## Thea Render OpenGL Viewport

<table>
<thead>
<tr>
<th>Revision</th>
<th>Author</th>
<th>Reason for Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/10/12</td>
<td>Christina Psarrou</td>
<td>Initial version.</td>
</tr>
</tbody>
</table>
Introduction

The Viewport is the realtime viewer in the center of the application. This is the main area where all the action takes place when you want to perform staging tasks, like moving an object, adding a light, creating an animation, starting interactive render etc.. Below, there is a detailed analysis of the existing toolbars, along with the corresponding functions. The main toolbars that appear in the Viewport are the Action Toolbar and the Viewer Toolbar. Both include a variety of options which are analytically described.

A. Action Toolbar

The Action toolbar is located at the top of the Viewport and includes all the tasks related to editing your scene. In figure 2 we see how this toolbar looks like.

These options, from left to right, are:
1. Object Selection & Viewport Navigation
2. Undo & Redo
3. Group & Ungroup
4. Duplicate Object
5. Object Transform: Translate, Rotate, Scale
6. Delete Object
7. Show all Objects & Hide Selected Object(s)
8. Object Visibility / Render Layers
9. Insert Lights, Cameras, Infinite Plane into the Scene
10. Preference Settings / Viewport Elements Visibility
11. Tools (Transform, Animation, Interactive Render)
12. Hide Toolbar

All these options will now be explained in detail.

Note 1: the way the Viewport is shown, can be changed from the Current View Properties panel, at the left side of the Viewport, displayed when clicking the small camera button. There, you can change the desired Resolution and Film Height along with the camera Focal Length (change of the zoom).

Note 2: this toolbar, as well as all other toolbars in the Viewport, can be placed to the position that is more convenient to the user. Once you click on it you can drag it wherever you want.
1. **Object Selection & Viewport Navigation**

By clicking on the first button of the Actions Toolbar, you can see a drop down list with 10 in total functions which define the action taken when the user clicks inside the Viewport. Here is an analytical description of these tools.

<table>
<thead>
<tr>
<th>Pin Tools button</th>
<th>Pin Tools button allow the user to place a small panel with all these options visible in the Viewport (figure 5), in order to have easier access to them. The new toolbar appears at the bottom right of the Viewport, but by clicking on the small horizontal lines at its right side, you can drag it to the position that is more efficient for you.</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Pin Tools" /> <strong>Figure 4: Pin Tools</strong></td>
<td><img src="image" alt="Pin Tools" /> <strong>Figure 5: Pinned Tools</strong></td>
</tr>
<tr>
<td>Select tool</td>
<td>This is the main (and default) function of your cursor. It allows you to click on an object in the Viewport and select it. The cursor is transformed to a hand shape.</td>
</tr>
<tr>
<td><img src="image" alt="Select" /> <strong>Figure 6: Select Tool</strong></td>
<td></td>
</tr>
<tr>
<td>Rotate tool</td>
<td>By clicking on this button, you can rotate your scene by clicking and dragging to your desired direction. Tip: you can see your geographical orientation, with the help of a compass which is located at the bottom right of the Viewport (figure 8).</td>
</tr>
<tr>
<td><img src="image" alt="Rotate" /> <strong>Figure 7: Rotate tool</strong></td>
<td><img src="image" alt="Viewport Compass" /> <strong>Figure 8: Viewport Compass</strong></td>
</tr>
</tbody>
</table>

Note 1: rotation around a point, can be done in two ways: around the **Global Frame** (center of the axes in the middle of the Viewport) and around the point you click on. In order to specify your desired way, you need to see if you are in **Dynamic Mode**. You can find this mode at the Viewport preferences (as will be analyzed later). While being in Dynamic Mode, rotation occurs according to your selected point. This may result in a small delay at the
Beginning of the rotation, for large scenes, but assures more intuitive rotation. By disabling Dynamic Mode, rotation is carried out around the Global Frame again.

![Figure 9: Disabled and Enabled Dynamic Mode](image)

Note 2: the rotation can be made in another mode as well. By default we have the rotation around Global Frame or selected point, as described above. Another way is **Fly Mode**, which can be enabled at Viewport Preferences. Fly Mode makes possible to “look around”, which can be very useful when navigating inside interior scenes.

