Desktop Radiance 1.02 Quick-start Tutorial

This guide will help you get familiar with the Desktop Radiance user interface. It describes a typical process for creating a simple room with one window, placing a desk, chair, and luminaire, setting up a camera and starting a simple interactive rendering.

Legend:

The **¿** symbol is used for "carriage return" or "enter" and in AutoCAD is often interchangeable with a "space".

Boldface text in Helvetica is used for commands to be typed into the AutoCAD command prompt.

The " **'** " (single quote in **bold**) is used for feet and the " **"** " (double-quote in bold) for inches.

Boldface text between "<" and ">" brackets in **Times** font is used for actions to be performed in the AutoCAD graphics window.

Menu commands are indicated with: **Menu→Submenu**

Setting up a drawing

1. Launch *Desktop Radiance* by selecting the *Desktop Radiance 1.0* icon from the **Start→Programs→ Desktop Radiance 1.0** menu group.

2. Depending upon your AutoCAD setup, you may be presented with the Setup Wizard. If so, say OK to a new drawing in English units. To set the units for *Desktop Radiance* entities, go to the **Radiance→ Preferences** dialog box. Under the "General" tab select "Imperial" units and "Inches" from the combo box. Clicking "OK" will save these units to the drawing. If any *Desktop Radiance* entities (such as cameras, furnishings and luminaires) appear too large or small, this feature can be used to cause these entities to be appropriately scaled for your drawing. You can also use the "Symbol Scale" feature to change the default size of camera, north arrow and reference grid symbols.
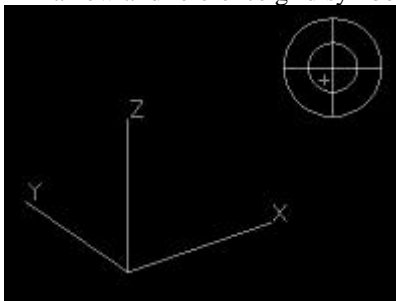

Figure 1. The AutoCAD "tripod" shows the desired position of the cursor within cross-hairs in the upper right corner

3. Type **ddunits** and select "architectural" to change the display to the imperial feet and inches format. Note: it is AutoCAD convention that the units display format of "architectural" corresponds to inches as the unit of measure for the drawing. Selecting a different unit in the preferences dialog will give unpredictable results.

4. Draw a box to represent the walls, floor and ceiling of the room. **box ¿ 0,0,0 ¿ 10',10',10' ¿**

5. Explode the box so that you can operate on individual surfaces: **explode ¿ <select box>**

6. Change the view to axonometric with **View→3D Viewpoint→Tripod**. Move your cursor to the position indicated by the small "+" mark near the center of the cross-hairs in Figure 1. **<position cursor near the cross-hairs between the origin and outer circle at 8 O'Clock> click the left mouse button**

Attaching Materials

7. Attach a dark floor material: **Radiance→ Materials→Attach Material… <click on floor polygon>¿**

Note: if you have difficulty selecting a surface which is co-planer with another, AutoCAD provides a "cycling" feature which highlights one co-planer entity at a time. For example, if you ctrl+left click once on the edge where a wall meets the ceiling, AutoCAD will show at the prompt: "<CYCLE ON>". Then if you left click (without the control key) on the edge, either the wall or the ceiling will be highlighted. If you left click again, the other will be highlighted.

For more information on how to select/deselect entities, see "Chapter 7 -- Editing Methods" in the AutoCAD help system.
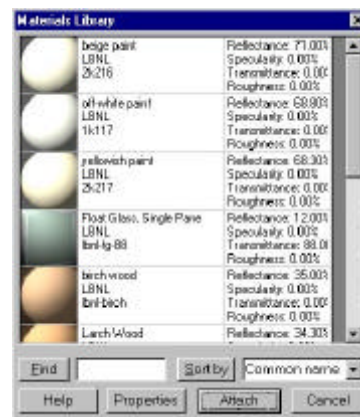

Figure 2. The Materials Library dialog box.

