersive |
| SFBool | outputOnly | isActive | | | Immersive |
| SFNode | initializeOnly | proxy | NULL | Shape or X3DChildNode | Immersive |
| MFNode | inputOutput | children | [ ] | [X3DChildNode] | Immersive |
| MFNode | inputOnly | addChildren | [ ] | [X3DChildNode] | Immersive |
| MFNode | inputOnly | removeChildren | [ ] | [X3DChildNode] | Immersive |
| SFVec3f | initializeOnly | bboxCenter | 0 0 0 | (-∞, ∞) | Immersive |
| SFVec3f | initializeOnly | bboxSize | -1 -1 -1 | [0, ∞) or -1 -1 -1 | Immersive |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

# Collision Node

```
<Collision DEF="MyCollisionNode"
  enabled="true"
  bboxCenter="0 0 0"
  bboxSize="-1 -1 -1">
   <Group DEF="MyCollidableGroup"
     containerField="children"/>
   <Shape DEF="MyHiddenProxy"
     containerField="proxy"/>
</Collision>
```

# Appearance, Material and Textures

- Abstract Node Types
  - X3DTexture2DNode
- Nodes
  - Appearance
  - Material
  - FillProperties
  - LineProperties
  - ImageTexture
  - MovieTexture
  - PixelTexture
  - TextureTransform
  - TextureCoordinate
  - TextureCoordinateGenerator

# X3DTexture2DNode type

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFBool | initializeOnly | repeatS | true | | Interchange |
| SFBool | initializeOnly | repeatT | true | | Interchange |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

# Appearance Node

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFNode | inputOutput | material | NULL | [X3DMaterialNode] | Interchange |
| SFNode | InputOutput | texture | NULL | [X3DTextureNode] | Interchange |
| SFNode | inputOutput | textureTransform | NULL | [X3DTextureTransformNode] | Optional under Interchange, supported under Immersive |
| SFNode | inputOutput | fillProperties | NULL | [FillProperties] | Full |
| SFNode | inputOutput | lineProperties | NULL | [LineProperties] | Immersive |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

# Appearance Node (cont'd)

```
<Shape>
  <Box/>
  <Appearance DEF="MyAppearance">
        <FillProperties filled="true"
                hatchcolor="1 1 1"
                hatchStyle="1"
                      hatched="true" />
        <LineProperties linetype="1"
                linewidthScaleFactor="1.0" />
        <Material DEF="MyMaterial"
                diffuseColor="0 0.6 0.6"
                shininess="0.2" />
        <ImageTexture DEF="EarthImage"
                      url="earth-topo.png"/>
        <TextureTransform
                      rotation=0.78" />
    </Appearance>
</Shape>
```

# Material Node

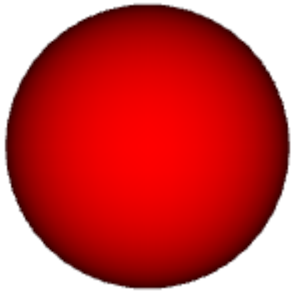
| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFFloat | inputOutput | ambientIntensity | 0.2 | [0.1] | Optional support in Interchange, complete in Immersive |
| SFColor | inputOutput | diffuseColor | 0.8 0.8 0.8 | [0,1] | Interchange |
| SFColor | inputOutput | emmissiveColor | 0 0 0 | [0,1] | Interchange |
| SFFloat | inputOutput | shininess | 0.2 | [0,1] | Optional support in Interchange, complete in Immersive |
| SFColor | inputOutput | specularColor | 0 0 0 | [0,1] | Optional support in Interchange, complete in Immersive |
| SFFloat | InputOutput | transparency | 0.0 | [0,1] | One-bit support in interchange profile (transparency >=0.5 is transparent). Complete support in Immersive profile. |
| SFNode | inputOutput | metadata | NULL | [X3D Metadata Object] | Core |

# Material Node (cont'd)

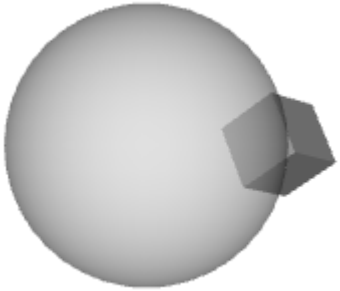
```
<Material DEF="MyMaterial"
  ambientIntensity="0.2"
  diffuseColor="0.8 0.8 0.8"
  emmissiveVolor="0 0 0"
  shininess="0.2"
  specularCOlor="0 0 0"
  transparency="0"
  containerField="material"/>
```

# Material Node

diffuseColor="1 0 0"



transparency="0.4"

