Manual and curriculum driver training

Contents

Foreword

Colorspace

All content is created using the sRGB colorspace. This assumed a Gamma value of around 2.2 on the monitors you are using. So, check if the Gamma on the monitor menu has been set to 2.2. If you want the image generation to be a bit darker, you can set it to 2.6, but a value of 2.2 is recommended.

Vehicles used in the traffic model

All vehicles are defined in the file \files\cars.def. There are a few different car lusts. If you prefer to use low poly vehicles then run \Carnetsoft\carsLP.bat. This copies \files\carsLP.def to cars.def. If you prefer better looking higher poly vehicles then run \Carnetsoft\carsHP.bat to install carsHP.def.

Cars.def defines a vehicle on each line. The first value is the Id as applied in CreatePart(id) (see system defined functions section). The second value is vehicle type (for example 1 for normal cars, 2 for buses, etc), the length, width and wheelbase (in meters), followed by the length of a trailer (0 if no trailer is present), and finally the file path of the 3D model).

1. IOConfig

The program IOConfig.exe is installed in the SimCarnet folder. It uses the python script files 'dispmodes.py' and 'disp.pyc'. It assumes that a version of Panda3d has been installed before. Changes in the configuration must be make BEFORE the simulator is started, and not during a running simulation. So, to change a setting, turn off the simulator program.

The program has 8 different functionalities, each on a different tab page:
- <u>Buttons</u>: settings of buttons and axes for the various input devices that are used. This is used to set a button or switch, for example a handbrake, to a specific button on a specific input device, or to set an axis to a device such as a steering wheel or a clutch pedal.
- <u>User interface</u>: position and type of user interface.
- <u>Displays</u>: Display resolution and position of rendering displays.
- <u>VI Support</u>: support by the Virtual Instructor.
- <u>Force feedback</u>: Sets the strength and type of force feedback on the steering wheel (if a force feedback steering wheel is available).
- <u>Vehicles</u>: to select the vehicle type (passenger can, bus or truck).
- <u>Rendering</u>: set rendering effects.
- <u>Processors</u>: Processes are assigned to separate processors.

Buttons and Axes for the input devices

All input devices must be connected to the computer via usb connections. There can be maximally 5 different input devices. During the application of IOConfig they must be plugged in, in order to be detected.

Buttons

The following logical 'buttons' can be defined:
- Contact: the power switch which must be set ON before the engine can be started.
- Start Engine: to start the engine. This can be a button or switch which must be held until the engine is started.
- Indicator Left: left indicator.
- Indicator Right: right indicator.
- Headlight: headlight which must be switched on during darkness of rain or fog.
- Highbeam: stronger headlight.
- Light signal: a button or switch which must be held during the light signal.
- Handbrake: parking brake.
- Claxon: a button or switch which must be held during the signal.
- Seatbelt: if the seatbelt is not strapped on and the contact is switched on, the seatbelt warning light on the dashboard is on.
- LookLeftMirror: to check the left mirror. Also to check all mirrors when 'Switch mirrors on by button' in the Rendering tab has been enabled.
- LookRightMirror: to check the right mirror. Also to check all mirrors when 'Switch mirrors on by button' in the Rendering tab has been enabled.
- LookLeftSide: to look to the left channel sideways
- LookRightSide: look to the right channel sideways
- LookLeftShouder: to look to over the left shoulder. Not only to communicate that you are looking over the left shoulder. It also generates an 'over the left shoulder' view on the left monitor.
- LookRightShoulder: to look to over the right shoulder. Not only to communicate that you are looking over the right shoulder. It also generates an 'over the right shoulder' view on the right monitor.
- Gear 1: first gear.
- Gear 2: second gear.
- Gear 3: Third gear.
- Gear 4: fourth gear.
- Gear 5: fifth gear.
- Gear 6: sixth gear.
- Gear Reverse: reverse gear.

If no Button Id has been set, the button is not used and thus not recognized during the simulation.

A button can be of 2 different types:
Toggle button: In that case, the toggle box must be ticked. A toggle button is a button that is pressed continuously to give the value ON. If the button is released, if returns the value OFF. Gear shifters are usually toggle buttons. If, for example, the lever is set into first gear, the device returns the same value (for example '1') continuously.

Non-toggle button: In that case, the toggle box must not be ticked. This type of button is set ON when the button is pressed. It stays 'ON' if it is released. When it is pressed again, it is set to the value 'OFF'. Most buttons of the G29 are treated like that.

Setting a button or switch to a logical device (for example gear 1 or handbrake) works as follows.

1)   First Select an input device.
2)   Select a logical button. Click on the radio button, to the left of a button name, to select one.
3)   Select a 'Button Id'. This is the button number for the selected device. To do this, first press the button <Press button/pedal or turn steer>. The led light to the right of this turns green, which means that for the selected device all buttons are sampled until a button is pressed. When you press a button for that device you see the button number change for the selected logical button.

When the button has been selected, press the <Ready> button to stop the sampling and continue with the next logical button (step 2).

Steering wheel and pedals

Steering wheel

The procedure to select the steering wheels and pedals is comparable to the buttons. To select the steering wheel,
1. first make sure you select the appropriate input device (the Logitech G29 in this case).
2. Then select the steering wheel (under the heading 'pedals') by clicking the appropriate radio button.
3. Then press the <Press button/pedal or turn steer> button and turn on the steering wheel.
4. The name of the axis then appears under the Axis heading (the X-axis in the case).
5. Then press the <Ready> button.