![Figure 10: Fly Mode Off & On](image)

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pan button</td>
<td>Allows you to translate inside the Viewport. This function is also achieved each time you do a right mouse and drag it around Viewport. By this way, you can go to any direction you want, without changing orientation. Note: Pan movement is also affected by Dynamic Mode. When enabled, Pan is achieved around the specific clicked point of the Viewport. By disabling Dynamic Mode, Pan uses again the Global Frame as reference point.</td>
</tr>
<tr>
<td>Roll button</td>
<td>By clicking Roll button, you can rotate the scene right and left, around the axis of the visual field.</td>
</tr>
<tr>
<td>Dolly selection</td>
<td>Allows you to zoom at the specific clicked point. It works like the mouse wheel, but this time, zoom center is the point that you click on.</td>
</tr>
<tr>
<td>Region selection</td>
<td>This option allows you to define a specific area in your Viewport and render it. When clicking on Region button, cursor takes a cross shape. By clicking and dragging, you can select the desired area. Once you release the button, the Start Render Window (with main render options) appears. We see in figures 15 and 16, that the rendered image corresponds to the region we have specified.</td>
</tr>
</tbody>
</table>
By choosing the Focus Tool, your cursor transforms to a double circle shape and allows you to choose your desired point of focus. This option is directly related to the current view Focus Distance and affects the depth of field. You can change Focus Distance value at the Current View Properties panel too, but with the Focus Tool, the distance is automatically adjusted according to the selected point in the Viewport. Starting Interactive Render (as we will explain later), is a good way to see how the selection of the focus point affects the rendered image.

Figure 17: Focus Tool

Figure 18: Focus Point at the Front
Focus point is at the front sphere (by clicking on it). Focus Distance has become 0.731 m. (we can see that at the Current View Properties panel). We see that the sphere and the room at the back are out of focus.

Figure 19: Focus Point at the Back
Focus point is at the back sphere (by clicking on it). Focus distance has become 2.151 m. (we can see that at the Current View Properties panel). We see that the focus area is located on the back sphere, while the front area (lower part of the image) is out of focus.
The Brush Tool is useful for placing instances on your canvas. This option, like Eraser Tool, is selectable when you use the Instancing Tool, at Settings window, and you have already selected an instance and the canvas. By clicking on Brush Tool, cursor takes a brush shape and by dragging it on the canvas, instances are placed following the instance motion.

The Eraser Tool is useful when you have already created some instances in the scene. By selecting it, cursor takes an eraser shape and allows you to delete the instances at the clicked point on the canvas (or at the a whole region is case of non-zero Tool Radius, at the Instancing Tool panel).

2. **Undo & Redo**

   ![Figure 22: Undo & Redo Options](image)

   These two options allow the user to undo or redo a movement of an object, a grouping procedure or a delete of an object.

3. **Group & Ungroup**

   ![Figure 23: Group & Ungroup Options](image)

   When all desired objects are selected (with Control+click you can select multiple objects), you can put them in a new group, by clicking on the Group button. This group is now appearing at the Tree View panel, with the default name “New Group” (w you can change it by clicking on it and retyping the name you want). By pressing the Ungroup button, while the selection being a group, you can ungroup the objects and delete the previously created group.

4. **Duplicate Object**

   ![Figure 24: Duplicate Object Option](image)

   This option allows the user to select an object and duplicate it. The new copied object appears right on the previous one and is now selected (appears with yellow color lines), so you can now manipulate it. It is also added to the scene’s Tree View.
5. **OBJECT TRANSFORM: TRANSLATE, ROTATE, SCALE**

With these actions, user can translate (move), rotate or scale the selected object, by choosing the corresponding button. In the next figures we see these actions described in detail.

- **Figure 27: Translate, Rotate and Scale Options**

Translation arrows allow you to click and drag the object to the desired position at the Viewport. You can either select a single axis and achieve a movement along this axis only.

- **Figure 28: Translation**

Rotation arrows, are useful for rotating an object around the desired axis. By clicking on the axis arrow that you want, you can rotate the object around it.

- **Figure 29: Rotation**

Scale arrows enable you to change an object’s size in one or all dimensions. You can either select an axis and drag it out or into to enlarge or shrink correspondingly the object, or
or, by clicking in the middle of the axis (on little gray sphere) move the object freely. By clicking and dragging the cross arrows, you can translate the object in 2 dimensions. For example, the green cross arrows button, which is between the blue Z-axis and the red X-axis, moves the object on the plane that these 2 axes define (X-Z plane), while its position on the green Y-axis stays fixed.