8. The **"Materials Library"** dialog box appears (See Figure 2.) Select blue-gray material**, click ATTACH**.
9. Select wall surfaces to attach material**: Radiance→Materials→Attach Material…** select all wall polygons, **¿**
10. **The "Materials Library"** dialog appears. Select "yellowish paint" material**, click ATTACH**
11. Select ceiling surfaces to attach material**: Radiance→Materials→Attach Material…** select ceiling polygon, **¿**
12. **The "Materials Library"** dialog appears. Select "off-white material"**, click ATTACH**

Notes: You will not see the attached *Desktop Radiance* materials in AutoCAD entities. They will only be visible (rendered) in a *Desktop Radiance* simulation. To see if you have successfully attached materials to the ceiling and walls, use Radiance→Materials→Show all attached materials. This will highlight all the surfaces which have attachments. For more complicated drawings, the Radiance→Tools→Show All Unattached maybe a more suitable tool.

A surface in *Desktop Radiance* is considered infinitely thin and can have only one material attached to it. It cannot have two different materials, one on the front and one on the back.

Therefore surface normal for *opaque* surfaces is irrelevant.

Creating an abstract human figure

13. Create a cylindrical figure: **cylinder** <click in left corner of room> --radius **.5'** –height **4'**
14. Create the spherical "head": **sphere center¿** <move cursor near top of cylinder and click mouse> – radius **.5 ¿**
15. Attach a material to the "head" and "body": Radiance→Materials→Attach Material… <select both the cylinder and sphere> **¿**
16. **The "Materials Library"** dialog box appears. Select "reseda green" material**, click ATTACH**

Creating a wall with a window opening

17. Delete the far right wall to make way for a wall with a window: **erase <select the east wall> ¿** (See note above on "cycling" if you have trouble selecting a particular wall surface).
18. Set the height of the sill for our window: **thickness ¿ 3' ¿**
19. Draw the portion of the wall below the window sill**: line <select opposite corner of floor> <select near right hand corner of floor> ¿**

20. Set the height of the window: **thickness 5' ¿**
21. Draw the wall on either side of the sill: **line ¿ end ↵ <select the far vertex on top of the wall portion created in step 18.> near ¿ <select a point a few feet from the corner> ¿**
22. Repeat the above step for the opposite side of the wall.
23. Set the height of the window "head": **thickness 2' ¿**
24. Draw the wall header: line **¿ end <select the far vertex on top of the wall portion created in step 20> end <select the near vertex on top of the wall portion created in step 21.>**
25. Attach a material to these wall pieces: Radiance→Materials→Attach Material… <select the wall pieces created above> **¿**
26. The "Materials Library" dialog box appears**. Select "beige"** (or any other color)**, click ATTACH**

Creating a glazing surface

Since you have created a wall with an opening, it is easy to now place a properly oriented surface inside this opening to accept the glazing attachment. The "right-hand rule" is used to determine the order in which the vertices of the glazing polygon should be created in order to properly orient the surface normal: Imagine placing your right hand against the wall with you thumb pointing into the space (the direction that the light travels). Your four other fingers now curl in the direction that the vertices should be created to obtain a properly oriented surface.

27. Create the glazing surface: **3DFACE, <select the four vertices of the glazing in the order described above, typically lower right, upper right, upper left, lower left.> ¿**
28. To check that the surface normal is oriented in the direction you intended, use: Radiance→Tools→Adjust Surface Normal <select the glazing surface created above>, The surface normal will then be displayed as a red arrow originating from the centroid of the 3dface. A properly oriented glazing surface will have its surface normal pointing INTO the room, in the direction that light travels from the brighter side to the dimmer side of the glazing. To flip the surface normal, type "Yes" at the command prompt and hit RETURN.
29. Attach a glazing to this glazing surface: Radiance→Glazings→Attach Glazing… <select the glazing surface created above> **¿**
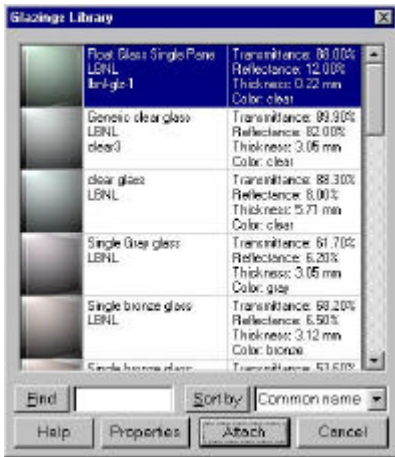
Figure 3. The Glazings Library dialog box.

