HVE Tutorial

Chapter 32

Overview

This chapter presents a series of basic tutorials that demonstrate various HVE techniques and capabilities. The purpose of these tutorials is to provide a solid grasp of the fundamentals of using HVE, and to help the user become as efficient as possible. This is accomplished through a series of high-level, task-oriented procedures using a step-by-step approach.

While this tutorial explores many of HVE's important features, it does not provide detailed explanations. For these details, the tutorial refers to specific chapters, and the user should refer to those chapters when necessary. Additional information, including a comprehensive index, may be found in the Appendix.

☞ *NOTE: In addition to this tutorial, every EDC physics model has a Program Manual that includes a comprehensive tutorial specific to that physics model. Manuals from3rd party vendors typically include a tutorial as well.*

The Tutorial is divided into four individual lessons:

- **Lesson 1 - Navigating in HVE -** This lesson is shows techniques that promote efficiency. The user learns how to move quickly within HVE to perform fundamental tasks.
- **Lesson 2 - Running a Simulation Model -** This lesson shows the best way to set up and execute HVE-compatible physics models (reconstructions and simulations involving human and vehicle dynamics).
- **Lesson 3 - Combining Multiple Events -** This lesson explains how to merge two or more individual simulations into a coherent and seamless sequence involving multiple humans and vehicles.
- **Lesson 4 - Creating a Video -** This lesson provides a quick and easy lesson describing how to create your first video.

Let's begin with the first lesson.

Lesson 1 - Navigating in HVE

Lesson 1 is a lesson in fundamentals, with an emphasis on efficiency. In this lesson you will learn to perform the following fundamental tasks:

- Starting HVE
- Learning About the Menu Bar
- Managing Dialogs and Viewers
- Choosing an Editor
- Using Dialogs
- Using Viewers
- Shutting Down HVE

Do not skip this lesson! By spending time performing these tasks, you will be able to navigate within HVE more quickly, more efficiently and (perhaps most important) more intuitively! You'll be able to effortlessly view the action from the desired viewpoint. You'll be able to set up your viewers to gain maximum efficiency and information from what HVE is telling you. Put simply, this lesson helps you get the most out of your HVE system. Let's get started.

Starting HVE

To start HVE, use the Start, Programs cascade menu to select the HVE program menu and then the HVE program icon, just as would start any other program on your computer. After starting HVE, the HVE Menu Bar and current HVE Editor dialog are displayed (in this case it is the Vehicle Editor), as shown in Figure 32-1.

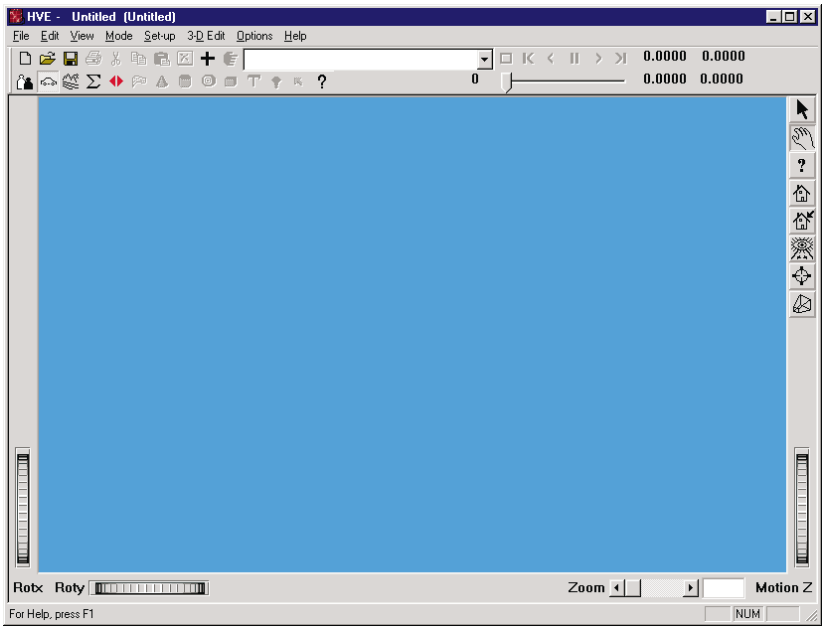

Figure 32-1 The Desktop, after starting HVE. HVE has a main program window with a Menu Bar, Tool Bar, integrated Event and Playback Controller, Viewer Manipulators and Zoom Slider.

☞ *NOTE: HVE saves the current editor when you exit; thus, the editor now displayed is the one you were using when you last exited HVE.*

Learning About the Menu Bar

We will be using many terms throughout this (and other) tutorials. If you have not worked with Windows before, many of these terms will be new to you. The actions you will be performing will be new as well.

Let's start off by identifying and experimenting with the components that make up what is called the *Menu Bar*. Many of the functions accessed using the menu option may also be selected by clicking on various toolbar buttons.

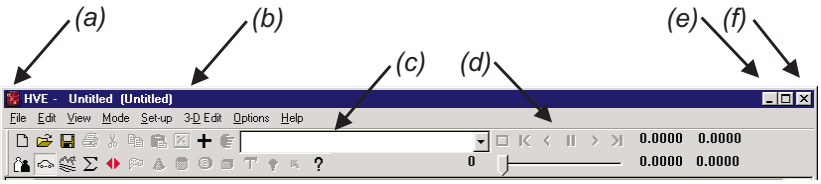

Figure 32-2 Menu Bar. HVE's menu bar is very traditional, with *File, Edit, View, Mode, Set-up, 3D-Edit, Options* and *Help* menu options. It also includes the *Dialog Control* button (a), the *Title Bar* (b), the *Active Objects List* (c), the *Event Controller* (d), the *Minimize* and *Maximize* buttons (e), the *Close* button (f), and several toolbar buttons for quick access to functions.

Menu Bar

A Menu Bar, shown in Figure 32-2, is common to all Window-type programs. It contains the program's fundamental options. In the case of HVE, these options are *File, Edit, View, Mode, Set-up, 3D-Edit, Options* and *Help*. Let's briefly explore these options:

➢ Click on *File.* The File menu is displayed. This menu provides basic system operations, such as starting new cases, opening and saving files, working with video, printing and exiting HVE.

➢ Click on *Edit*. The Edit menu is displayed. This menu provides operations that allow you to edit selected objects.

☞ *NOTE: No Edit menu options are currently available because no object is selected. Other menus will also have disabled options until the appropriate situation allowing the use of the option is present.*

➢ Click on *View*. The View menu options are displayed. This menu provides operations that determine how you look at simulations.

➢ Click on *Mode*. The Mode menu options are displayed. This menu allows you to select which Editor you are currently using, and also to add new or previous objects into the Editor (e.g. Select *Mode, Add*, *New* or *Previous*).

➢ Click on *Set-up*. The Set-up menu options are displayed. This menu allows you to enter inputs for setting up your simulation or reconstruction events.