In most devices, the steering wheel is on the X-axis. If a Logitech G29 is, used, the software assumes that the steering wheel angle is between -450 and +450 degrees. In the driver settings of the G29, make sure the 'Degrees of rotation' is set to 900, see next figure.

Also, make sure that "Enable Centering Spring in Force Feedback Games" is enabled, and "Centering Spring Strength" is set to 30%. If you make this larger, the steering wheel may stick in a non-zero position after driving for a while. Sensitivity should be set to 50%.

Clutch, brake and accelerator pedals

For the clutch, brake and accelerator pedals, a similar procedure is used. The clutch is selected as a 'Logitech G29 Racing Wheel USB device'. When the clutch pedal is pressed, the Y axis changes, so this is the one selected. There's also a checkbox with the heading 'Inverted Axis' checked. In some

cases, the axis is inverted. Normally, when a pedal is pressed fully, the driver returns the maximum value and when the pedal is not pressed, it returns 0. But this is not always the case. Sometimes it returns 0 when the pedal is pressed fully, while it returns the maximum value when the pedal is not pressed. In that case the axis is converted. When you start the simulator and the pedal gives the maximum value when it is NOT pressed, then you know the axis is inverted. In such a case, you need to tick the checkbox 'Inverted axis' for the respective axis. In the G29 all pedals have inverted axes.

The settings for the pedals are:
- Clutch: sensitivity 50%
- Brake: sensitivity 80%; disable Combined Pedals
- Accelerator (Gas): sensitivity 50%; disable Combined Pedals

If all buttons, switches, pedals and steering wheel have been configured, store the data. Press the <Ok> button. If you do not want to store the data, click the <Cancel> button. If you click the <Ok> button, you are asked for confirmation.

The data is stored in the file 'inputdevices.def' in the SimCarnet folder. This is a simple text file that can be edited manually if required, or copied to the computer that runs a simulator. You have to make sure the input devices as referred to in this file are available on that computer.

User interface

Press the User interface tab to configure the control.exe GUI.
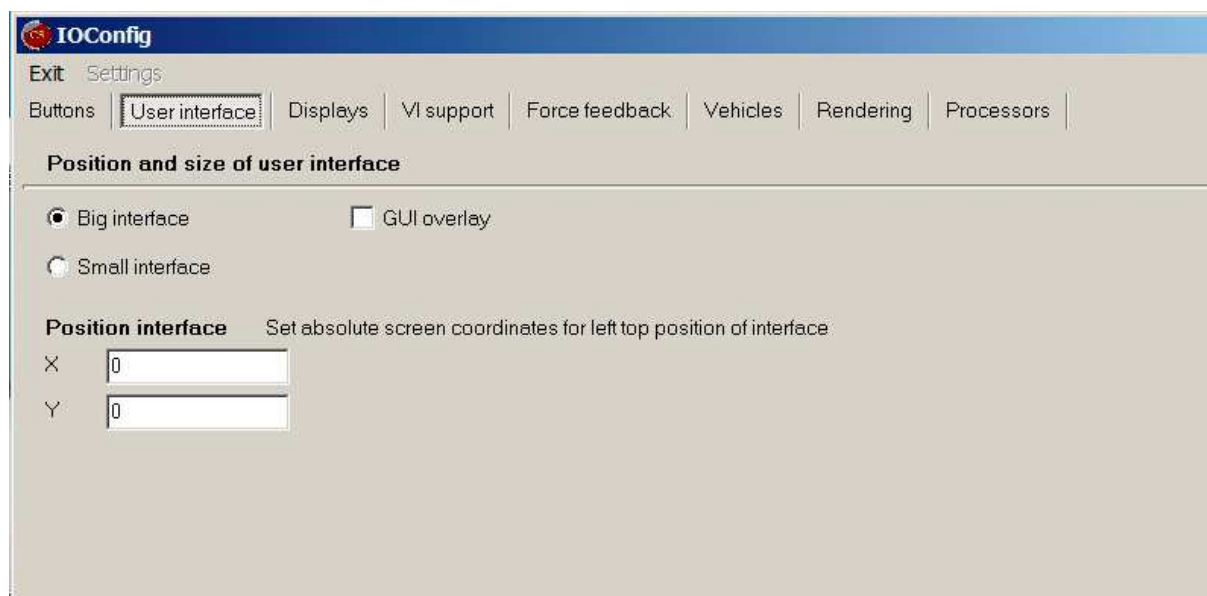
- The first choice is between a 'Big interface' or a 'Small interface'. Normally a Big interface is used. This is when you use 4 displays: 3 for rendering and 1 for the user interface.
- If you want to use 3 displays in total and put the GUI on one of the rendering displays on top of the rendering surface, choose the 'Small interface' option. The next figure shows a small interface. This can be put on top of a rendering surface and you don't need a separate display for that.
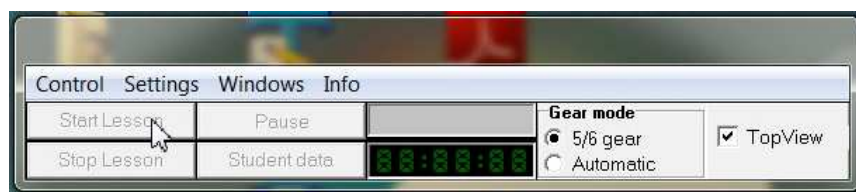
- Enable GUI overlay when you want to use 3 displays in total and also have the big GUI displayed on one of the monitors, typically the left one. In that case, the top panel of the big GUI will be displayed on top of the graphics engine rendering surface. If you enable GUI overlay, make sure the big interface option is switched on.