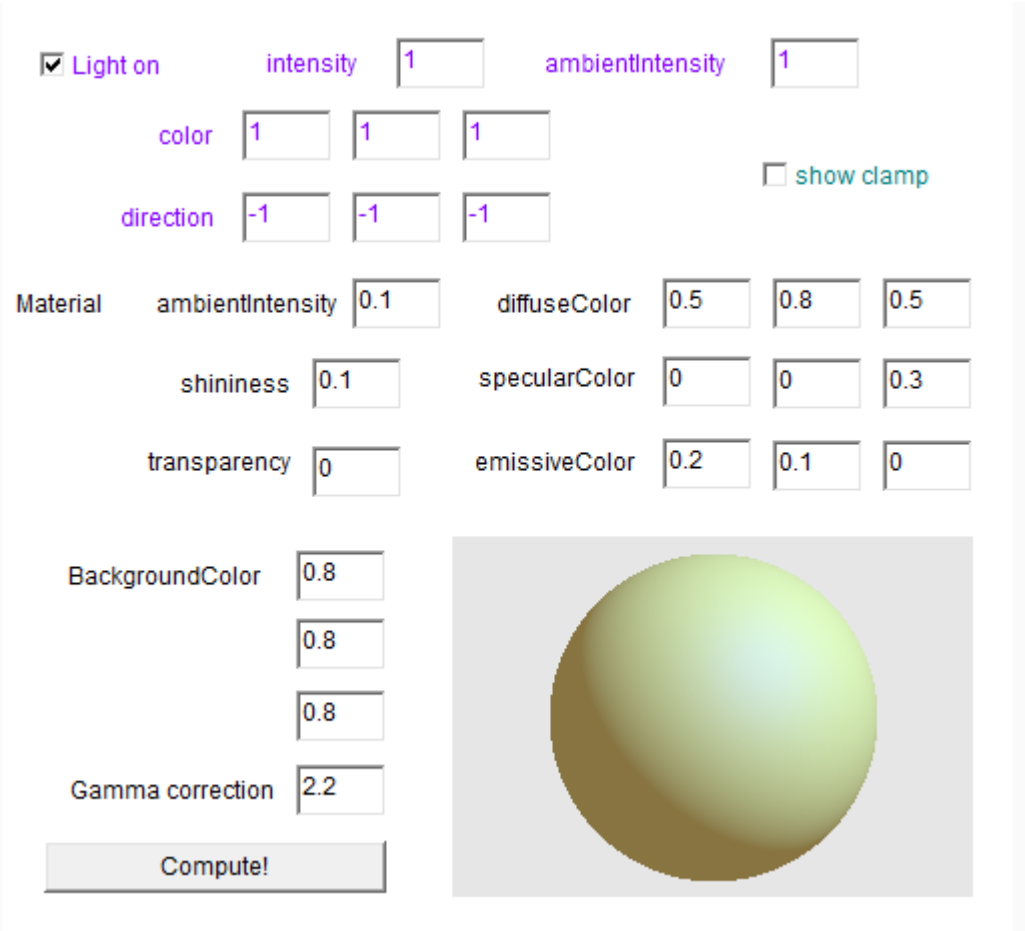


diffuseColor="0.4 0.4 0.4"
shininess="0.7"
specularColor="0 0 1"

emissiveColor="0 1 0"

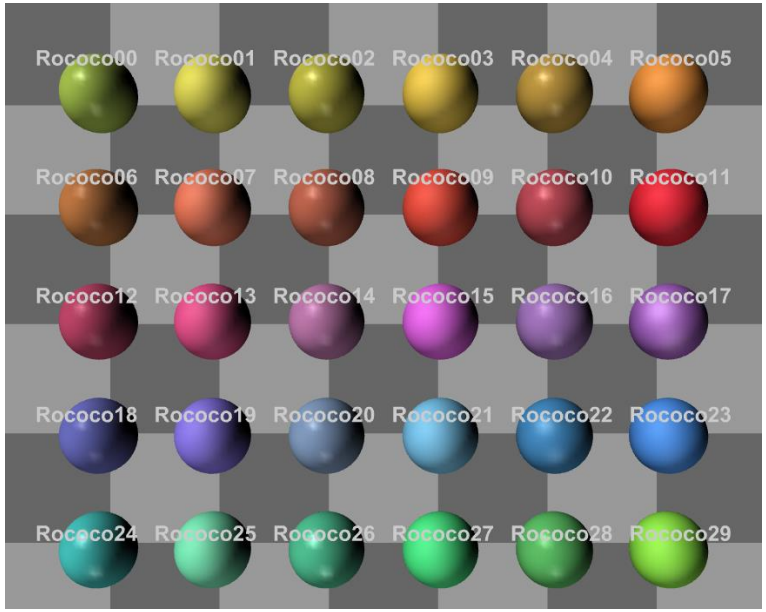
# Pellucid Java applet

http://www.siggraph.org/education/materials/HyperGraph/illumin/vrml/pellucid.html