➢ Click on 3D-Edit. The 3D-Edit menu options are displayed. This menu allows you to launch and close the 3D Editor while in Environment mode, plus edit material attributes, colors and textures or change manipulators while in the 3D Editor.

➢ Click on *Options*. The Options menu is displayed. This menu provides several user-definable options and preferences.

➢ Click on *Help*. The Help menu is displayed. This menu provides access to the various HVE Help System options.

The *Dialog Control* button is located in the upper left corner of the Menu Bar (see Figure 32-2 (a), on the previous page).

➢ Click on the *Dialog Control* icon. The dialog control options are displayed. These options allow you to move the dialog, change its size, minimize it (replace the dialog with a small icon - handy if you're not currently using the dialog), and maximize it (make the dialog as large as possible).

All dialogs and viewers have a *Dialog Control* button.

The Menu Bar also includes the *Title Bar*. This component (*b*) displays the current case title, followed by the current filename in parentheses. All dialogs and viewers also have a Title Bar, and it has an important function:

➢ Click on the *Title Bar* and drag the mouse. The dialog (i.e., the *HVE program window* in this case) follows your mouse cursor. This is a fundamental navigation task that allows you to move dialogs and viewers anywhere you wish.

The *Active Objects List* is integrated into the Menu Bar. This component (c) displays a drop-down list of active objects while in the Human, Vehicle, Environment and Event mode. By clicking the button on the right side of the list, the complete list of objects is displayed. The current object is displayed in the viewer. To add a new object to the list, click on the *Add New Object* button (looks like a + sign) located two buttons to the left of the list on the toolbar.. To display the Object Information dialog for the current object, click on the *Object Info* button (looks like a hand pointing) immediately to the left of the list on the toolbar.

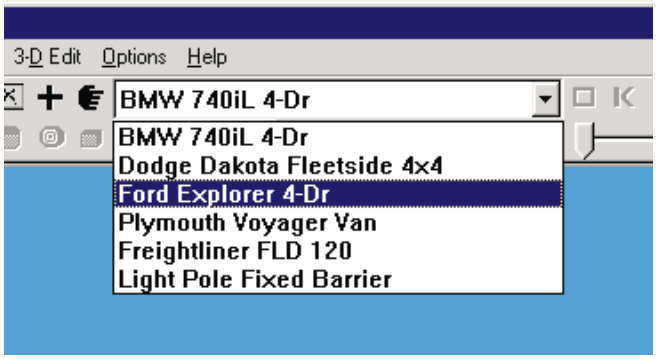

Figure 32-3 Active Objects List drop-down display shown in Vehicle Mode. *Add New Object* and *Object Info* toolbar buttons are located to the left of the list.

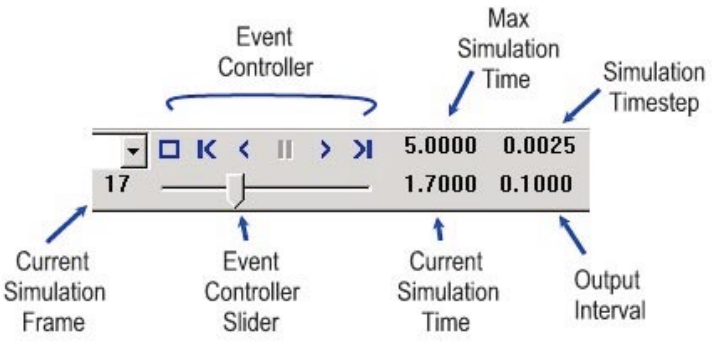

Figure 32-4 Event Controller

The *Event* (and *Playback*) *Controller* is integrated directly into the Menu Bar. Additional information displays used in conjunction with the Event Controller are shown in Figure 32-4. These information displays are as follows:

- **Current Simulation Frame** - Displays the current frame of simulation output. A frame is equivalent to one timestep of output.
- **Max Simulation Time** - Displays the selected Simulation Controls Maximum Simulation Time termination condition.
- **Simulation Timestep** - Displays the integration timestep used for typical vehicle trajectory calculations as set in Simulation Controls.
- **Current Simulation Time** - Displays the current timestep of the complete event.
- **Output Interval** - Displays the timestep interval used for display results as set in Simulation Controls.

The Event Controller Slider can be used to move forward or backward through each simulation frame. This provides the user with an easy means to locate a specific point in a simulation, without having to Play and Stop the simulation.

The Menu Bar includes *Minimize* and *Maximize* buttons, as shown in Figure 32-2 (e).

➢ Click on the *Minimize* button. The dialog disappears! Actually, it turned into an icon and is displayed along the bottom of the Windows desktop.

➢ Click on the HVE icon. The current HVE program window is redisplayed.

➢ Click on the *Maximize* button. The Menu Bar fills the screen.

☞ *NOTE: Using the Maximize button to maximize the program window allows you to use the whole screen for your work. Setting your display to 1024 x 768 or 1280 x 1024 resolution provides you with an even larger work area.*

➢ Click the *Maximize* button again (which is now the *Restore* button). The dialog returns to its original size.

Finally, the Menu Bar (and all windows and dialogs) includes a *dialog frame* that surrounds the dialog. The dialog frame has two functions:

➢ Click on the frame and drag the mouse. The dialog changes size.

Depending on where you click on the frame, the dialog changes size in the direction you drag. If you click on the corner, it changes size in both directions.

➢ Click and drag on various parts of the dialog frame, experimenting with this feature.

☞ *NOTE: Some dialogs cannot be resized.*

The second function of clicking on the frame is that it raises the dialog to the top of the display, a useful feature if the dialog is partially covered and you need access to it. We'll explore this use later in this tutorial.