The next figure shows a big interface. This has more functionality and gives more information. You need a separate display (monitor) for that, or enable GUI overlay.
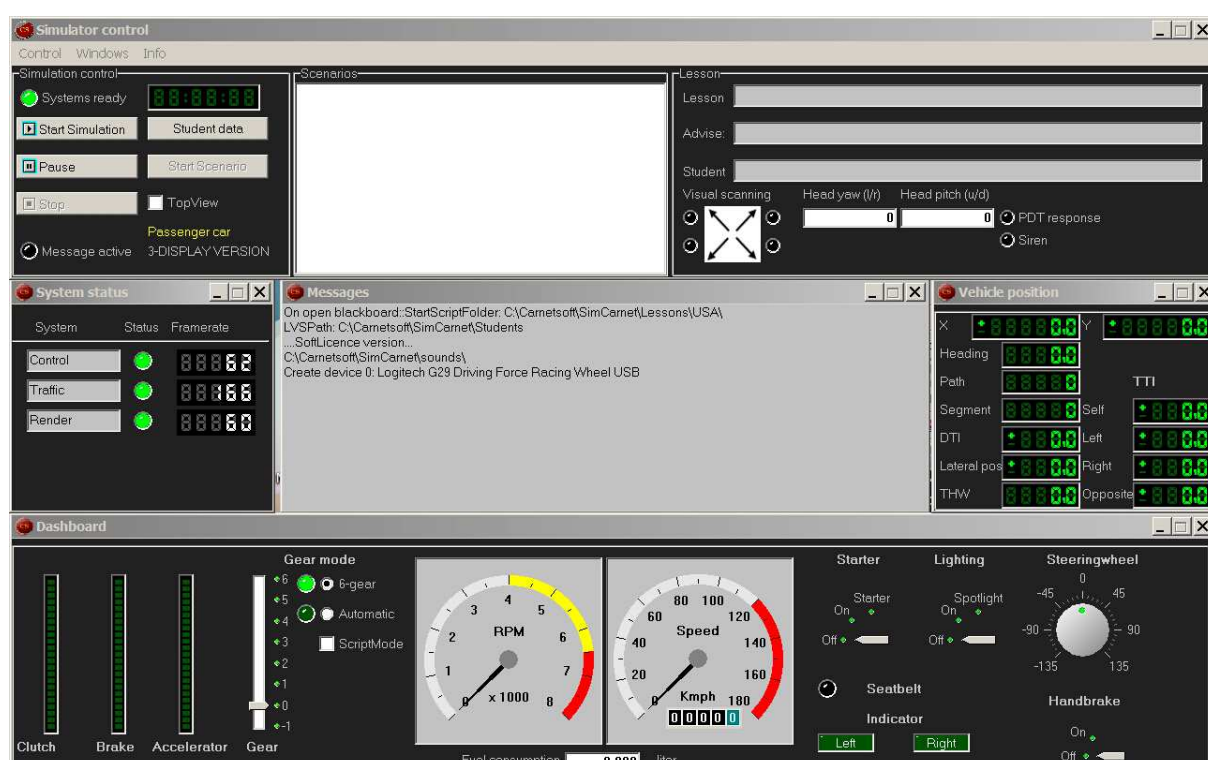
The position of the interface can be set by changing the values of the top-left of the interface. In the example X and Y of the top-left are both set to 0. The left-most of the display surface is X=0 and the top of the display is defined as Y=0. If, for example you have 4 displays, the logical left display (first display) then starts at (0;0). If this display has a resolution of 1920x1080, the second display starts at (1920;0). If you want to apply the GUI on the first display, then set the GUI top-left position on the first display, for (0;0). The rendering surfaces are then defined on the 2nd, 3rd and 4th display.

Press the <Ok> button to store the User interface data. The data is stored in the file 'windowsettings.def' in the SimCarnet folder. This is a simple text file that can be edited manually if required, or copied to the computer that runs a simulator.