# Universal Media Materials Library

http://www.web3d.org/x3d/content/examples/Basic/UniversalMediaMaterials/



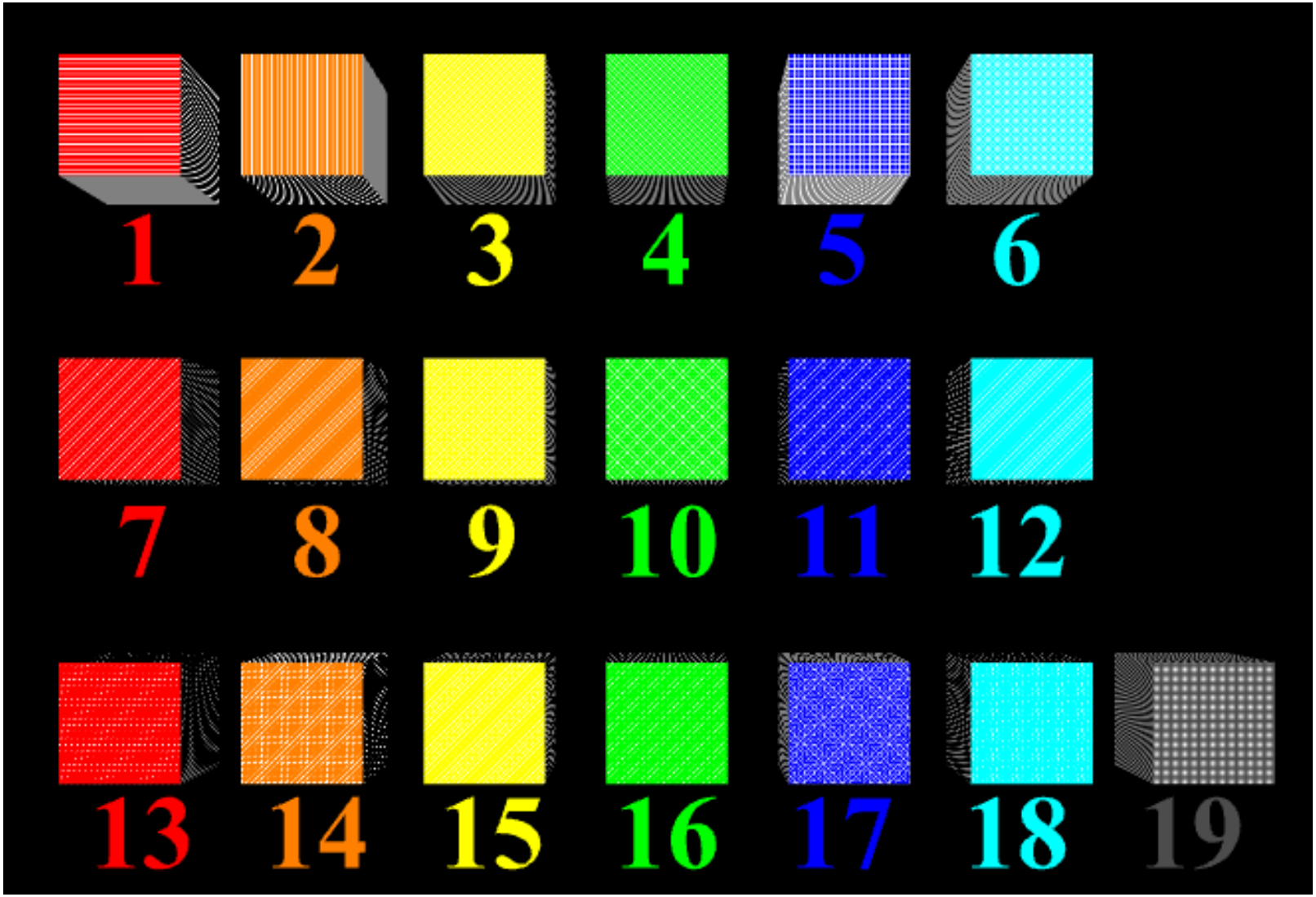

```
<ProtoDeclare name='Rococo06'
        appinfo='UniversalMediaMaterialsprototype'
        documentation=' http://ww…Materials '>
        <ProtoBody>
                <Material
                ambientIntensity='0.25'
                diffuseColor='0.748016
                        0.467103
                        0.261641'
                shininess='0.872727'
                specularColor='0.251984
                        0.251984
                        0.251984'/>
        </ProtoBody>
</ProtoDeclare>
```

# FillProperties Node

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFBool | inputOutput | filled | true | | Full |
| SFColor | InputOutput | hatchColor | 1 1 1 | [0,1] | Full |
| SFBool | inputOutput | hatched | true | | Full |
| SFInt32 | inputOutput | hatchStyle | 1 | [0, ∞) | Full |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

```
<FillProperties DEF="MyFillProperties"
  filled="true"
  hatched="true"
  hatchColor="1 1 1"
  hatchStyle="1"
  containerField="fillProperties" />
```

# hatchStyle field



# hatchStyle field

| Enumeration Code | Hatch Pattern |
|---|---|
| 1 | Horizontal equally spaced parallel lines |
| 2 | Vertical equally spaced parallel lines |
| 3 | Positive slope equally spaced parallel lines |
| 4 | Negative slope equally spaced parallel lines |
| 5 | Horizontal/vertical crosshatch |
| 6 | Positive slope/negative slope crosshatch |
| 7 | (cast iron or malleable iron and general use for all materials) |
| 8 | (steel) |
| 9 | (bronze, brass, copper, and compositions) |
| 10 | (white metal, zinc, lead, babbit, and alloys) |
| 11 | (magnesium, aluminum, and aluminum alloys) |
| 12 | (rubber, plastic, and electrical insulation) |
| 13 | (cork, felt, fabric, leather, and fibre) |
| 14 | (thermal insulation) |
| 15 | (titanium and refractory material) |
| 16 | (marble, slate, porcelain, glass, etc.) |
| 17 | (earth) |
| 18 | (sand) |
| 19 | (repeating dot) |