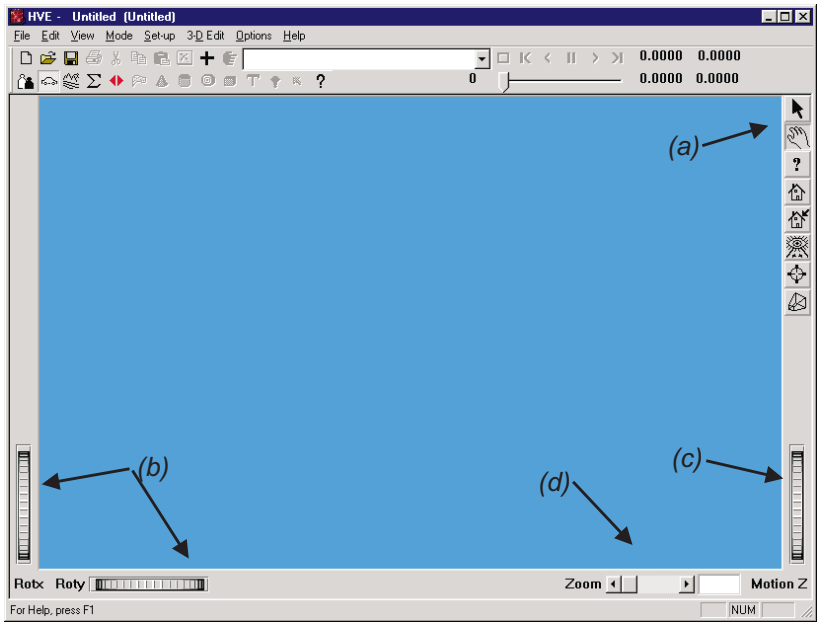

Figure 32-5 Typical Viewer. *Pick Mode* or *Manipulate Mode* is selected by choosing the arrow or hand, respectively, near the upper right edge of the viewer (a). *RotX* and *RotY* thumb wheels (b) rotate the object in the viewer about the viewer's X and Y axes, respectively. The *Dolly* thumb wheel (c) increases or decreases the size of the object by moving the camera away from or towards the object. The *Zoom* slider (d) increases or decreases the size of the object by reducing or increasing the viewer's included angle.

Viewers

Viewers are used to display 3-D objects. A typical viewer is shown in Figure 32-5.

Viewers have the same window manager components that were just explored using the Menu Bar. In addition, viewers also have the following components:

- **Viewer Mode Selector -** This component, shown in Figure 32-4 (a), allows the user to switch between *Pick* mode, used for choosing objects in the viewer and performing an editing operation on that object, and *Manipulate* mode, used for changing the 3-D view using direct manipulation.
- **Viewer Controls -** These components include *Viewer X* and *Y* rotation thumb wheels, shown in Figure 32-4 (b), *Dolly* thumb wheel, Figure 32-4 (c), and *Zoom* slider, Figure 32-4 (d).

These components will be explored later in this tutorial.

Figure 32-6 HVE Mode Selector, located at the left hand side of the toolbar. The Mode Selector is used to switch between modes. The depressed button appearance indicates the Vehicle Editor is currently selected.

HVE Mode Selector

The HVE *Mode Selector* is integrated into the toolbar at the left hand side of the Main Menu. As shown in Figure 32-5, the *Mode Selector* has five buttons, as follows (left to right):

- **Human Editor Button -** Displays the Human Editor, placing HVE in Human mode.
- **Vehicle Editor Button -** Displays the Vehicle Editor, placing HVE in Vehicle mode.
- **Environment Editor Button -** Displays the Environment Editor, placing HVE in Environment mode.
- **Event Editor Button -** Displays the Event Editor, placing HVE in Event mode.
- **Playback Editor Button -** Displays the Playback Editor, placing HVE in Playback mode.

Let's get a little practice using the HVE Mode Selector:

➢ Click on each button in the Mode Selector to display the various HVE editors.

Managing Dialogs and Viewers

Becoming an efficient HVE user requires using a few simple, but important, procedures. These procedures include:

- Arranging your desktop to allow you to be as efficient as possible
- Raising viewers and dialogs to the top of the desktop
- Minimizing windows to help improve system performance (especially for 3-D viewers that must be rendered)

Minimizing Windows

While using HVE, you may find your desktop becomes cluttered with numerous data windows and viewers. This is especially true while using the Playback Editor under the following two scenarios:

- You are working with a case that has multiple events and you have created several output reports for each event.
- You are working with a case that has multiple Trajectory Simulation windows and you are in the process of rendering the Playback Window containing multiple Trajectory Simulation events.

In these instances, you can minimize the window containing the report so it takes less screen space.

☞ *NOTE: A minimized window maintains all the data associated with it; minimizing simply removes the visual representation of the window and replaces it with and icon.*

☞ *NOTE: Minimized 3-D viewer windows are not rendered. Because it takes time and computer resources to render a window, minimizing 3-D viewer windows can significantly speed up your work!*

Let's practice minimizing windows in the Playback Editor. Start by opening a case:

➢ Click on *File* menu option and choose *Open*. The HVE File Selection dialog is displayed.

➢ Select EdhisTutorialEDC and press *OK*.

➢ Choose *No* to the request to save the changes to the current case.

The selected case file is loaded into HVE and the Vehicle Editor displays the current vehicle in the Active Vehicles list and 3-D viewer.

➢ Choose *Playback* mode. The Playback Editor is displayed, as shown in Figure 32-7.

➢ Click on the *Traj Sim* window to bring it to the top of the desktop.

➢ Click on the Dialog Control button and choose *Minimize*. The Traj Sim window is turned into an icon as shown in Figure 32-8.

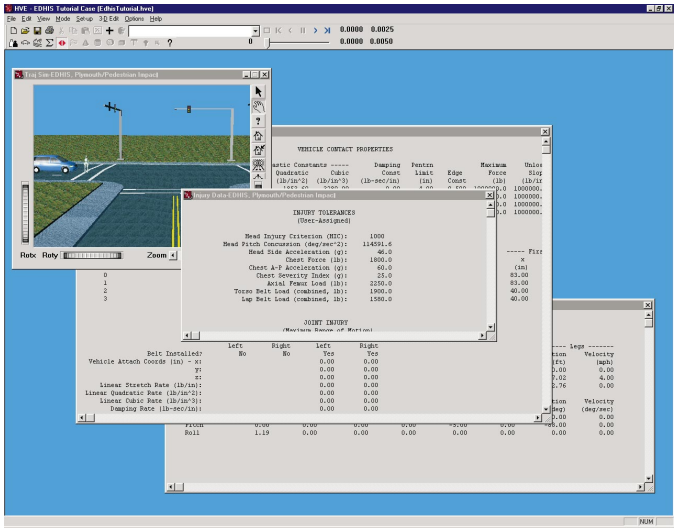

Figure 32-7 Playback Editor with multiple reports. In this case, the numerous reports make it difficult to manage the desktop, so we'll iconify the Traj Sim.

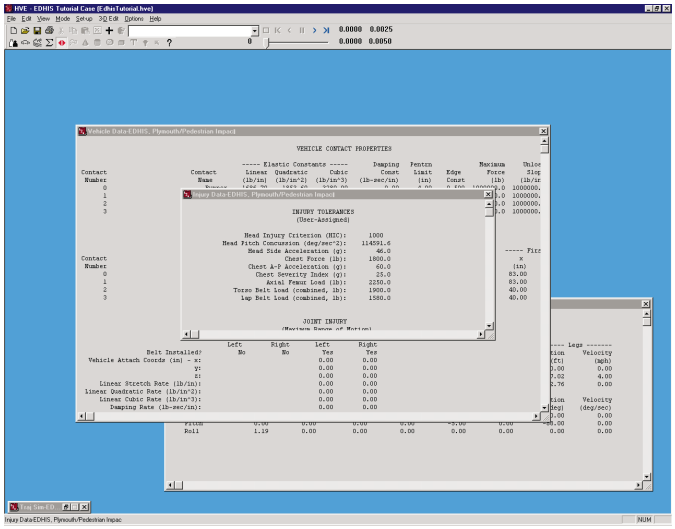

Figure 32-8 Playback Editor with multiple reports. This case differs from Figure 32-7, above, in that one of the report windows has been iconified (note the HVE *Traj Sim* icon is displayed along the bottom of the desktop).