Displays

The rendering displays can be configured by clicking the 'Displays' tab, see next figure.
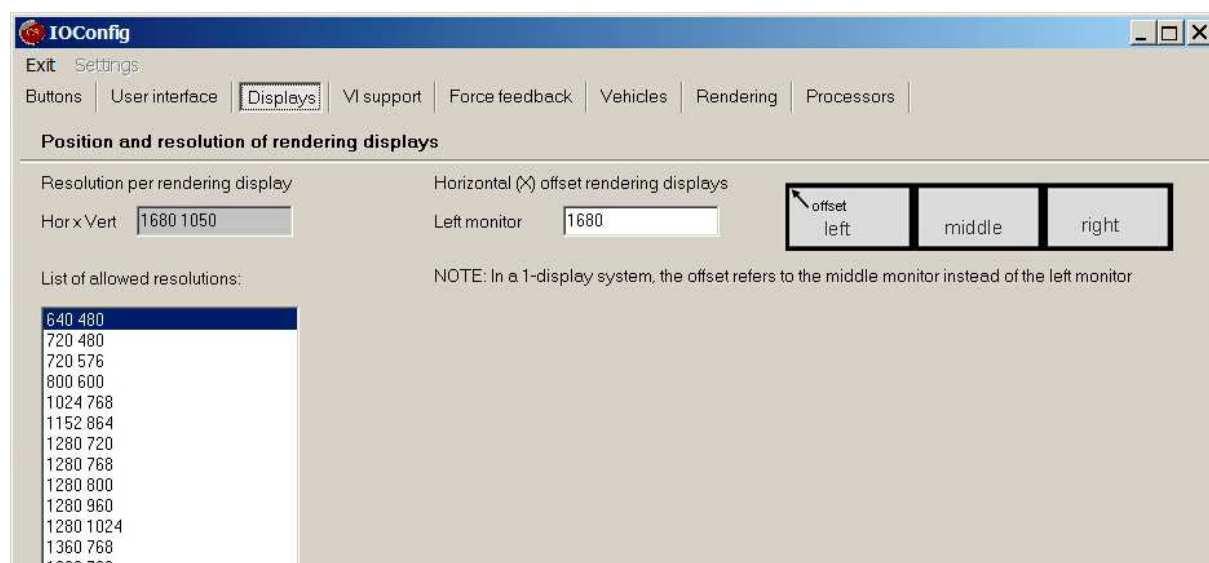
A list shows all allowed resolutions per display. If you click on a list item, it is moved to the 'Resolution per rendering display' field. Then all 3 rendering displays (left, middle and right) must have the same resolution.
For a 3-rendering display system, the Horizontal (X) offset refers to the coordinate of the top-left of the LEFT rendering display.
For a 1-rendering display system, the Horizontal (X) offset refers to the coordinate of the top-left of the only rendering display.

If you use 1680x1050 as the screen resolution for each display, you have to make sure this is also configured in the screen resolution settings of the display driver. 3 x 1680x1050 displays require a 5040x1050 resolution, see next figure (screen resolution settings display driver): In the example, the GUI display is monitor 1, the left rendering display is monitor 4, themiddle rendering display is monitor 3 and the right rendering display is monitor 2. Screen 1 starts at (0;0) in this example, and must be the main display.

Press the <Ok> button to store the User interface data. The data is stored in the file 'screensettings.def' in the SimCarnet folder. This is a simple text file that can be edited manually if required, or copied to the computer that runs a simulator.

If there's no screensettings.def file available then the simulator system uses the display settings defined in the files 'ConfigC.prc' and 'ConfigL.prc' and ConfigR.prc. Never remove these *.prc files from the system because there are a lot of other different settings defined in these files that are used by the rendering system.

VI-Support

The folder where the sound files for the speech messages and other sounds are located can be specified in this tab. Normally they are located in the sounds folder.
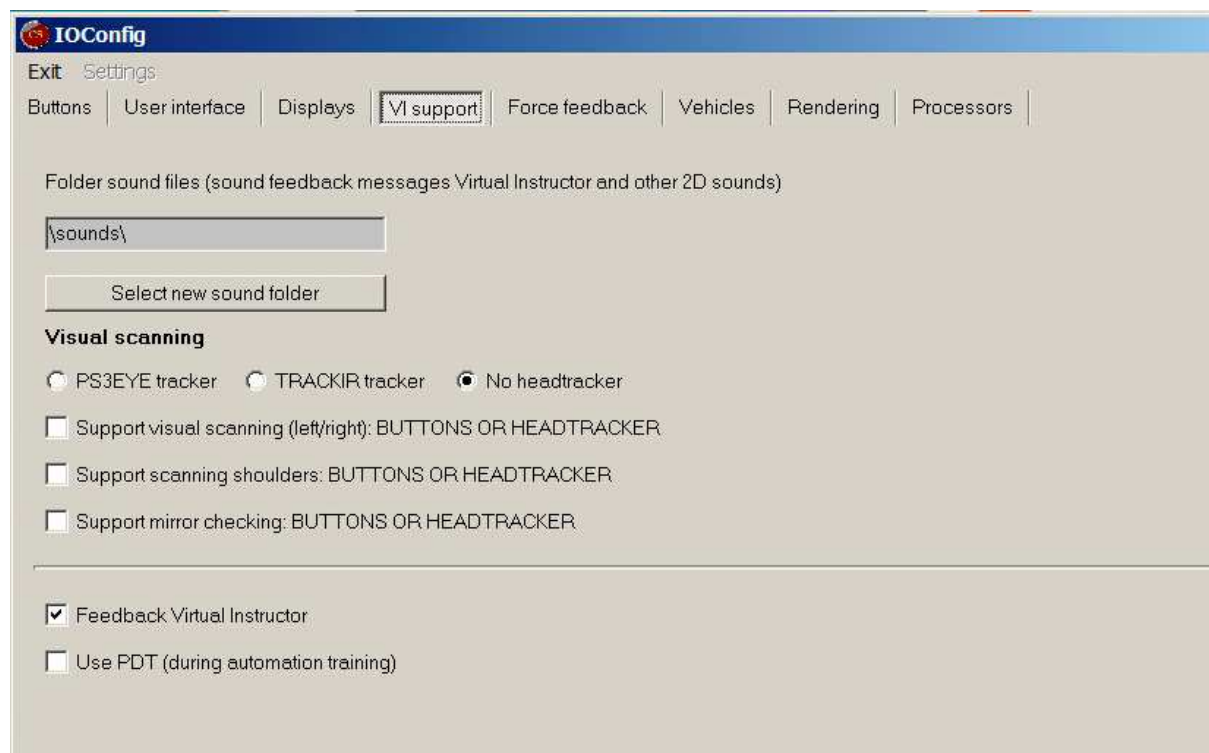
If you want to put the sound messages (*.wav files) into a different folder, press the 'Select new sound folder' folder, and then select the name of the folder from the selection dialog. This option is useful when you have more than one language installed. To switch between languages you then have to select another folder.