The "Glazings Library" dialog box appears (Figure 3). **Select "clear glass", click ATTACH.** The glazing is now attached to the surface.

Note: For glazings, the surface normal is important when the glazing is treated "as a light source" for the rendering.

A glazing in *Desktop Radiance* is always modeled as a single surface. Having two panes of glass close together does not efficiently simulate a double-pane glazing. Having a box (3Dsolid) to model glazing with thickness is also incorrect. All glazings in the *Desktop Radiance* library are designed to be attached to infinitely thin, single paned surfaces, regardless of their real-life counterparts.

Placing Furnishings

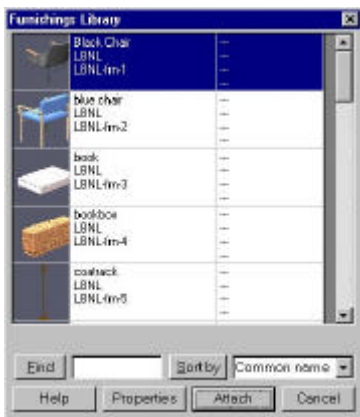**30.** Place a desk in the room: Radiance→Furnishings→Place Furnishing…

Figure 4. The Furnishings Library dialog box.

31. The "**Furnishings Library**" dialog box appears (Figure 4). **Select the "desk" and click ATTACH**

Upon returning to the AutoCAD Graphic Editor the desk should be shown next to the cursor, moving along with it. Find a convenient location for the desk and click the left mouse button. You may need to rotate the desk to be oriented in the correct position. You can select a scaling factor if desired. Furnishings can be rotated and mirrored arbitrarily, using the corresponding AutoCAD commands. After insertion, be sure to rotate, scale and mirror your objects about the furnishing or luminaire's insertion point using the "insert" snap modifier. Doing so will ensure that the Radiance item stays in alignment with the AutoCAD drawing.

Placing luminaires

32. Place a luminaire in the room: Radiance→Luminaires→Place Luminaire…

Figure 5. The Luminaires Library dialog box.

33. The "**Luminaires Library**" dialog box appears (Figure 5). **Select "pendant cone reflector" and click ATTACH**

Upon returning to the AutoCAD Graphic Editor the luminaire should be shown next to the cursor, moving along with it. Find a convenient location for the luminaire and click the mouse. You may rotate and/or scale the luminaire if desired. The "twist angle" specifies the orientation of the output luminance pattern relative to the luminaire housing. You may need to move the luminaire to a more convenient location using the "ortho" mode, after first placing the luminaire at the correct height. Luminaires can also be rotated and mirrored with the usual AutoCAD command. Rotating the luminaire block will cause the luminaire aiming to change. You can inspect the aiming with **Radiance→Luminaire→Aim Luminaire <select the luminaire>.** A red arrow

will be displayed showing the direction of the luminaire aiming.

Defining a ZONE

A ZONE is a specified region of your model that the simulation is focused on. This current version of *Desktop Radiance* supports only one Zone per drawing. Defining a Zone helps increase simulation accuracy and provides a set of pre-defined views, like "plan," "elevations," etc., that are easy to access from the interactive rendering program. These will be supported in future versions of *Desktop Radiance*. A Zone is not required to begin a simulation, but is recommended when the area of interest inside the drawing is less than half of the overall drawing size.
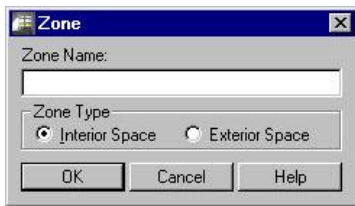
34. Define a zone: Radiance→Analysis→Define Zone

Figure 6. The Zone Properties dialog box.

35. The "Zone Properties" dialog box appears (Figure 6). Enter the name for this zone such as "Z1" and select Interior or Exterior space. Click OK.
36. Create a zone equal to the overall size of the room: <select the lower left corner> <select the upper right corner> ¿

Setting up a camera

37. Return to a plan view to make camera placement easier: plan ¿ ¿
38. Define the camera position: Radiance→Analysis→Define Camera <select the origin of the view>

Figure 7. The Camera Properties dialog box.