Choosing an Editor

HVE is designed around five fundamental editors. These editors are:

- **Human Editor -** Used for selecting and editing 3-D humans
- **Vehicle Editor -** Used for selecting and editing 3-D vehicles
- **Environment Editor -** Used for selecting and editing 3-D environments
- **Event Editor -** Used for setting up and executing reconstruction and simulation models
- **Playback Editor -** Used for creating visual and numeric output reports and videos

This lesson teaches you how to quickly navigate between these editors. To make this lesson a little more interesting and useful, we'll use the current case to illustrate the various HVE editors. Continuing from the previous discussion, we're in the Playback Editor. Let's switch to Human mode.

☞ *NOTE: Switching to Human mode is synonymous with selecting the Human Editor.*

Switching editors is performed using the Mode Selector located at the left hand side of the toolbar (refer to Figure 32-5). To switch to Human mode:

➢ Press the Mode Selector's *Human* pushbutton. The Human Editor is displayed with the current human, *Female Adult Pedestrian*, selected in the Active Humans list and displayed in the Human 3-D viewer (see Figure 32-9).

Switch to Vehicle mode:

➢ Press the Mode Selector's *Vehicle* pushbutton. The Vehicle Editor is displayed with the current vehicle, *Plymouth Voyager Van*, selected in the Active Vehicles list and displayed in the Vehicle 3-D viewer, as shown in Figure 32-10.

Next, let's display the Environment Editor. To switch to Environment mode:

➢ Press the Mode Selector's *Environment* pushbutton. The Environment Editor is displayed with the current environment, *Untitled Environment,* displayed in the Environment 3-D viewer, as shown in Figure 32-11.

☞ *NOTE: There is no Active Environments list, because there is only one environment.*

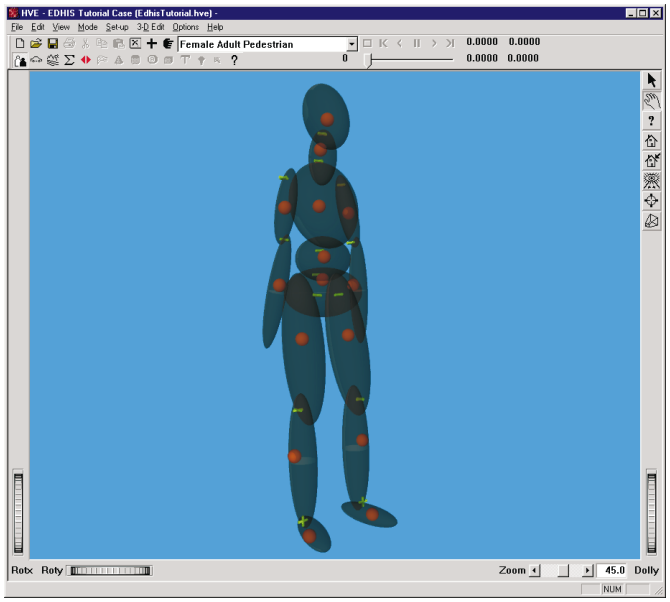

Figure 32-9 Human Editor with the active human, *Female Adult Pedestrian*, displayed in the Human 3-D Viewer.

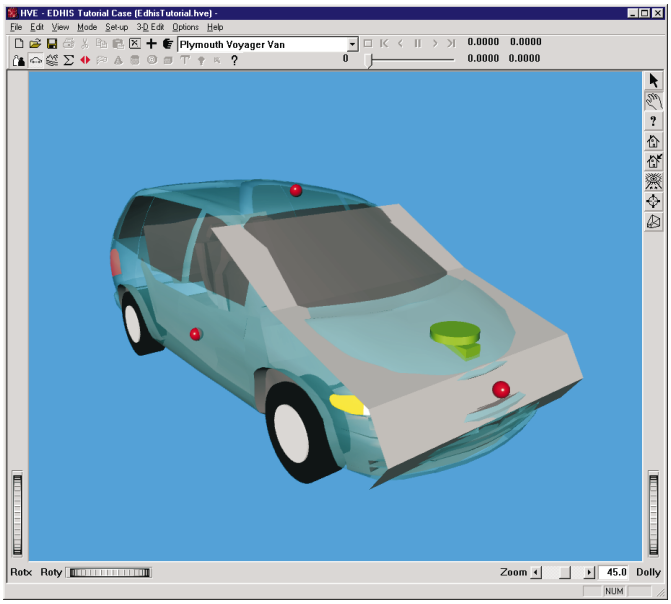

Figure 32-10 Vehicle Editor with the active vehicle, Plymouth Voyager Van, displayed in the Vehicle 3-D Viewer. Contact surfaces, used for the pedestrian impact simulation, are displayed on the vehicle if the Show Contacts option is selected.

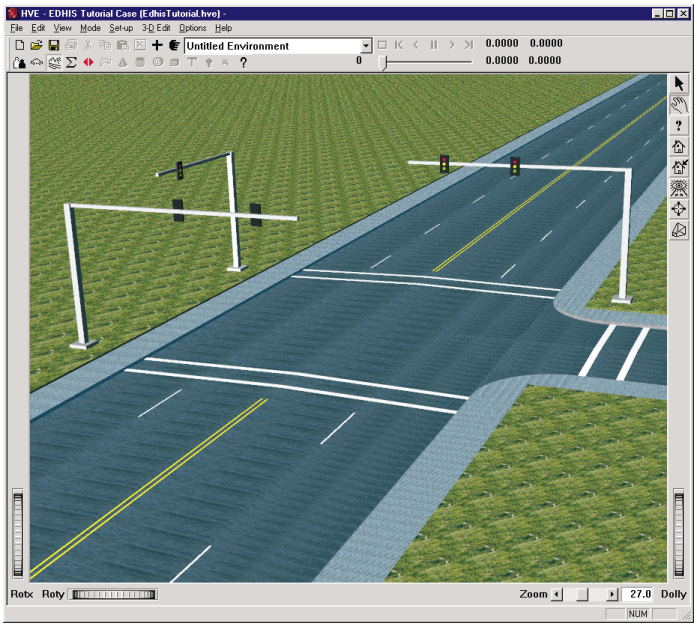

Figure 32-11 Environment Editor with the current environment, *Untitled Environment*, displayed in the 3-D viewer.