Here you can also select visual scanning support. Basically visually scanning has three different components:
- scanning to left and right
- looking over shoulders (shoulder check)
- checking the mirrors (left, central, right)

The methods to detect and measure scanning are either:
- via a **headtracker**: the TRACKIR5 device OR
- via a **button** on the steering wheel. Buttons can be assigned to each direction: left, right, left mirror, left shoulder etc.

If you want to enable visual scanning support and checking, there are basically two ways to do that: either via the TrackIR device of via buttons that have been assigned a specific function.

1) Support mirror checking
While driving, frequent mirror checking is of great importance because the driver should know what's in the immediate surroundings of the car (situational awareness). Attentive driving requires a continuous situational awareness of the surroundings. The TrackIR is sensitive enough to detect if the driver has checked either one of the three rear-view mirrors. The mirrors have to be checked regularly, but also when approaching an intersection or before the driver changes lanes. So it is recommended to enable 'Support mirror checking'.

2) Support visual scanning
When approaching an intersection, the driver has to look to left and right. This can also be detected either via a button press or via the TrackIR.

3) Support scanning shoulders
Shoulder checks are important when turning left or right at an intersection, or when changing lanes, for example before the driver enters a highway. Not every driving instructor wants this enabled. Shoulder checks can be measured via the TrackIR or via a button press.

By unchecking the 'Feedback virtual instructor' checkbox, the VI only gives instruction and no feedback. This can be used, for example, if you want to use a lesson as a **driving test** instead of a regular lesson.

By unchecking the 'use PDT' button, the PDT test is not applied during automation training lessons. I that case, automation data are not stored in the student assessment system. Most users do not use PDT measurement so this one is typically switched off. It is recommended not to use this feature anymore because it will be discontinued.

To store the data for the simulator, press the <Ok> button on the bottom of the tab.

Force feedback

To specify the force feedback settings, use this tab.
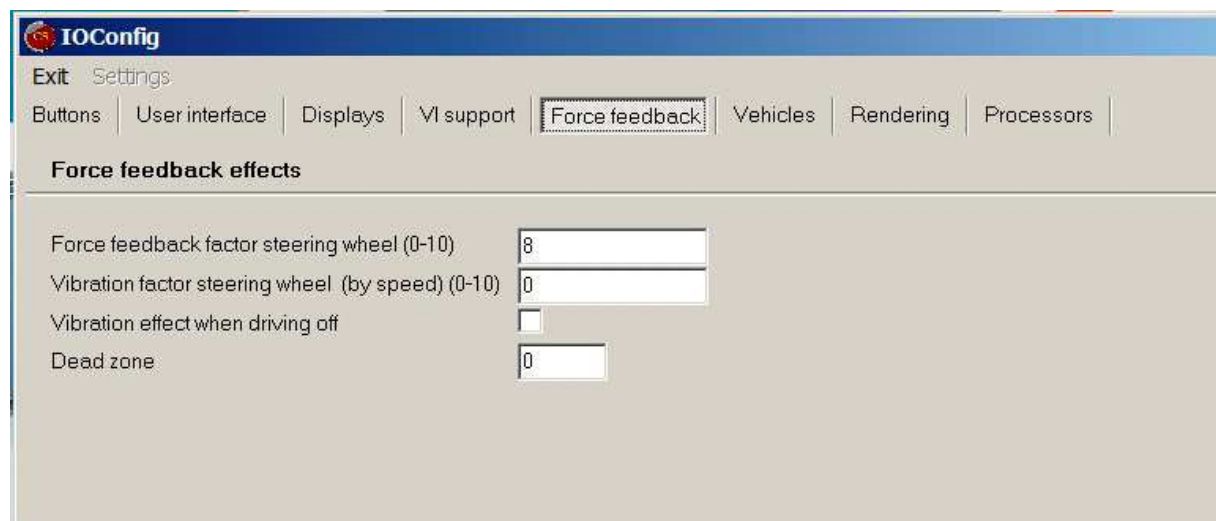
There are 4 options:
- <u>Force feedback factor steering wheel</u>: This must have a value between 0 and 10. The vehicle model returns a steering wheel torque depending on, for example, speed, vehicle mass, road friction, etc. If this force feedback is set to 0, this steering wheel torque is ignored. If the factor is set to 10, this torque is maximal. Usually, a lower value is used, for example 8.
- <u>Vibration factor steering wheel</u>: This must have a value between 0 and 10. This gives a vibration on the steering wheel that increases with speed, and gives some feedback about vehicle speed. When the factor is set to 0, this is off.
- <u>Vibration effect when driving off</u>: This can be switched on of off. When the driver drives off, this gives feedback about the moment of target coupling, when the clutch pedal is raised.
- <u>Dead zone</u>. An angle around the zero point where the steering wheel angle has no effect. Because of side effects, a value of 0 is recommended. The Logitech G29 has a fairly bid dead zone already that can't be reduced by the used, unfortunately.