Expect from this way for translating, rotating or scaling an object, you can also insert the desired coordinates' values for more accurate results. When you select an object, you can see at the Properties Panel (at the left of the Viewport) the Selection Coordinates tab.

At this tab as shown in figure 31, we can see all the position and texture coordinates of the object and its textures as well. As you drag the translation, rotation or scale axes in the way we previously described, you can see the changes applied at the corresponding values (X, Y, Z coordinates) here. Center represents the center of the object. Min and Max show the position, in the Viewport, of the object's bounds in each axis. All coordinates are displayed with respect to the Global Frame. When you move an object, its Center and Min and Max values change automatically. You can also type the desired values, and the object will be assigned to the new coordinates. There is also the possibility to switch from meters to centimeters, millimeters, inches or feet as the translation unit. Scale values change correspondingly whenever you change your object size. You can specify here the exact dimensions you need. Rotation values change too as you rotate an object. Rotation unit can be degrees or radians.

All these transformations are being achieved with respect to the object **Pivot Point**. Pivot Point is used as a reference point for every object. It is the point where all axes are placed and most important, any rotation will be applied. By default, most of the times, Pivot Points are at the center of the object, but this can be changed according to user’s preference. In order to change
an object’s Pivot Point, you should enter in Pivot Mode either by pressing “p” key on the keyboard or by clicking on the corresponding icon at the Viewport preferences tab (as we will describe later). A new icon will appear at top left of your Viewport as a reminder of being in Pivot Mode.

While being in Pivot Mode, you can translate or rotate the axis of the object, without moving the object at all. When you exit the Pivot Mode and, for example, try to rotate the object, you will notice that the fixed point, around which the rotation now occurs, is the new Pivot Point. Pivot Point can be also outside of the object.

6. **DELETE OBJECT**

This option allows the user to delete the selected object(s) or group(s). This function can be also achieved by right clicking on the object at Viewport (or at Tree View list), then selecting edit and then Delete.
7. **SHOW ALL OBJECTS & HIDE SELECTED OBJECT(s)**

These two options give to the user the possibility to hide the selected object(s) from the Viewport and show them again. The open eye button makes all the objects, that the user has previously hidden, visible again. The closed eye button, hides from the Viewport the selected object. You can also hide an object by right clicking on it (in the Viewport or at the Tree View list) and un-checking the Visible option.

8. **OBJECT VISIBILITY/RENDER LAYERS**

These ten small squares represent the available layers that can be used in your scene. When you start adding objects in the scene, all objects are added, by default, in layer 0. The first square has now a small blue dot in it to show that it is containing at least one object.

Many times though, it is useful to have different layers with certain objects in each, so that you can minimize the visible objects of your scene and work on a specific layer each time. When you have selected an object, you can right click on it and then Assign Layer to it, by choosing the one you want. Now, a small blue dot appears also to that new layer, indicating that this layer is containing at least one object too. If you want to hide a layer (which means hiding all the objects that are assigned to it) you can simply click on the small square of that layer. The selected layer square will now appear as shown in the next figure (with an orange triangle corner). All the objects in it will be hidden. By clicking on the layer square again, its objects will reappear.

Tip: by hiding specific layers, not only you hide them from the Viewport, for working more efficiently, but you exclude them from rendering as well. This means you can select the layers you want and render only them.
9. **Insert Lights, Cameras, Infinite Plane Into the Scene**

![Figure 43: Rendering all Layers](image1)
![Figure 44: Rendering only Layers 2 & 3](image2)
![Figure 45: Rendering only the Third Layer](image3)

![Figure 46: Insert Lights, Cameras and Infinite Plane into the Scene](image4)

From this button, user can add lights, cameras or an infinite plane and also select the point that the new item will be placed.
Omni Light is a source that emits light uniformly in all directions, like a bare light bulb. In the next figure we see an inserted point light (at a room without other light sources) and how it appears in the Viewport. We can also edit its specifications at the Selection Properties tab (first button in the Properties panel).

At **emittance** panel you can specify the color, the power, the efficacy and the attenuation of your light source.

Spot lights, opposite to omni lights, can be controlled to aim light at specific targets. A Spot light limits lighting within a specific cone only. In the next figures we see a spot light in the previous scene (without other light sources) and the specific area that illuminates. Apart from its position, its light beam can also been controlled.