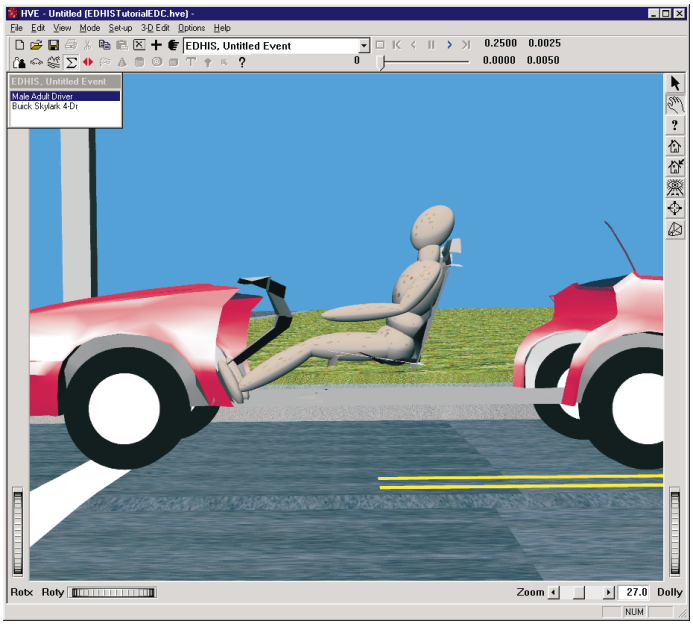

Figure 32-12 Event Editor with the current event, *EDHIS, Buick/Ford, 90 deg,* displayed in the 3-D viewer.

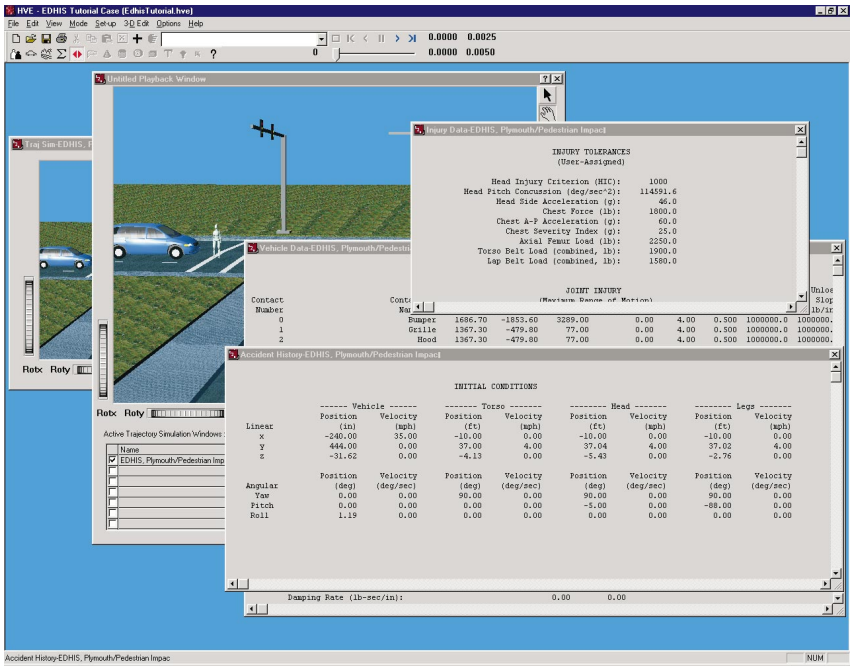

Figure 32-13 Playback Editor with several report windows displayed on the desktop.

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Switch to Event mode:

➢ Press the Mode Selector's *Event* pushbutton. The Event Editor is displayed with the current event, *EDHIS, Buick Occupant*, displayed in the Active Events list and displayed in the Event 3-D viewer, as shown in Figure 32-12.

Switch to Playback mode:

➢ Press the Mode Selector's *Playback* pushbutton. The Playback Editor is displayed and several reports are displayed, as shown in Figure 32-13.

☞ *NOTE: The Playback Editor displays all selected reports. This allows you to compare results from several events.*

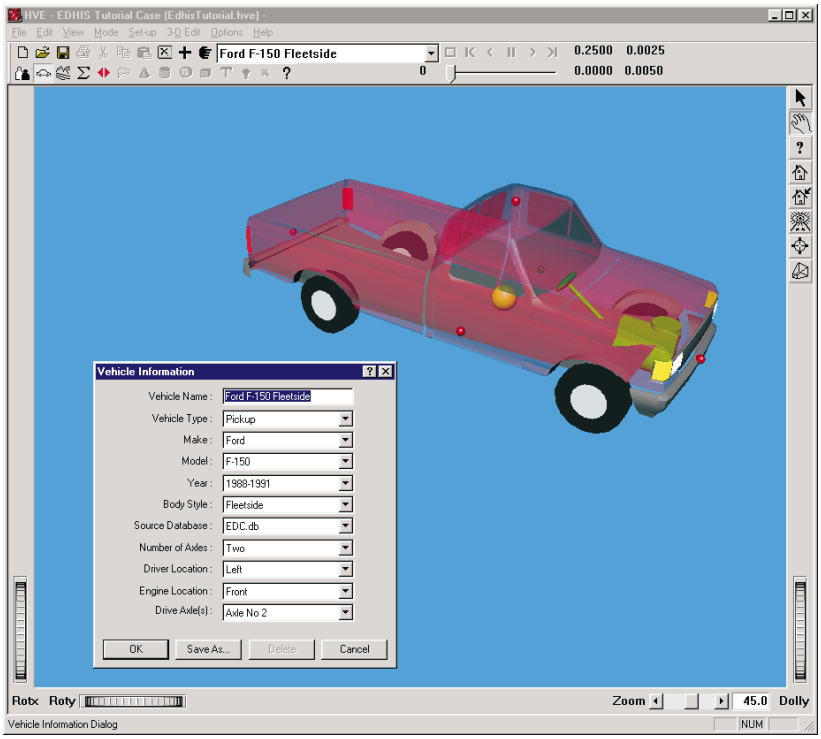

Figure 32-14 Vehicle Information dialog, displaying the current vehicle's basic attributes.

Switch back to Vehicle Mode:

➢ Press the Mode Selector's *Vehicle* pushbutton.

The Vehicle Editor is displayed with the current vehicle. Let's change the current vehicle:

➢ Choose *Ford F-150 Fleetside* in the Active Vehicles list. The chosen vehicle becomes the current vehicle and is displayed in the 3-D Vehicle viewer.

Let's take a look at *Ford F-150 Fleetside*'s basic vehicle attributes (*Driver Location, Engine Location, Number of Axles, Drive Axles*):

➢ Click on the *Object Info* button on the toolbar.. The Vehicle Information dialog for *Ford F-150 Fleetside* is displayed, showing its basic attributes, as shown in Figure 32-14

➢ Press *Cancel* to remove the Vehicle Information dialog.