# LineProperties Node

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFBool | inputOutput | applied | true | | Immersive |
| SFInt32 | inputOutput | linetype | 1 | [1, ∞] | Immersive |
| SFInt32 | inputOutput | Linewidth scaleFactor | 0 | (–∞, ∞) | Immersive |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

```
<LineProperties DEF="MyLineProperties"
    linetype="1"
    linewidthScaleFactor="0"
    containerField="lineProperties"/>
```

# lineType field

# ImageTexture Node

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| MFString | inputOutput | url | [ ] | [urn] | Interchange |
| SFBool | initializeOnly | repeatS | true | | Interchange |
| SFBool | initializeOnly | repeatT | true | | Interchange |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

```
<ImageTexture DEF="MyImageTexture"
    repeatS="true"
    repeatT="true"
    url=‘ "earth-topo.png" "earth-topo.jpg" ’
    containerField="texture" />
```

# ImageTexture Node

```
<Shape>
        <Box/>
        <Appearance>
                <ImageTexture
                    url="Boat.jpg"/>
        </Appearance>
</Shape>
```

# ImageTexture Node

# MovieTexture Node

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFBool | inputOutput | loop | false | | Immersive |
| SFTime | inputOutput | resumeTime | 0 | (-∞, ∞) | Immersive |
| SFTime | inputOutput | pauseTime | 0 | (-∞, ∞) | Immersive |
| SFFloat | inputOutput | speed | 1.0 | (-∞, ∞) | Immersive |
| SFTime | inputOutput | startTime | 0 | (-∞, ∞) | Immersive |
| SFTime | inputOutput | stopTime | 0 | (-∞, ∞) | Immersive |
| MFString | inputOutput | url | [ ] | [urn] | Immersive |
| SFTime | outputOnly | duration_changed | | | |
| SFTime | outputOnly | elapsedTime | | | |
| SFBool | outputOnly | isActive | | | |
| SFBool | outputOnly | isPaused | | | |
| SFBool | initializeOnly | repeatS | true | | Immersive |
| SFBool | initializeOnly | repeatT | true | | Immersive |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

# MovieTexture Node

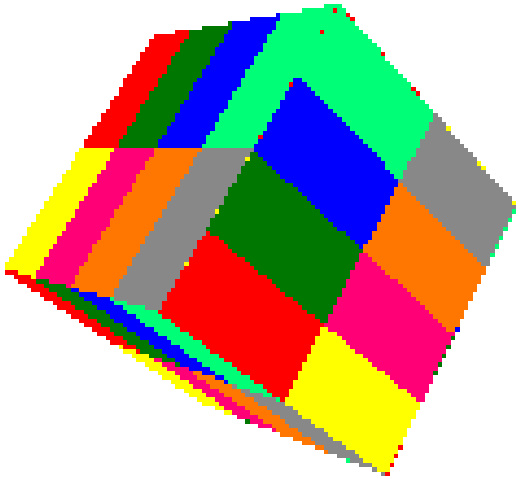
```
<MovieTexture DEF="MyMovieTexture"
    url="MovieName.mpg"
    loop="false"
    pauseTime="0"
    repeatS="true"
    repeatT="true"
    resumeTime="0"
    speed="1.0"
    startTime="0"
    stopTime="0"
    containerField="texture" />
```

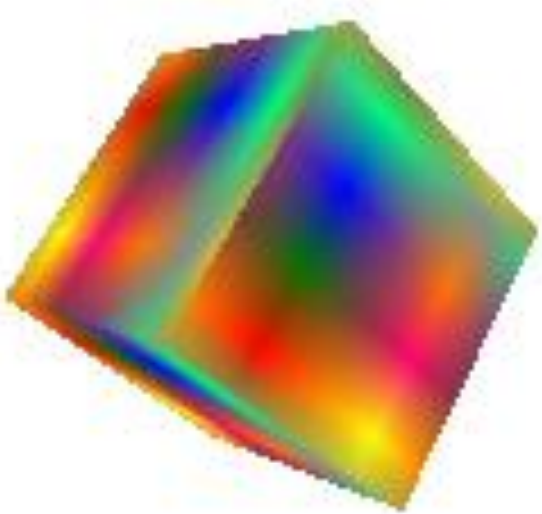
# PixelTexture node

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFImage | inputOutput | image | 0 0 0 | | Immersive |
| SFBool | initializeOnly | repeatS | true | | Interchange |
| SFBool | initializeOnly | repeatT | true | | Interchange |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

```
<PixelTexture DEF="MyPixelTexture"
    image="0 0 0"
    repeatS="true"
    repeatT="true"
    containerField="texture" />
```