You have two more options to edit for Spot lights, the Fall Off and Hot Spot angles (in degrees). Hot Spot represents the angle in which the light beam has a constant power (orange inner cone), while Fall Off defines the maximum angle, after which, lighting is not emitted at all (green-blue outer cone). Between the Hot
Spot and the Fall Off the power is gradually attenuated reaching zero at Fall Off angle.

IES stands for Illuminating Engineering Society. IES file format was created for the electronic transfer of photometric data and is basically the measurement of distribution of light intensity stored in ASCII format. After selecting this button and inserting a light, you can import these data at the Properties panel in order to create specific lighting distributions. There are also some default IES files shipped with Thea Render. You can load them from Thea Render Data Folder. There is also the ability to preview these lights' beam cones. You can press the plus (+) sign at the Browser panel (below Viewport) and select the IES folder. You can now see the existing IES files.

At the Emittance panel, we can select the IES file we want to load and specify its multiplier. By this way we can create the light distribution we want.
By inserting a projector, you can specify a rectangular area that you want to light and, by this way, create a kind of illuminating screen. It is similar to spot light, but with a rectangular beam.

Figure 60: Projector Light

At Projector's properties, you can select the color or texture of the projection, the size of the rectangular area, the efficacy and the attenuation.

Figure 61: Projector in the Viewport

Figure 62: Emittance Properties for a Projector Light

Figure 63: Rendering a Scene with a Projector

Figure 64: A cool effect using a Projector light with user-defined bitmap and a Global Medium (0.1 scatter and absorption density in this case) to reproduce a cinema-like movie projector.
From the same drop-down menu you can also insert the cameras in the scene. After inserting the camera, you can always move it to the appropriate location and also adjust the area that will capture.

At camera properties window we can see many different options for the camera adjustment. The user can define the Resolution, the Film Height (size of the yellow square) and the Focal Length at first. At lens properties, the user can select among the existing projections (perspective, cylindrical, spherical, parallel), define the shutter speed, the X and Y Shifts and the Diaphragm. At the last panel, the user can change the f-number of the camera, the Focus Distance and the Depth of field (in percentage). These last options are useful for creating and adjusting the depth of field.

IPlane stands for infinite plane which is added to the scene on the X-Y axes. Once it is inserted, it is represented by a rectangular surface while, when it is rendered, it is infinite.
There are three different options that use some key point for inserting items in the Viewport. Specifying these points, makes it easier in large scenes to insert and locate the new items.

<table>
<thead>
<tr>
<th>Inserted objects are positioned at the origin of the viewer frame as you see in figure 73 below for an inserted Omni light.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The new objects are all placed at the start of the axes (Global Frame) that is located in the middle of the grid. You can see it also in figure 75.</td>
</tr>
<tr>
<td>There exists also in your scene, a small red cross-shape object that can be moved like all other objects, and all new inserted ones will be placed where this cursor is. (Figure 77)</td>
</tr>
</tbody>
</table>

| Figure 72: At Viewer Frame |
| Figure 74: At Global Frame |
| Figure 76: At Cursor Frame |

| Figure 73: Inserting a Light at Viewer’s Frame |
| Figure 75: Inserting a Light at Global Frame |
| Figure 77: Inserting a Light at Cursor Frame |

10. **Preference Settings / Viewport Elements Visibility**

With this drop-down menu, user can select the desired modes that wants to be in, in order to achieve specific operations, like changing the pivot point, and hide Viewport elements. All these options are analyzed here in detail.

Tip: you can also pin this toolbar at the Viewport, for quick selection of the desired preferences. By clicking on the Pin Tools button, a new window will be placed at the right bottom of the Viewport. By clicking on the small horizontal lines at its right side, you can drag it wherever you want.
**Fly Mode**

Fly Mode, is used to create a “View Around” effect, just like someone is standing at viewer frame and looks the space all around. The effect of Fly Mode is applicable while using the Rotate Tool, as we have previously explained. While in default mode, rotation takes place around clicked point or Global Frame, in Fly Mode, rotation takes place around viewer frame itself.

**Dynamic Mode**

While being in Dynamic Mode, rotation, pan and dolly movements occur according to your selected point. This means that the whole movement of the view (in order to rotate for example or zoom in) is taking place according to the specific point that you click on and not around the global axis. This may result in a small delay at the beginning of the rotation-pan-dolly movement, for large scenes, but usually it is more intuitive. By disabling Dynamic Mode, all these movements are being carried out around the global frame instead.