To store the data for the simulator, press the <Ok> button on the bottom of the tab. The name of the file is 'forcefeedback.def'.

Vehicles

This is used select a vehicle type. This must be done before the simulator is started.
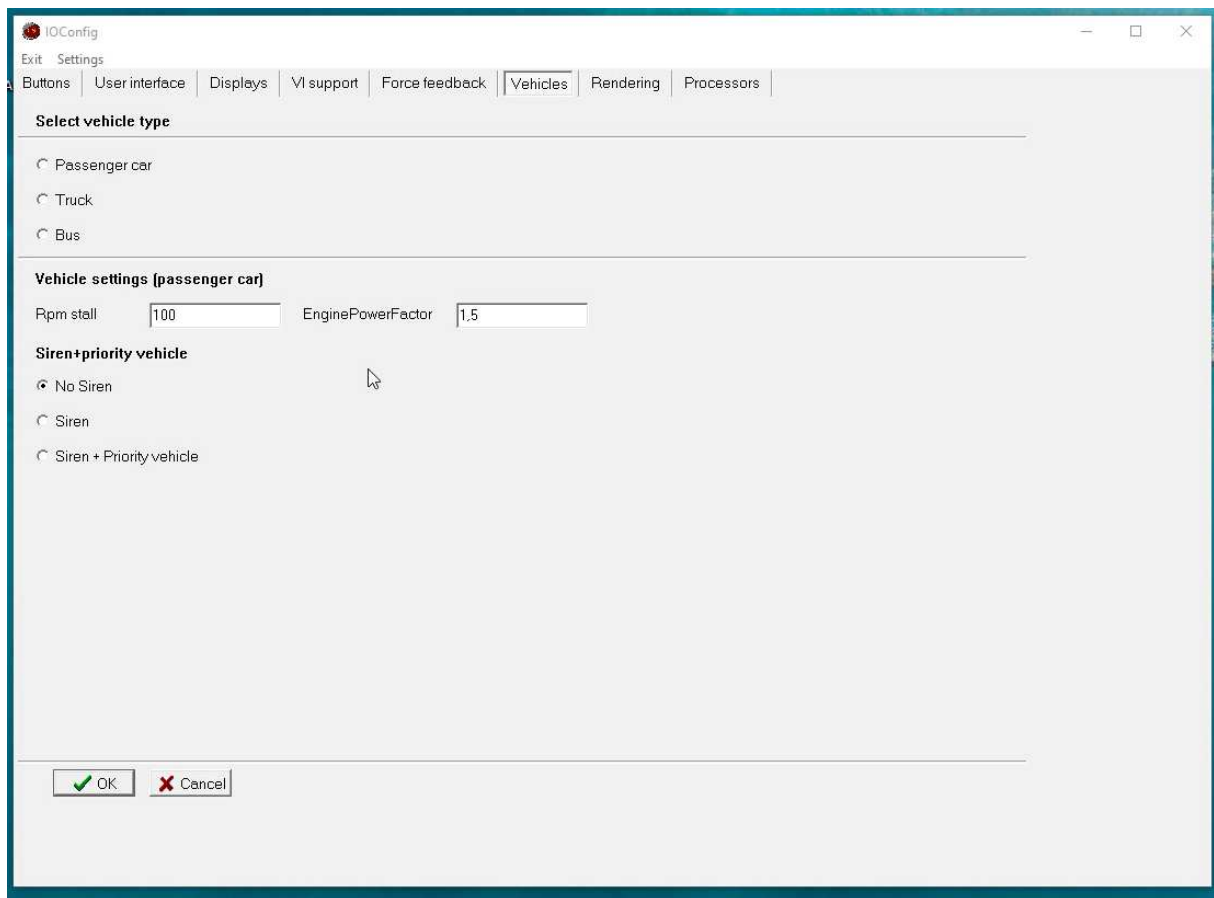
Rpm stall is the RPM at which the engine stalls. If you don't want to stall too easy, you can lower this value to 100, for example. To increase the engine power, if you want to be able to drive at a higher speed, set the EnginePowerFactor higher, in this example to 1.5. That means the engine power of the simulator vehicle will be 1.5 times higher as the default value.

Priority vehicle/police training

The option for police training, or training to drive a priority vehicle in general (ambulance, firetruck, police) can be enabled by choosing a siren option in the Vehicles tab.

Use of the siren can be enabled as either:
- No siren
- Siren
- Siren + Priority vehicle

If you want to use the siren, you must also assign a siren button in the buttons panel. Press the OK button to save the new configuration.

Siren (only) means that the siren switches on when you press the siren button but traffic does not alter its behaviour (normal priority rules apply etc.), so other traffic does NOT take account of the the priority vehicle.

Siren + Priority vehicle means that the siren switches on when you press the siren button AND traffic changes behaviour such that they give priority to you, oncoming vehicles stop and move aside when you overtake etc.

For police training this means that driving as a priority vehicle can be trained where other traffic either takes account of you driving a priority vehicle or not.

In order to be able to drive faster you can increase the regular engine power (and thus maximum speed) by changing the value from 1 to, for example, 2. In that case engine power doubles.