39. A Camera Properties dialog box appears (Figure 7): Enter the name of this camera such as "V1", enter the lens size in millimeters, ¿ A lens size of "20" mm is recommended for interior views. AutoCAD camera

names are always in UPPERCASE and may not have any spaces.
40. Enter the height of the camera: 5' ¿
41. Make the camera we just created the current view: view R <V1>¿. The display should now change to a view from the inside of the camera looking in the specified direction. You can use the standard "**dview**" commands to alter the view if desired. If changes to this view are made, they need to be saved back to the view definition using the following two commands:
42. Save the view: ddview <click on "new" button> V1 <click on "save view" button>, <click "yes" to overwrite>.

Note: Due to AutoCAD limitations, camera names will always be saved in ALL CAPS. Keep this in mind when selecting names for the cameras. Also note that plan and axonometric views will be displayed for the "default" view when the view "distance" parameter is zero. The default plan view is created at the origin (height=0), it will be coincident with any geometry also at the Z=0 plane and will be invisible in the *Radiance* simulation.

If all you see in the interactive render is beige, you are looking at the ground. This is remedied by using the AutoCAD "elevation" command. Set height of the default view above the Z=0 plane.

Starting a rendering

Now that all surfaces have materials attached to them and you have a zone and view defined, you can start a Radiance simulation to produce a rendering.

43. Select the surfaces to be included in the simulation and begin the geometry export: Radiance→Simulation→Camera <select the camera or click enter for the current view>¿ <select surface(s) to include or type "all"> ¿

Figure 8. The Simulation Setup dialog box.

44. Behind the scenes, Desktop Radiance has created a project directory with the same name as your drawing. If you rename or move your drawing, you will be prompted with various choices. If the project ID in the project database (dradproj.mdb) does not match the project ID stored in the drawing, you will be prompted to overwrite the existing project, use the existing project, or start a new one. The new button leads to a browse dialog box in which you can navigate your hard disk to find a suitable place for a new project directory or to open an existing project directory in a different location.

45. The AutoCAD text window scrolls by with various messages, and the Simulation Setup dialog box appears (Figure 8).

46. The scenario name at the top of the window shows the name for this scenario. Because this name is used as the base name for *Radiance* simulations, the name may only contain a limited set of valid characters: {a-z, A-Z, 0-9, _ }. Each time you initiate a simulation, you will be asked to provide a scenario name. The scenario keeps track of all the settings and used for each simulation.

47. Select the camera from the list of names.

48. The "Accuracy" setting only contains a "medium" setting for this version. However, you can adjust the rendering parameters under the "Advanced" button on the Simulation Setup dialog box to get a high quality rendering. The help document and online *Desktop Radiance* FAQs have more information on setting up the parameters.

49. Select one of the pre-defined sky conditions, CIE Clear, CIE Overcast, CIE Intermediate, or CIE uniform. In later versions a custom sky selection will allow you to define a custom sky luminance distribution based on TMY weather data.

50. The Location combo box lists a few predefined locations, or you can define your own locations by selecting "New…" from the bottom of the list. In the "location" dialog box, specify the city and state name, longitude, latitude and altitude from sea level. Click "OK" to save this location. The new location is then available for later simulation in this project and others.

51. In the "Add New Location" dialog box (Figure 9), specify a city name. Country and state are optional fields. Then input the latitude and longitude of the location you want to simulate and pick a corresponding time zone from the pull down menu. Be aware of whether your time zone is observing Daylight Saving Time. If not listed, pick "other" from the list and then enter the Standard Meridian for that location. See the *Desktop Radiance* User Manual for more information.
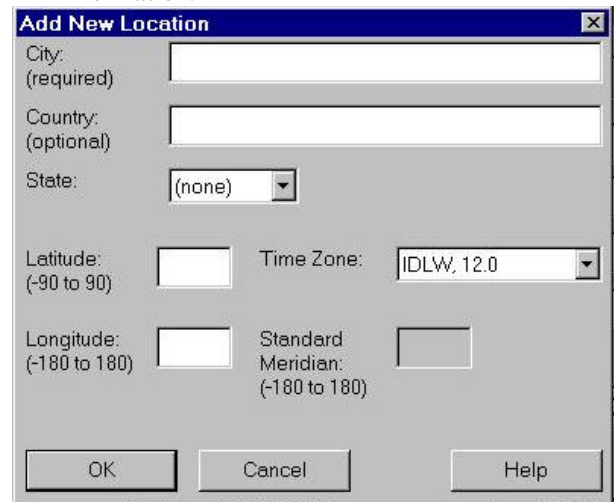