**Pivot Mode**

While being in Pivot Mode, the user can translate or rotate the axes of a selected object in Viewport, without moving object itself. Only the placement of axes is changing and from now on, they are being used as the reference point from which the movement of the object will be performed. More details can been seen in previous figures (figures 32-37).

**Draw Edges**

As will be analyzed later, there are four ways of seeing the objects in the Viewport: Pointcloud, Wireframe, Solid and Hiddenline mode. When in wireframe mode (where we see only the meshing of the objects), we can choose to see the full meshing (all edges) of the object, by enabling the Draw Edges option. The same effect is also achieved while being in Hiddeline mode (where only the front visible lines are seen for each object and not the geometry inside or behind them).
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>88</td>
<td><strong>Draw Selection</strong>&lt;br&gt;This button can be very useful in large scenes with many objects since it allows the user to view only the selected object. Note: even if the user sees only the selected object, the whole scene is rendered though. In case you only need this item to be rendered, you can put it in a new layer and then render this layer only.</td>
</tr>
<tr>
<td>89</td>
<td><strong>Initial Scene at the Viewport</strong></td>
</tr>
<tr>
<td>90</td>
<td><strong>Viewing Selection Only</strong></td>
</tr>
<tr>
<td>91</td>
<td><strong>Whole Scene is Rendered</strong></td>
</tr>
<tr>
<td>92</td>
<td><strong>Draw Gizmo</strong>&lt;br&gt;This option enables the user to see or not the Gizmo (the axes icon) when an item is selected. When we need though to translate, rotate or scale an object, Draw Gizmo must be enabled. This option exists as a safety switch, to avoid moving an object by accident (which for example, could cause the restart of the Interactive Render).</td>
</tr>
<tr>
<td>93</td>
<td><strong>Draw Frame</strong>&lt;br&gt;Draw Frame button shows or hides the axes icon at the left bottom side of the Viewport. This is a replica of the Global Frame, fixed at the corner of the Viewport, which helps user to visualize the current orientation. Note, that in Thea Render, Z-axis is considered to be pointing upwards.</td>
</tr>
<tr>
<td>94</td>
<td><strong>Axes Frame in Viewport</strong></td>
</tr>
<tr>
<td>95</td>
<td><strong>Draw Compass</strong>&lt;br&gt;Compass can be found at the right bottom of the Viewport and shows the geographical orientation of the user. Compass icon can be enabled or not by this button.</td>
</tr>
<tr>
<td>96</td>
<td><strong>Compass in Viewport</strong></td>
</tr>
<tr>
<td>![Draw Grid](Figure 97: Draw Grid)</td>
<td>This button allows the user to turn on or off the Grid (squares at the ground) placed on X-Y plane. Grid helps the user to get a quick qualitative impression of the size and placement. Note: each square is 1x1 square meters.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>![Grid is Visible](Figure 98: Grid is Visible)</td>
<td>![Grid is Invisible](Figure 99: Grid is Invisible)</td>
</tr>
</tbody>
</table>

### 11. **Tools (Transform, Animation, Interactive Render)**

In this drop-down menu, there exist three very useful options: the Transform window, the Animation Tool and the Interactive Render which will be explained in detail below.

<table>
<thead>
<tr>
<th>![Transform](Figure 101: Transform)</th>
<th>By clicking on this button, a new window appears at the top right side of the Viewport. In the next figures we see the available options in this window.</th>
</tr>
</thead>
</table>
At the top of this bar, there are four main buttons. The first one, is the transform button, which shows the coordinates of the selected object, exactly as we see them at the Properties panel (at the left side of the Viewport). You can click at each cell and enter the values you want for your object position, scale and rotation.

From these three buttons, the two first are useful for aligning two or more objects with each other. The first button allows the user to align the selected objects, so they are all at the same vertical line (X & Y coordinates of the second object change). The second button, allows the user to stack the selected objects, so that one object comes over the other, without changing their X & Y coordinates though. The third button can be used for one or more objects bringing everything selected on the ground. In the next images we can see these options visually.