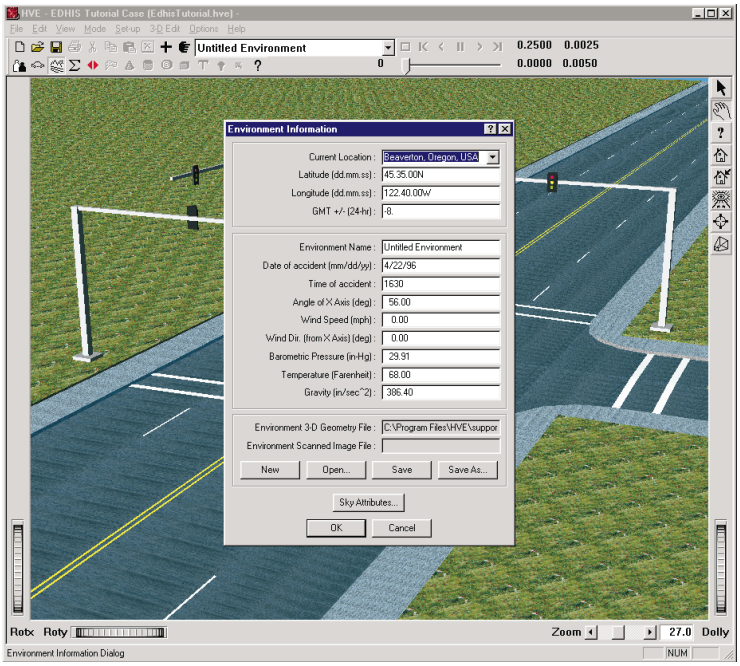

Figure 32-15 HVE Environment Editor, displaying the Environment Information dialog. This dialog is used for assigning the primary environment attributes, such as temperature, barometric pressure, and other information.

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Switch to Environment mode:

➢ Press the Mode Selector's *Environment* pushbutton. The Environment Editor is displayed with the current environment in the 3-D viewer.

Let's take a look at the current environment attributes. These are displayed in the Environment Information dialog. To display this dialog, perform the following steps:

➢ Click on the *Object Info* button on the toolbar. The Environment Information dialog is displayed, as shown in Figure 32-15.

The Environment Information dialog is used for assigning physical event information (*sun position, wind direction* and *velocity* for aerodynamics calculations, *air temperature* and *pressure* for use in air density calculations, and *gravity constant*, for NASA engineers doing Martian vehicle simulation).

The Environment Information dialog may also be used for assigning a 3-D geometry file to drive on, as well as sky color and fog for visibility studies.

➢ Press *Cancel* to remove the Environment Information dialog.

Using Dialogs

HVE has more than 200 dialogs for entering and editing information. All HVE dialogs have default information already assigned. Therefore, when using a dialog, you are always editing existing default data.

Modal vs Modeless Dialogs

HVE (and most other applications) use two different types of dialogs: *Modal* and *Modeless*.

A *modal* dialog requires the user to complete an action by pressing *OK* or *Cancel* before another action can be performed.

> ☞ *NOTE: You cannot make any other program selection until you remove the modal dialog.*

On the other hand, a *modeless* dialog allows you to enter and edit data in the dialog, as well as to make selections from the menu bar and manipulate objects in viewers while the dialog is still displayed.

Let's explore the use of these dialogs. First, let's look at a typical modal dialog:

- ➢ Click on *File* menu option and choose *Open*. The HVE File Selection dialog is displayed.
- ➢ Using the HVE Mode Selector, choose *Event* mode.

Note that HVE beeps. This happens is because the File Selection dialog is a modal dialog. You cannot perform any other operations until the File Selection dialog is removed, either by pressing the dialog's *OK* or *Cancel* button.

- ➢ Choose *Cancel*. The File Selection dialog disappears.
- ➢ Choose *Event* mode. The Event Editor is displayed, and the current event is displayed in the 3-D viewer.

Now, let's look at a modeless dialog. The most important example is the Position/Velocity dialog used by the Event Editor:

- ➢ Click on *Male Adult Driver*'s pelvis segment in the Event 3-D viewer. The Position/Velocity dialog for the current human is displayed, as shown in Figure 32-16.

> ☞ *NOTE: You can tell right away that the Position/Velocity dialog is a modeless dialog because it does not have the OK/Cancel/Help buttons like a modal dialog.*

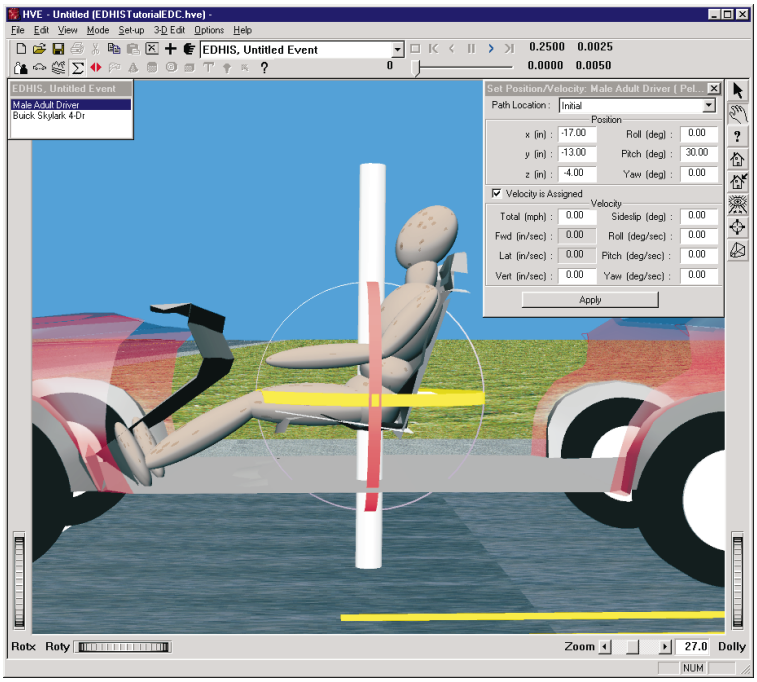

Figure 32-16 HVE Event Editor's Position/Velocity dialog.

Let's get some practice using a modeless dialog:

➢ Place the mouse cursor in the Position/Velocity dialog's Z coordinate field and change the value to `-20.00` inches from -4.00 inches.

➢ Press the <*Enter*> key or the *Apply* button. The human's position is updated.

☞ *NOTE: Notice that nothing happened until you pressed the <Enter> key! This is a big difference between modal dialogs (with an OK button) and a modeless dialog: Pressing OK on a modal dialog is like pressing <Enter>; since a modeless dialog does not have an OK button, you must explicitly press <Enter> for the value(s) in the dialog to be updated.*

☞ *NOTE: You can enter several values into the dialog, then press <Enter> once to have all the values updated at the same time. This can save some time when updating a human's or vehicle's position, since HVE re-renders the viewer whenever the viewer's contents change.*

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Using 3-D Viewers

HVE uses 3-D viewers to display humans, vehicles and the environment. Of course, 3-D viewers are also used to visualize the motion of these objects during Event and Playback modes.