Figure 9. The Add New Location Dialog box

52. Back in the Simulation Setup dialog box, select the Month, Day, and Time for the simulation.

53. Select the desired simulation quantity (luminance or illuminance[1]) and select "interactive".

54. Click the "start" button to begin the simulation. This initiates the synchronization of your project files with the contents of the drawing.

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[1] In simple terms, "luminance" refers to the light reflected off a surface towards a specific direction, while "illuminance" refers to the light arriving at a surface from all directions.
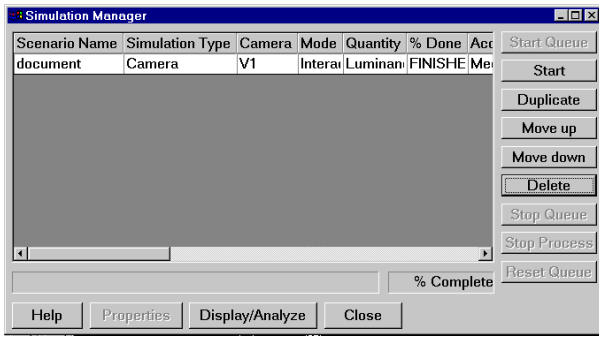
Figure 10. The Simulation Manager dialog box.

55. The Simulation Manager dialog box (Figure 9) should appear momentarily. Wait for the interactive window to appear. This can take a few seconds for small scenes or up ten minutes for very complex scenes.

56. Then a window called "rview" should appear and begin to refine an image over a period of less than a minute. If you have many glazings, light sources, or a very complex scene, this could take a bit longer.

Note: Rview is an interactive renderer suitable for previewing and validating your model, but not for generating high quality renderings. For high quality renderings, use batch mode instead.

57. After tracing the first several dozen rays, the image will be automatically exposed to the average for this view. (See Figure 11)

Figure 11. The interactive rendering window.

58. Visibility and placement of the toolbars is controlled with the "view" menu. Different views of your scene can be created by manipulating the various toolbar widgets. F/B, L/R, ad U/D stand for Front/Back, Left/Right, and Up/Down position displacements of the viewpoint. If the toolbars are not visible, use the view menu to display them.

59. To save a view for subsequent renderings use the **File→Append View to View File** or **Append View to RIF File** commands. Adding a view to an existing View file will overwrite the file. Adding a view to a RIF file will allow that view to be accessible from the Simulation Setup dialog box for subsequent simulations based upon the original scenario in which the rendering was created.

Note: View file names cannot contain spaces.

60. If you would like to save a draft version of your rendering, the **File→Save** menu command can be used to save the drawing under the default name. Note that the naming convention for images is "**Scenarioname_viewname.pic**." You can save the image with a different name, but the Simulation Manager will not be able to automatically display it using the "Display/Analyze" button. You will need to open the Winimage program, select **File→Open**, and navigate to find the name of your image. To close rview, either type "quit" in the rendering window or click the "close button (x).

Note: Rview will always prompt you to save the image when closing even if the image has already been saved before. This is because rview does not stop rendering once you save the image but continues to refine it until it is either finished (status bar near bottom of screen reads "ready") or the application is closed. Make sure that you are saving the image in your project directory. Window 98 and Windows 2000 default to the "My Documents" folder.