The fourth option in this window, with the name Bitmap, allows the user to select a texture and edit its coordinates (click and write) and its projection on the object. These coordinates (position, scale, rotation) can be also found at the Properties (at the left side of the Viewport), at the Texture Coordinates panel. From there the user can choose also the desired projection. In this window, the main four projections are only available: UV, Cube (Cubic), Sphere (Spherical) and Tube (Cylindrical).
Animation button opens the Animation Toolbar, which enables the user to edit object motion, by setting appropriately the key frames. Animation toolbar works together with the Animation tab, which can be found at the Settings > Render panel at the right side of the Viewport (figure 114).

At first, user must define the total frames for the animation (20 for example), the frame rate, the current frame (which also changes in the Viewport animation toolbar), which frames will be rendered and the day light animation of the sun – sky in the scene.

At this toolbar (figure 115), which is located at the bottom of the Viewport, user can set the desired key frames when defining the object motion. There are also buttons for deleting key frames and playback the animation. The white key is used for adding/saving and adjusting the object animation. You can choose another key frame, perform the necessary object movements and save the key frame again. By choosing another key frame, after doing the necessary movements of the object, we can save the key frame again. By repeating this procedure you can create an animation. You will need to render all the key frames that take part in the animation in order to have the full movement rendered.

Here, we describe the function of the buttons of the Animation Toolbar, from left to right, as we see in figure 116.
A: these buttons are used for going to the first, previous, next and last frame correspondingly.
B: with these buttons the user can go to the first and last key frame.
C: these buttons are used for setting a key frame, deleting it and deleting all the key frames.
D: with these buttons, the user can perform a playback, a playback in loop and a reverse playback.
Interactive Render is a very useful tool that allows the user to create a rendered preview of the scene inside the Viewport and get continuous render feedback during staging operations. This toolbar, appears at the left of the Viewport, and works together with the Interactive Render Properties panel at the left side of the Viewport (see it in figure 141). In the next figures we see these options and we analyze in detail each parameter. Apart from the horizontal lines at the top, which help us to move the window to the desired position in the Viewport, and the close button at the bottom, we have eight buttons, in total.

Synchronous Display: this option allows you (when enabled) to see the rendered image all the time while you move around the Viewport (auto refresh must be on too) without typical OpenGL mesh visualization during transition. This is the case when Synchronous Display is disabled; in this during the render restart, there exists an initial delay, where instead of waiting for the frame to be available, the typical OpenGL mesh visualization is performed. In very heavy scenes though, you can find that Synchronous Display results in a smoother navigation.
### Auto Refresh
Auto Refresh: most of the times, you will need to see the rendered image being refreshed during the scene staging. The Auto Refresh button (re)starts rendering continuously while you are making changes.

### Start Interactive Render
Start Interactive Render: this is the button that allows you to start interactive render whenever you want to see how your scene looks from the current view. As soon as you make any change to the scene, the interactive render stops.

### Stop Interactive Render
Stop Interactive Render: once you are satisfied with your rendered image, you can stop interactive render. If you have enabled the Auto Refresh though, rendering will start again when you make a change.

### Render Resolution
Render Resolution: there are five different resolutions that you can choose for the interactive render. After pressing the render resolution button a list appears with the available choices. Remember that the resolution you have chosen will be the same to the image that you may want to save (save button is below resolution button and is explained later on).

Tip: in case you shrink or enlarge the Viewport size, interactive render will start again. This happens to all resolutions except the Camera frame.

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Figure 126: IR Resolution at 320x240</th>
<th>Figure 127: IR Resolution at 400x300</th>
<th>Figure 128: IR Resolution at 500x375</th>
</tr>
</thead>
<tbody>
<tr>
<td>320x240</td>
<td>![320x240]</td>
<td>![400x300]</td>
<td>![500x375]</td>
</tr>
<tr>
<td>400x300</td>
<td>![320x240]</td>
<td>![400x300]</td>
<td>![500x375]</td>
</tr>
<tr>
<td>500x375</td>
<td>![320x240]</td>
<td>![400x300]</td>
<td>![500x375]</td>
</tr>
</tbody>
</table>

The first three available resolutions are these of 320x240, 400x300 and 500x375. They all open a new window next to the Interactive Render Toolbar, as we see in figures 126, 127 and 128. These resolutions give you the possibility to work in parallel in the Viewport, move, edit, apply materials, etc., and see at the same time these changes appearing (automatically if auto refresh is on or by hitting start button).
At camera frame, the resolution of the rendered area is the same as the resolution of the current view (see figure 129). We can change this resolution at the Current View Properties panel, where you can specify the resolution you need. You will see, that the rest Viewport is invisible (covered with gray color) but you still can move around. Another very useful element of rendering at camera frame, is the fact that Viewport changes in size do not affect the rendering window and therefore Interactive Render is not restarted.