Rendering

A number of different graphical effects can be enabled here.
- **Distance haze** results in a more realistic haze effect on objects that are farther away. Apart from a more realistic atmosphere, enabling this also results in less obvious popping up of objects that come into view. Objects far away are not drawn and if they come within a certain distance from the view camera, they will popup within view.
- **Shadows** add to the realism of the simulations so it is recommended to leave this enabled.
- **Sun scattering** shows the effect of the scattering of the sun from the direction the sunlight reaches the camera. Although the effect can be nice it is not 100% correct so you may want to disable this.
- **Gloss mapping/bloom effect** results in better looking graphics during daytime driving and blooming effects on vehicle lights during night driving.
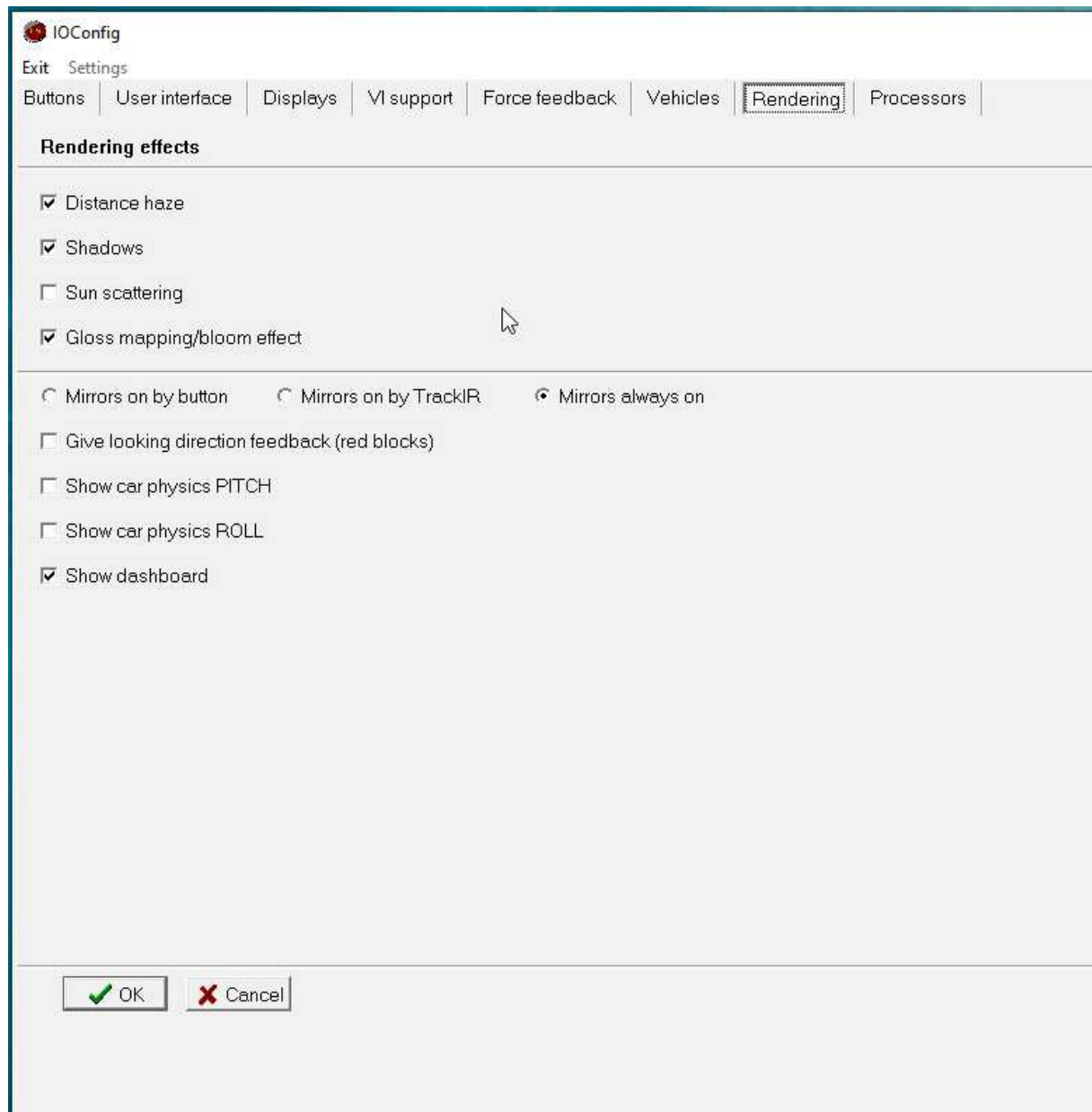
'Mirrors always on' is enabled by default. This means that all rearview mirrors are enabled. If 'Mirrors on by button' has been enabled, the images in ALL mirrors are rendered when the driver presses either the 'LookLeftMirror' or 'LookRightMirror' button. If 'Mirrors on by TrackIR' has been enabled, all image rendering of the rearview mirrors is disabled unless the driver looks specifically in the direction of a specific mirror. So, if the driver looks at the rearview central mirror, the rearview images are rendered in that mirror.