HVE's 3-D viewers have many features that make it easy for the user to select how the 3-D objects are displayed. In particular, the user can perform the following viewer operations:

- Resizing the viewer
- Panning the contents in the viewer
- Zooming in and out
- Dollying in and out
- Changing the camera position

These operations are described below.

Resizing Viewers

The size of the viewer is controlled by the user. To resize a 3-D viewer, perform the following steps (refer to Figure 32-17):

➢ Close the Position/Velocity dialog still displayed on your screen. Be sure *Show Key Results* has been selected from the *Options* menu.

➢ Click on the right edge of the Key Results viewer frame (note the cursor changes shape) and drag it to the left. The viewer grows in width.

➢ Click on the lower edge of the viewer frame and drag it down. The viewer grows in height.

➢ Click on the bottom left corner edge of the viewer frame and drag it to the lower left corner of the screen. The viewer grows in both width and height.

Notice by resizing the Key Results viewer, we've covered up the Event Objects List viewer. Perform the following step:

➢ Click on the left edge of the Event Objects List to bring the dialogs to the top of the desktop.

☞ *NOTE: While 3-D viewers may be resized, dialogs normally cannot.*

Spend a few moments practicing resizing the viewers and bringing various desktop objects to the top of the desktop.

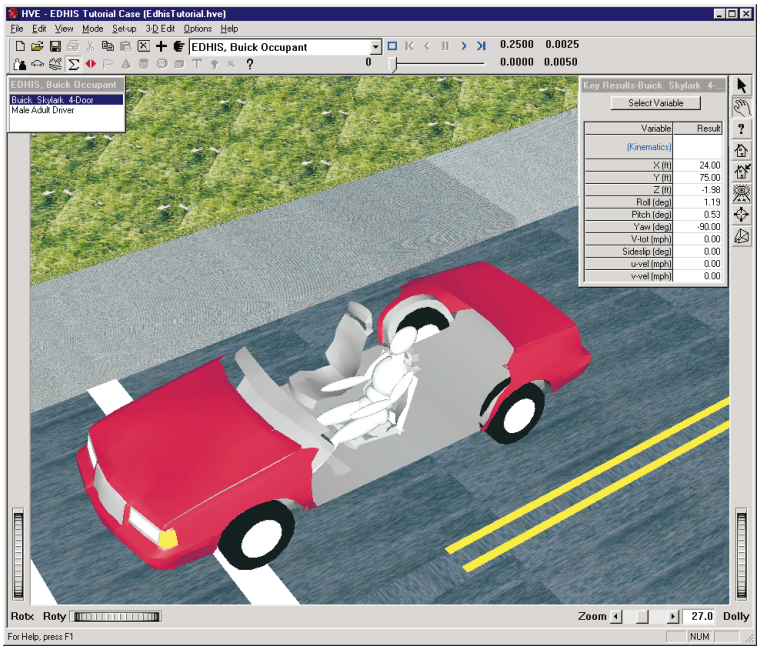

Figure 32-17 Using HVE 3-D viewers. Click on any edge and/or corner to resize the viewer. In general make your viewers nice and *BIG!*

Panning

Panning involves moving the scene horizontally and vertically within the 3-D viewer.

To pan the scene, perform the following steps:

- ➢ Confirm the viewer is manipulate mode (the current viewer mode is set by clicking on the hand icon along the upper right edge of the viewer). If necessary, click on the hand icon.
- ➢ Place the mouse cursor in the middle of the viewer.
- ➢ Press the middle mouse button and drag to the right. You may also press the left mouse button while holding down the <Shift> key to perform the same operation. The viewer contents are dragged to the right, as shown in Figure 32-18.
- ➢ Press the middle mouse button and drag to the left. The viewer contents are dragged to the left.
- ➢ Use the same procedures to drag the viewer contents up and down.

Spend a few moments practicing panning the contents in the viewer.

Zooming In and Out

Zooming involves changing the lens of the virtual camera that HVE uses to display the objects in the viewer. The current zoom status and zoom slider are located along the right end of the lower edge of the viewer.

To zoom in, perform the following steps:

➢ Click on the *Zoom* slider and drag the slider to the left. The camera zooms in on the scene. This is analogous to changing from a 50 mm camera lens to a 150 mm telephoto lens.

To zoom out, perform the following steps:

➢ Move the slider to the right. The camera zooms back away from the scene. This is analogous to changing back to a 35 mm lens.

Zoom back to the original camera state:

➢ Move the slider back to the left until the scene returns to its original size in the viewer, as shown earlier in Figure 32-17.

Dollying In and Out

Dollying involves changing the camera position, moving it closer to, or further away from, the object (just like in filming a movie scene). To dolly in and out, perform the following steps:

➢ First confirm the viewer is in manipulate mode: Place the mouse cursor in the middle of the viewer and press the <*Escape*> key. The viewer switches modes, as indicated by the icons along the upper right edge of the viewer.

➢ Press the mouse cursor in the middle of the viewer and press <*Escape*> again, and again, and again... Note the viewer toggles between *Pick* and *Manipulate* mode. Leave the viewer in *Manipulate* mode.

☞ *NOTE: We've illustrated two equivalent methods for switching viewer modes (clicking the viewer Mode icons or pressing <Escape>. The method you choose is up to you.*

➢ Place the mouse cursor in the middle of the viewer.

➢ Press both the left and middle mouse buttons and drag down. You may also press the left mouse button while holding down the <Shift> + <Ctrl> keys to perform the same operation. The camera dollys in, as shown in Figure 32-19.

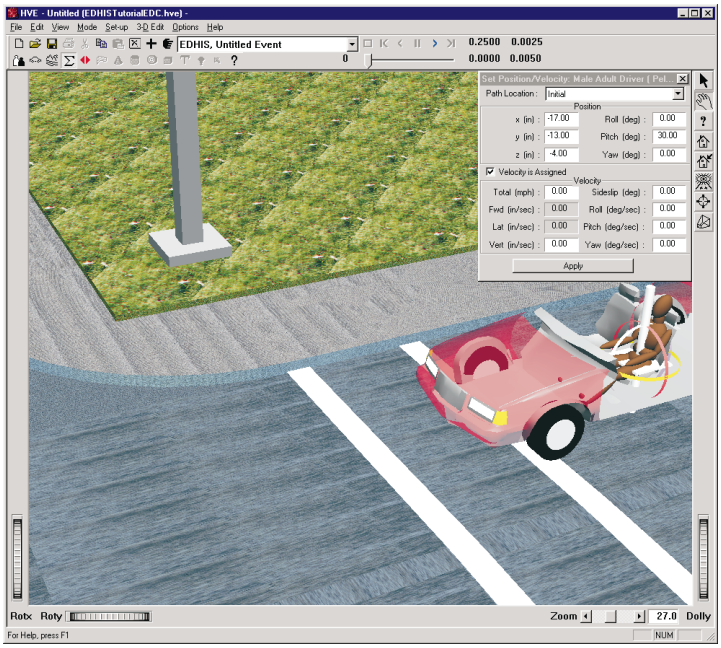

Figure 32-18 Panning the camera in a 3-D viewer.