With overlay resolution, the rendering resolution is the same as the resolution of the Viewport. Assuming the application is maximized, this resolution directly relates to the monitor resolution itself, minus the space the rest panels occupy (see figure 130).

<table>
<thead>
<tr>
<th>Camera Frame</th>
<th>Overlay</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Figure 129: IR Resolution at Camera Frame" /></td>
<td><img src="image2" alt="Figure 130: IR Resolution Overlay" /></td>
</tr>
</tbody>
</table>

**Save Image:** this button allows you to save the rendered image that has been created using the Interactive Render tool.

**Toggle Display Mode:** with this option, you can switch between the rendered view, the OpenGL Viewport and an in-between image. This function works for Overlay or camera resolutions only and the blended image works only for wireframe model display (which we will analyze later).
**Refresh Render Display**

This button allows you to refresh your image, after changing some of the display options that can be found at the left side of the Viewport (see figures 137 and 139), as for example the ISO or the f-number, without the need to start interactive rendering again. Since Interactive Render is refreshed periodically its main use is to refresh it when rendering has been stopped. In the next figures we have changed some settings twice to show how the rendered image looks after hitting refresh.

<table>
<thead>
<tr>
<th>Figure 136: Refresh</th>
<th>Refresh Render Display</th>
</tr>
</thead>
</table>
| **Figure 137:** Exposure Settings 1
| **Figure 138:** Updated Image 1 |
| **Figure 139:** Exposure Settings 2
| **Figure 140:** Updated Image 2 |

Note: these display controls are equivalent to the Darkroom controls; as soon as you make a change to one panel, the other panel is updated with the same value.
As we have mentioned, the parameters of the Interactive Render itself (such as the engine core, the super-sampling, etc.), can be found at the Interactive Render Properties panel at the left side of the Viewport (figure 142).

As we can see, the user can select at first the desired engine core for the Interactive Render tool. The available options are: Unbiased* (MC), Progressive (BSD) and Adaptive (AMC). Then, values like Supersampling, used Threads, Tracing Depth and Caustics can be edited. Note, that for certain engines, some parameters are not available, as for example, the Diffuse Depth is only available with the Progressive (BSD) engine. Ambient Occlusion and Ambient Lighting are also available for editing with the Progressive engine only.

At the top right side of this panel, you can notice two small buttons with arrows (figure 142). The first one allows you to apply to the Interactive Render Properties panel, the render settings that you may have already specified in your scene (Settings > Render). The next button makes the opposite. It enables you to apply the Interactive Render Properties to your scene and, by this way, you can render your image at the Darkroom, exactly with the same settings used in the Interactive Render tool.

11. Hide Toolbar

This option allows the user to hide the Action Toolbar completely. In practice, this works like a minimize window function. Instead of the whole toolbar, a small button appears now at the left top of the Viewport, which brings up the toolbar again.
B. Viewer Toolbar

Viewer toolbar is located at the bottom of the Viewport and includes all the options related to the way the scene is drawn in the Viewport. These are:

1. View Selection
2. Next Camera View
3. Mount Camera
4. Go to Selected Camera View
5. Model Display
6. Switch to Parallel View
7. Fit Selected Object in View
8. Center Selected Object in View
9. Hide Toolbar

All these options will now be explained in detail.

1. View Selection

These menu options help the user to quickly switch between predefined views of the scene. So, the whole scene can be viewed from the Front and Back side, Left and Right, Top and Bottom. In the next images we have these six different views of a car scene.
2. **Next Camera View**

Most of the times, there are more than one camera in the scene, each one covering a different view. This button, allows the user to move to the next camera view. The cameras are all listed at the Tree View with names Camera #n (n=1,2,3,..) or custom user names (all names are editable). Once you press the Next Camera View button, the view changes to the next camera in the list. By pressing it again, you go to the next one, until you return to the beginning. This procedure can be repeated as long as is needed.
3. **Mount Camera**

This option allows the camera to change accordingly to our movement inside the Viewport. To be more specific, once we are at a camera and see its view (you will see the Camera name above the toolbar) we can press the Mount Camera button. The camera then will be following any movement or change of view, inside the Viewport (note that the focus rectangle and camera name turn to red), and in this way, we can adjust easily the position of the camera. By un-mounting the camera (press Mount Camera again), the camera is now placed at the last view and stops following our movement.