61. You will now return to the Simulation Manager dialog box. The scenario will be indicated as "finished."

62. You can create a new scenario based upon the previous one by clicking the "Duplicate" button.

63. The Simulation Setup dialog will appear. Here you can make changes to the settings. For higher quality renderings, you will want to render an image to a file in "batch" mode. Click the Queue button to add this scenario to the simulation manager queue. This process can be repeated for as many scenarios as desired To manually start any of the queued scenarios, select the desired scenario by clicking on its line and click "start". In future versions of *Desktop Radiance*, the Simulation Manager will provide a means of managing simulations that are processing and scheduling processes to begin when others have finished.

Image Analyzer

64. To view the results of one of the finished batch renderings from within Simulation Manager, select the desired scenario row and click the "Display/Analyze" button. Interactive renderings cannot be displayed using this button unless they have been saved with the appropriate filename. In either case, they can be loaded directly within the Image Analyzer (winimage.exe) application, described below. Batch renderings must be finished before they can be displayed.
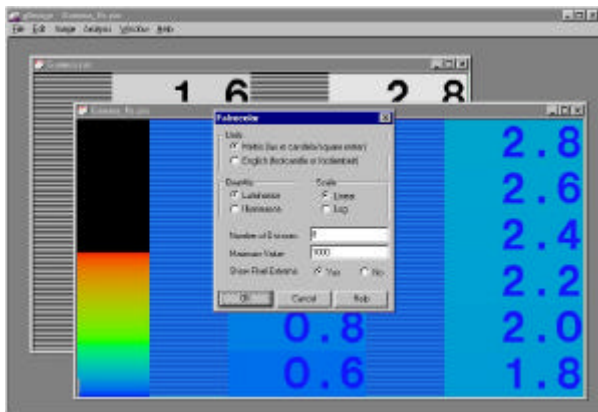

Figure 12. The Image Analyzer (winimage) application allows you to display and post-process *Radiance* images. Image Analyzer is a stand-alone program that can be run separately from the rest of the *Desktop Radiance* AutoCAD plug-ins.

65. If Image Analyzer is opened without a specified filename, an empty gray window will be displayed. This window can be safely closed and ignored.

66. To open a specific image to perform analyses use the **File→open…** dialog box.

Note: There are two basic types of *Radiance* images (both with the .pic extension), ones that contain "real world" luminance values (also known as "raw" images) and those whose dynamic range has been compressed for display purposes. The "raw" images which come straight from the rendering engine contain the predicted "real-world" luminance or illuminance values as would be measured with a luminance or illuminance meter. These images can be altered in ways that either preserve or lose the underlying luminance values. A *Radiance* image that has been altered in some way (as with some of the operations supported by the Image Analyzer) retains the same appearance as its predecessor, but no longer contains the full dynamic range of the original "raw" image. The functions provided in the "**Image**" menu of the Image Analyzer application preserve the "real-world" luminance or illuminance values while the functions in the "**Analysis**" menu cause the image to loose the real-world values. It is meaningless to perform an "Analysis" menu command on an image produced through an "Analysis" menu command.

67. To adjust the exposure of the image to the average for the overall image while preserving the linear brightness mapping function, use the **Image→Exposure→Image** command. This will create an exposure that approximates the dynamic range of a printed photographic image.

68. To generate an Iso-Lux or Iso-Candela plot of image illuminance or luminance values, use the **Analysis→Falsecolor**… command. The resulting image no longer contains the actual luminance or illuminance values. The filename will be automatically renamed with a "_fls" extension.

69. To generate a representation of how the selected image will appear considering the sensitivity and adaptation of the human eye, you can use the **Analysis→Human Sensitivity→Image** command. The resulting image will show loss of visual acuity and loss of color saturation at low light levels, and will show veiling glare around bright windows. It will also adjust the overall image according to a human contrast sensitivity function to more closely mimic the human visual perception.

Note: The human sensitivity functions of the Image Analyzer are documented in the paper by Greg Ward called "A Visibility Matching Tone Reproduction Operator for High Dynamic Range Scenes" which can be viewed on the Internet at: http://radsite.lbl.gov/radiance/papers/index.html. While highly useful for generating an impression of what a human would experience, the algorithms have not been rigorously validated and should be used with caution.

70. Any image, raw or analyzed, can be saved to .GIF, .BMP, .PICT (Macintosh), .EPS (gray-scale), or .TIFF file formats for printing. The **File→Save as…** menu item provides you with the usual browse dialog to perform these operations.