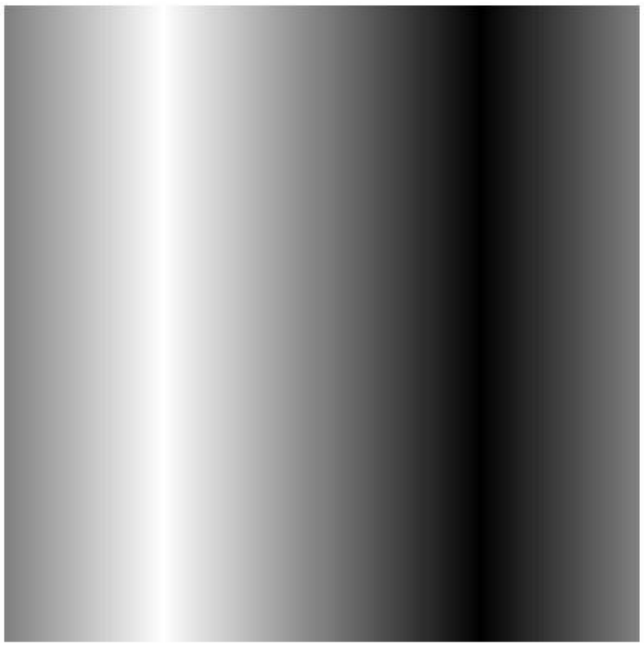
# PixelTexture node



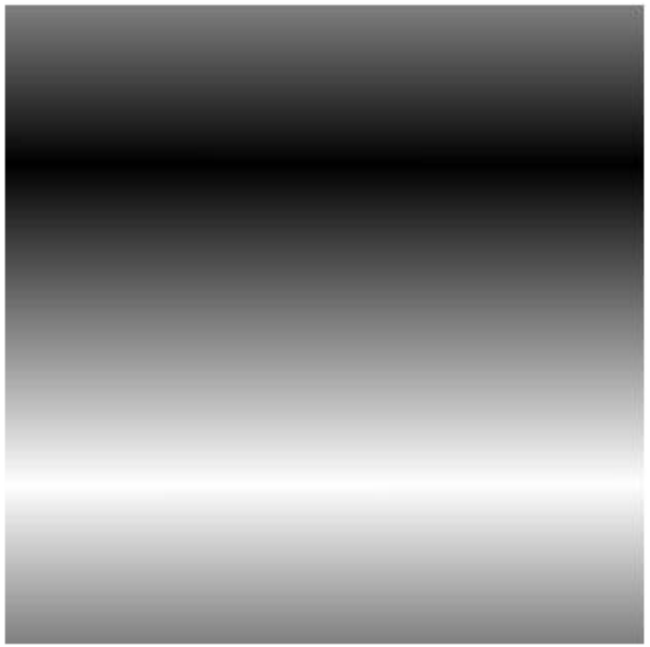


# Image field type

```
<Shape>
    <Box/>
    <Appearance>
          <PixelTexture DEF='PixelColors'
           image=‘2 1 1 0xFF 0x00'/>
     </Appearance>
</Shape>
```

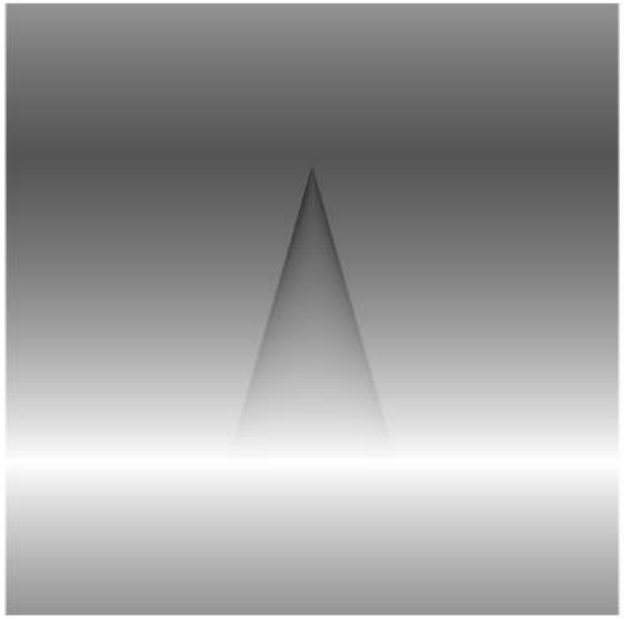


```
<Shape>
    <Box/>
    <Appearance>
          <PixelTexture DEF='PixelColors'
           image='1 2 1 0xFF 0x00'/>
     </Appearance>
</Shape>
```