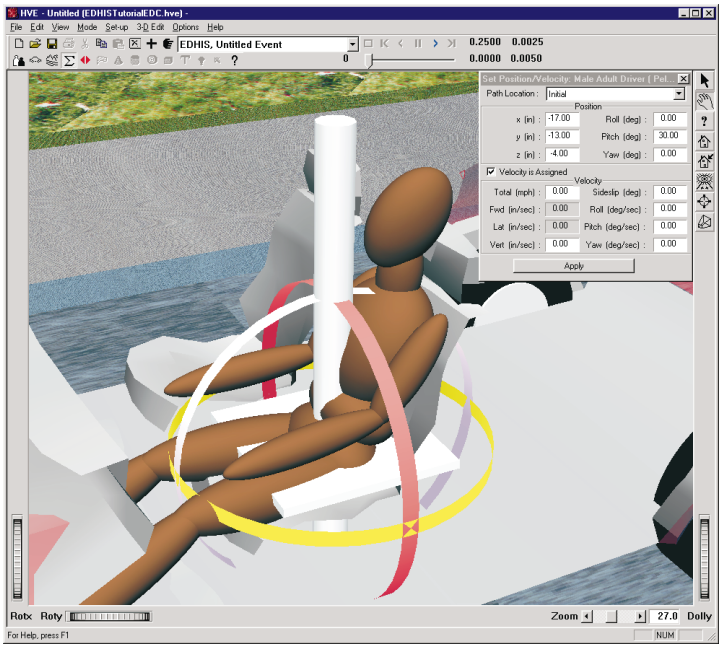

Figure 32-19 Dollying the camera in a 3-D viewer.

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➢ Place the mouse cursor in the middle of the viewer, press both the left and middle mouse buttons and drag up. The camera dollys out.

Let's use a different method to dolly in and out:

➢ Click the mouse cursor near the top of the *Dolly* thumb wheel (located along the lower right edge of the viewer) and drag down. The camera dollys in.

➢ Drag the *Dolly* thumb wheel up. The camera dollys back.

➢ Click on the *Dolly* thumb wheel and drag the mouse cursor to the top of the viewer. The camera dollys waaaaaaaay back.

☞ *NOTE: We've just illustrated the thumb wheel's range of motion is not limited by its visible size.*

☞ *NOTE: We've also illustrated you can dolly in and out using direct manipulation in the viewer or using the Dolly thumb wheel. These two methods are equivalent. The method you use is up to you.*

Use either method (direct viewer manipulation or *Dolly* thumb wheel) to dolly back in until the vehicle returns to its original size.

☞ *NOTE: Both dollying and zooming appear to have the same effect, that is, to make objects appear larger. However, if you zoom in too close, the objects become distorted just as if you were using a fisheye lens. For this reason, we recommend dollying instead of zooming if your goal is to get a close-up view.*

Changing Camera Position

The final task we need to learn about viewer manipulation is changing camera position. This is a very important task, because if you're good at it, you can quickly and effortlessly look exactly where you want to look. The initial view of the vehicle was shown earlier in Figure 32-17. To look at the back of the vehicle, perform the following steps:

➢ Place the viewer in *Manipulate* mode, using either of the methods described above.

➢ Place the mouse cursor about 2 inches (5 cm) to the left of the center of the viewer.

➢ Click the left mouse button and drag the mouse horizontally. The vehicle spins about the viewer's vertical axis.

➢ Place the mouse cursor about 2 inches below the center of the viewer.

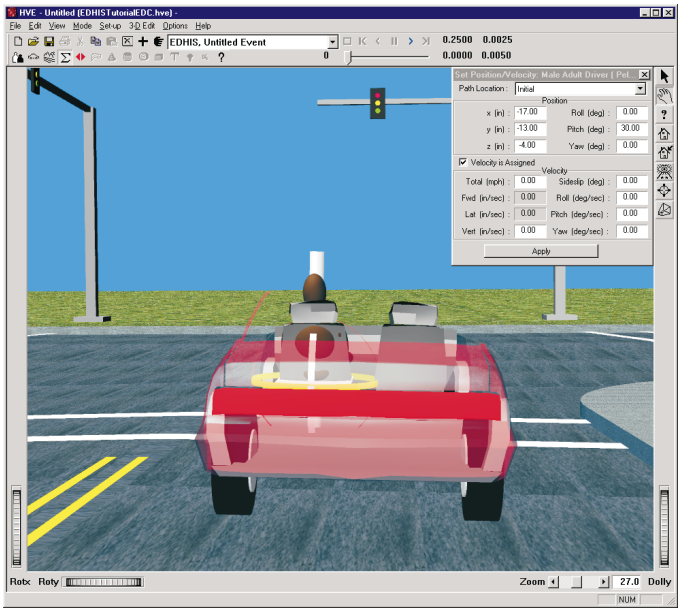

Figure 32-20 Moving the camera in a 3-D viewer.

➢ Click and drag the mouse vertically. The vehicle spins about the viewer's horizontal axis.

➢ Place the mouse cursor somewhere else in the viewer (you choose the location) and drag vertically. The vehicle spins about the center of the viewer.

☞ *NOTE: This is an important concept! While using direct manipulation of the viewer, it always spins about the center of the viewer.*

➢ Spend a moment or two to practice using direct manipulation to change the view. As a final exercise, see how quickly and easily you can recreate the view shown in Figure 32-20.

☞ *NOTE: We suggest deciding on an area of the vehicle to look at, then see how quickly you can manipulate the scene to get it in the middle of the viewer.*

As a final tutorial exercise, continue looking at various parts of the vehicle using direct manipulation and a combination of panning (middle mouse or left mouse + <Shift>), dollying (left and middle mouse or left mouse +<Shift>+<Ctrl>) and rotating (left mouse). Spend some time here! By mastering the task of viewer manipulation, you will benefit every time you use HVE. In particular, you will be able to work faster, and you will be able to better visualize your work.

Shutting Down HVE

When you are finished working with HVE, you will end your session by saving your work and exiting HVE. It is important to exit HVE gracefully because HVE asks you to save your work if it has changed since your last save, and because HVE updates your configuration file so your next HVE session uses the same preferences and options you've selected for use in the current session. HVE also saves the current editor when you exit; thus, when HVE is next used, it will display the same editor you were using when you last exited HVE.

To shut down HVE:

➢ Click on the *File* menu and choose *Exit.*

Because your work case file has changed since your last save, HVE asks you to save or cancel these changes.

➢ Choose *No.*

HVE is shut down and you can now go have lunch.