Tip 1: there is also the way to manually place the camera to the desired position with the gizmos, just like any other object in the Viewport.

Tip 2: the mount button helps also when previewing animation. After the animation path of an
object has been created, you can select a camera to follow this movement. You can copy and paste the motion from the object to the camera and the camera will move along. By pressing the mount button, you can also view the image from within camera view as it changes, while the animation is played back (see figure 118).

Figure 161: Mounting a Camera while Playing Animation - Key Frame 0
Figure 162: Mounting a Camera while Playing Animation - Key Frame 15
Figure 163: Mounting a Camera while Playing Animation - Key Frame 30

4. **Go to Selected Camera View**

Figure 164: Go to Selected Camera View Tool

This button allows you to go to the view of the camera you have selected. You may have changed view, but once you press the Go to Selected Camera button, you see you scene as it is seen from the selected camera. If you select another camera from the Tree View list and press this button, you go also to its view.

5. **Model Display**

Figure 165: Model Display Options

There are four ways to see the objects in the Viewport and so we have four Model Display options: Pointcloud, Wireframe, Solid and Hiddenline.
As we see in the figure, at Pointcloud view, the object vertices are only drawn (represented with dots). A cube for example, has one dot at each corner. Note that the Pointcloud display is the fastest one.

In Wireframe mode, the edges of the objects are drawn. A cube is drawn with one line for each edge and we can see even the back edges.

In Solid display mode, the objects are fully drawn, using a material representation and basic lighting (one light exactly on viewer, acting like a flash light. Note that only the active texture bitmap is being displayed (this is set for each material separately in the material lab).

The Hiddenline view is like the Wireframe, with the difference that only the front faces of the meshes are visible. Note that the Hiddenline view is slightly slower than the Wireframe mode.

<table>
<thead>
<tr>
<th>Figure 166: Pointcloud Display</th>
<th>Figure 167: Wireframe Display</th>
<th>Figure 168: Solid Display</th>
<th>Figure 169: Hiddenline Display</th>
</tr>
</thead>
</table>

### 6. Switch to Parallel View

Parallel View corresponds to orthogonal projection of the scene. It means that the phenomenal size of the objects dies not change with the distance from the viewer. We can see the way that Parallel View looks like in the next figures. You can go back to perspective view, by clicking again this button (Switch to Perspective View).

Note: Parallel View helps aligning objects. Since, their projected position is not affected by the distance, we can visually align objects by making their edges coincident.

<table>
<thead>
<tr>
<th>Figure 170: Switch to Parallel View Tool</th>
</tr>
</thead>
</table>

| Figure 171: Perspective - Wireframe Mode | Figure 172: Parallel - Wireframe Mode | Figure 173: Perspective - Solid Mode | Figure 174: Parallel - Solid Mode |
7. **Fit Selected Object in View**

![Figure 175: Fit Selected Object in View Tool](image)

This option allows the user to select an object and move in front of it so that it occupies almost all the Viewport area. This means that a zoom in or out is taking place.

![Figure 176: Initial Object View](image)  ![Figure 177: Selected Object Fits in View](image)

8. **Center Selected Object in View**

![Figure 178: Center Selected Object in View Tool](image)

This option helps the user to have the selected object centered in the view. This time, there is no zoom in or out, only a horizontal or vertical translation of the current view that shows the object in the center of the Viewport.

![Figure 179: Initial View of the Scene](image)  ![Figure 180: Selected Object in Center](image)
9. **Hide Toolbar**

This option allows the user to hide the Viewer Toolbar completely. It actually works as a minimize window function. Instead of the whole toolbar, a small button appears now at the left bottom of the Viewport, which brings up the Toolbar again once is pressed.

![Figure 181: Hiding Toolbar](image)

Note: Viewer Toolbar (in contrast to Action Toolbar) changes the view in the corresponding window only. There is a hidden action, activated when the user presses “0” (zero) on the keyboard, that splits the Viewport in four smaller ones. View modes can be different in each one of them as it is shown in figure 183.

![Figure 182: Toolbar Minimized](image)

![Figure 183: Viewport Split in Four](image)