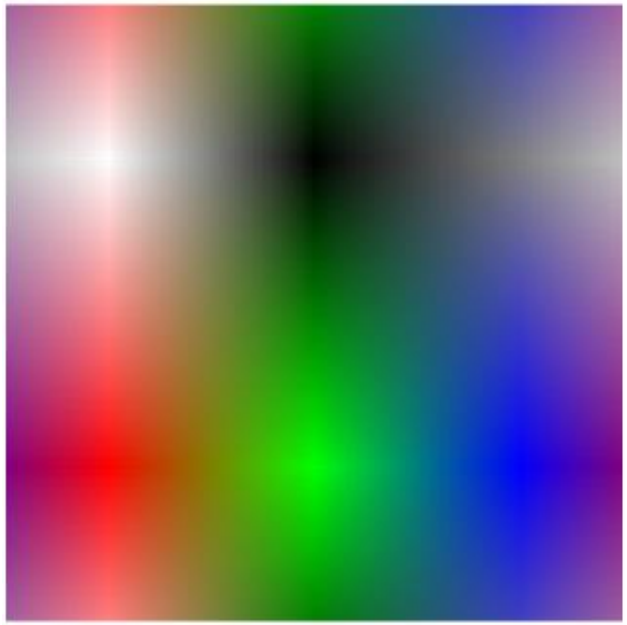


# Image field type

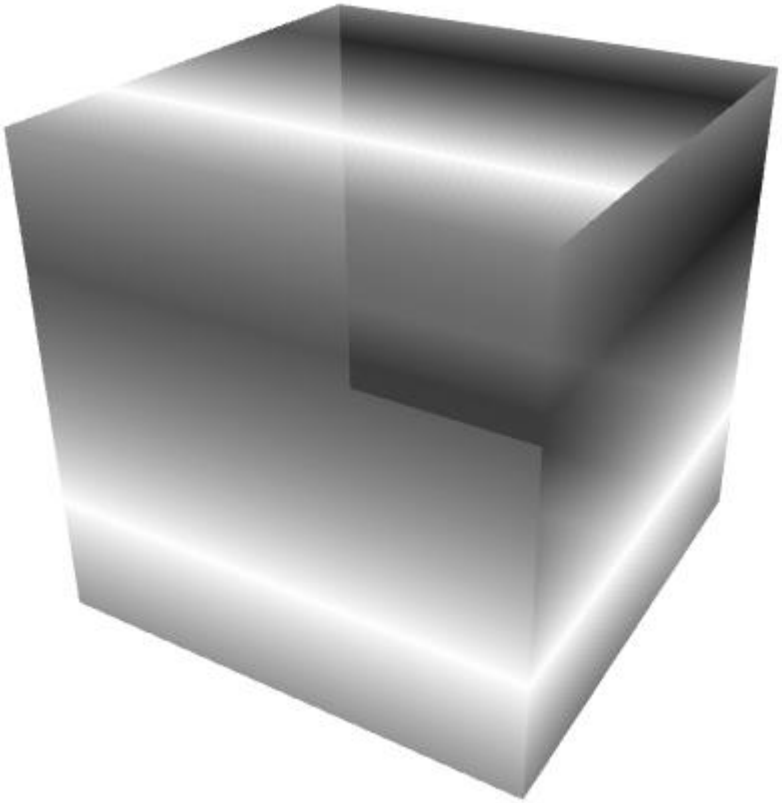
```
<Shape>
    <Box/>
    <Appearance>
          <PixelTexture DEF='PixelColors'
             image='1 2 2 0xffff 0x00d0'/>
</Appearance>
</Shape>
```

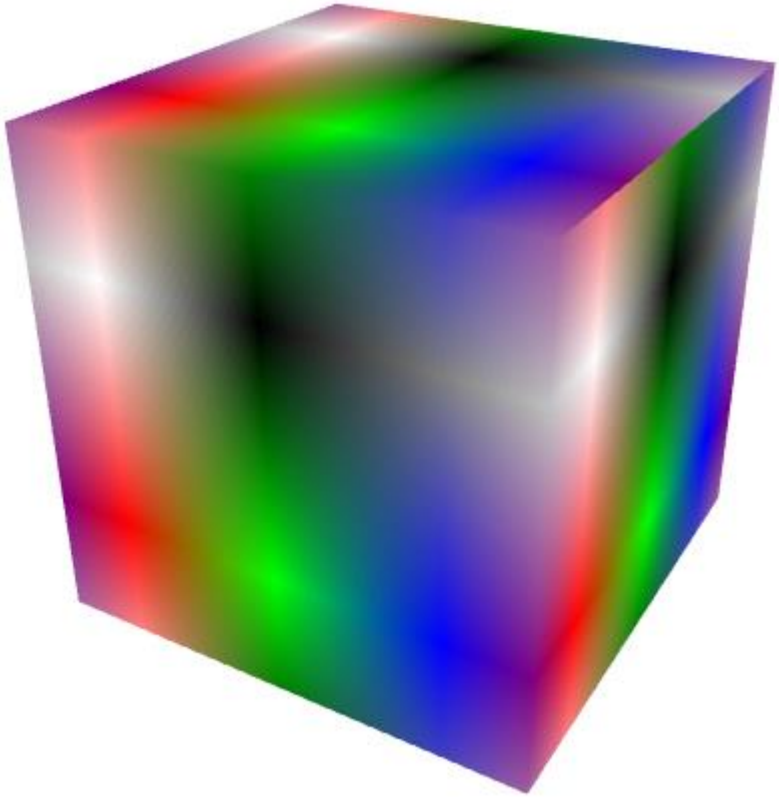


```
<Shape>
    <Box/>
    <Appearance>
          <PixelTexture DEF='PixelColors'
             image='3 2 3 0xff0000 0x00ff00
                         0x0000ff 0xffffff
                         0x000000 0x808080'/>
    </Appearance>
</Shape>
```



# PixelTexture node





# TextureTransform Node

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFVec2f | inputOutput | center | 0 0 | (-∞, ∞) | Immersive |
| SFFloat | inputOutput | rotation | 0 | (-∞, ∞) | Interchange |
| SFVec2f | inputOutput | translation | 0 0 | (-∞, ∞) | Interchange |
| SFVec2f | inputOutput | scale | 1 1 | (-∞, ∞) | |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

```
<TextureTransform DEF= "MyTextureTransform"
    center="0 0"
    translation="0 0"
    rotation="0"
    scale="1 1"
    containerField="textureTransform"/>
```

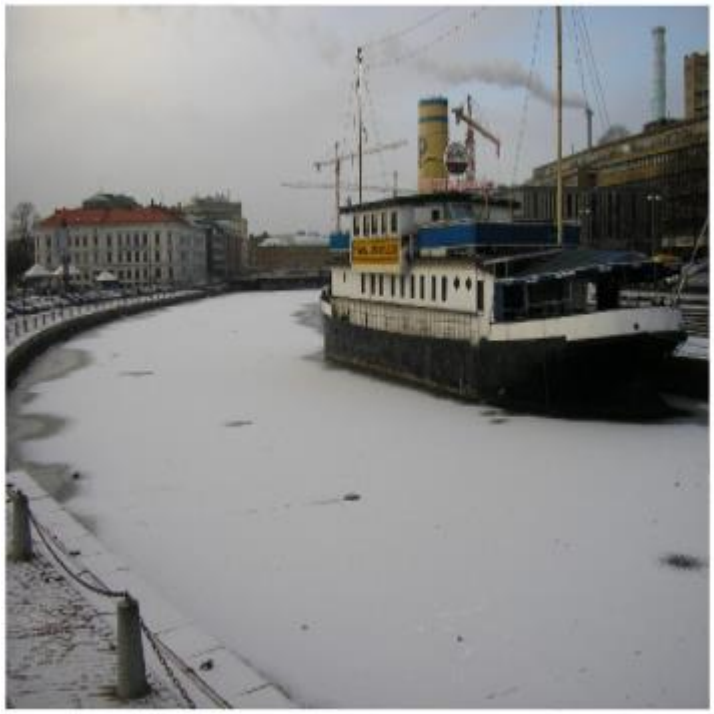
# TextureTransform Node

```
<Shape>
    <Box solid='false'/>
    <Appearance>
        <ImageTexture url='boat.jpg'/>
    </Appearance>
</Shape>
```

```
<Shape>
    <Box solid='false'/>
    <Appearance>
        <ImageTexture url='boat.jpg'/>
        <TextureTransform translation="-0.2 0"/>
    </Appearance>
</Shape>
```

# TextureTransform Node

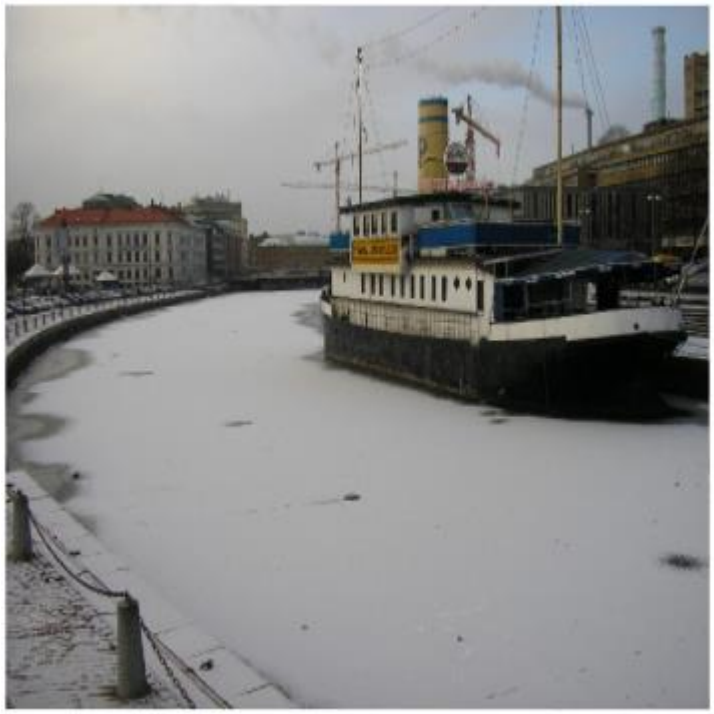
<ImageTexture url='boat.jpg'/>



<ImageTexture url='boat.jpg'/>
<TextureTransform translation="0.3 0.3"/>

# TextureTransform Node

```
<ImageTexture url='boat.jpg'/>
<TextureTransform translation="1  1"/>
```



```
<ImageTexture url='boat.jpg'/>
<TextureTransform translation="1.3  1.3"/>
```

# TextureTransform Node

```
<ImageTexture url='boat.jpg'
        repeatS="false"/>
<TextureTransform
        translation="0.3 0.3"/>
```

```
<ImageTexture url='boat.jpg'
        repeatT="false"/>
<TextureTransform
        translation="0.3 0.3"/>
```

# TextureTransform Node

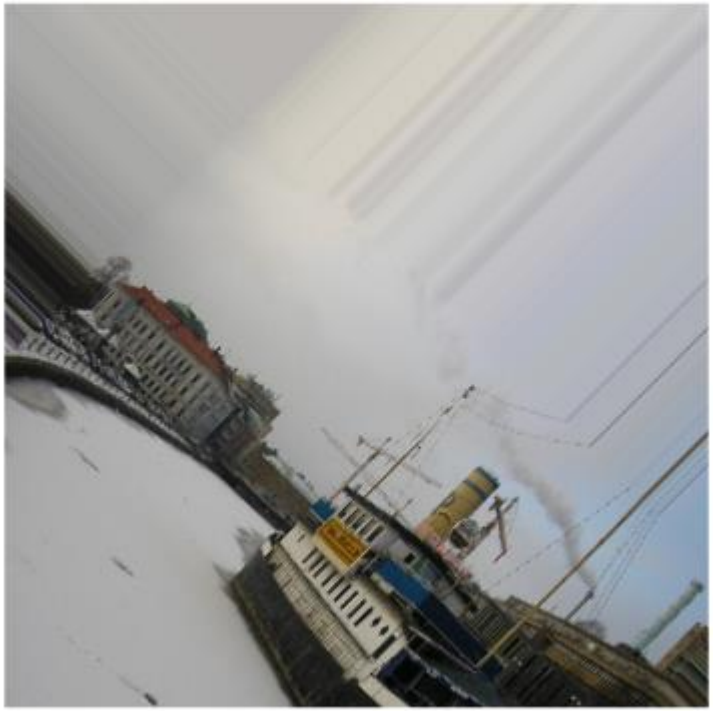
```
<TextureTransform
        rotation="0.785"/>
```

```
<TextureTransform
        rotation="0.785"
        center="0.5 0.5"/>
```

# TextureTransform Node

```
<TextureTransform
        rotation="0.785"
        center="0.5 0"/>
```

```
<TextureTransform
        rotation="0.785"
        center="0 0.5"/>
```



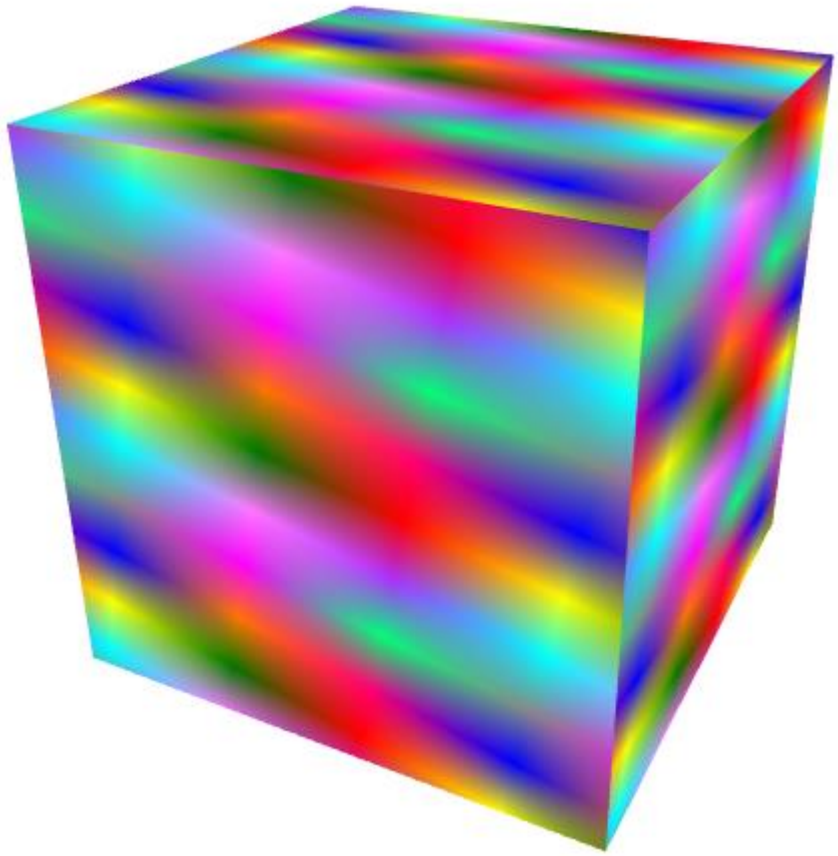
# TextureTransform Node

<TextureTransform scale="0.5 1"/>

<TextureTransform scale="1 2"/>

# TextureTransform Node

```
<PixelTexture image=
        '3 4 3 0xff0000 0xffff00 0x007700
              0xff0077 0x0000ff 0xff7700
              0x00ff77 0x888888 0xff00ff
              0xac31ff 0x00ffff 0xff77ff'/>
<TextureTransform scale="1.3 2.2"
        rotation="0.2" center="0.4 0.2"
        translation="0.4 0"/>
```



# TextureCoordinate node

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| MFVec2f | inputOutput | point | [] | (-∞, ∞) | |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

```
<TextureCoordinate DEF='MyTextureCoordinate'
point='0 0, 0 1, 1 1, 1 0'
containerField='texCoord'/>
```

# TextureCoordinateGenerator

| Type | accessType | Name | Default | Range | Profile |
|---|---|---|---|---|---|
| SFString | inputOutput | mode | "SPHERE" | Special | Immersive |
| MFFloat | inputOutput | parameter | [ ] | Special | Immersive |
| SFNode | inputOutput | metadata | NULL | [X3DMetadataObject] | Core |

<TextureCoordinateGenerator DEF='MyTextureCoordinateGenerator' mode='SPHERE' parameter='0 0, 0 1, 1 1, 1 0' containerField='texCoord'/>