2. Special purpose buttons on the user interface

In the top-right section of the control.exe user interface there are a number of buttons that can be used by the user.
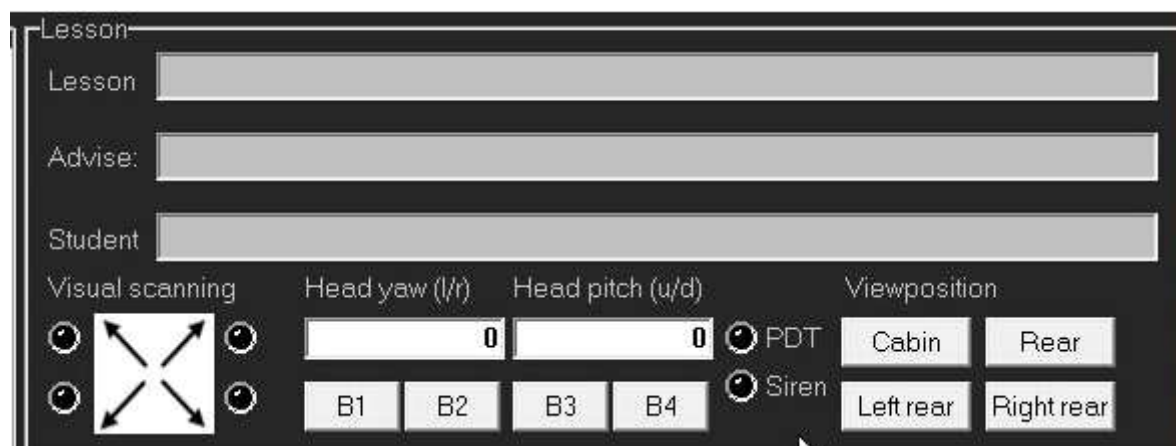
The buttons B1, B2, B3 and B4 are for use in the research simulator software. The operator can click on these buttons and then the event generated can be used in the script language to fire an event or start a scenario, for example to let a lead vehicle brake. In the script language the functions guibutton1(), guibutton2(), guibutton3() and guibutton4() are defined and if the return the value True, the respective button was pressed by the operator.

By pressing the view position buttons Cabin, Rear, Left rear and Right rear you can set the camera position either from the vehicle cabin or from hovering behind the simulator car and looking at the car from rear, from left rear or right rear. This enables the operator to have look from above at the simulator car, for example to check the position on the road with respect to surrounding traffic.

Head yaw and head pitch give the yaw and pitch angles of the head if a head tracker is used.

3. Scanning

Visual scanning is an important aspect of driver training. When the student approaches an intersection, changes lanes or drives off, it is important that he/she looks left and right and looks over the shoulder. In the training program visual scanning is an option. To check whether the driver looks left and right, the optical head tracking via the TrackIR5 is the preferred method. Mirror checking is also a very important aspect of scanning. The driver must always be aware of relevant objects around the car (situational awareness), and for that, mirror checking is of utmost importance.

If visual scanning is supported, the Virtual Instructor checks if the student has looked left or right, into the mirrors, or over the left or right shoulder when appropriate. If the student has failed to do so, a feedback message is delivered by the Virtual Instructor. Results on visual scanning are stored in the student assessment system when visual scanning is supported.

Define buttons for scanning

In IOConfig (Buttons tab), viewing direction can be assigned to buttons, if you don't have access to the TrackIR.

The settings in the IOConfig example, and defined by default, are as in the G29 steering wheel picture.

So, when the 'look left' button is pressed, the Virtual Instructor is alerted that the student looks to the left monitor. In that case, a red block with the text 'looked here' is displayed on the left monitor IF 'give looking direction feedback' has been enabled in IOConfig (in the Rendering tab). When the 'left shoulder' button is pressed, a view from over the left shoulder is displayed on the left monitor.

Alternatively, looking left and right can be detected via the head tracking system.

Head tracking

A TrackIR5 device costs around 175 US dollars and can be ordered at major electronics stores.
To install the trackIR software, start TrackIR_5.4.2.exe. It installs the software in the folder:
C:\Program Files (x86)\NaturalPoint\TrackIR5\TrackIR5.exe

To use head tracking with the TrackIR5 system you need the following:
- a trackIR infrared camera fitted on top of the middle monitor the driver is facing. Make sure the driver's head is positioned in front of the center of the middle rendering monitor, preferably at less than 1 meter from the monitor (see instructions that come with the TrackIR).
- the driver is wearing a baseball cap with the reflectors attached to the cap (see instructions that comes with the TrackIR).
- since the TrackIR is sensitive to other light sources, make sure there are no light reflections behind the driver that disturb the detection by the trackIR, see below.

- The TrackIR software starts automatically when the computer is started. When the driver wears the baseball cap with the reflectors, and is seated in front of the central monitor and faces forward, **press F12 to calibrate** the system (so it knows your head is in a face-forward position). Also press F12 if the detection appears to be less accurate.

- Make sure that the Motion Control panel, Speed is set to 0.5 and Smooth is set to 6.
- Advanced settings->Camera->set Lightfilter Threshold to 253 (maximum) and camera rotation to 0
- If you can't get stable head yaw and pitch, then there are probably reflections. In that case, enable <Display><Camera view>. You should now see the three reflectors as 3 green blobs. If there are any other green blobs, these are reflections that disturb the image processing. Red blobs are also reflections but these are ignored. Find the source of the other green blobs and remove that source. These are usually windows that let sunlight in behind the driver, so close the curtains in that case.
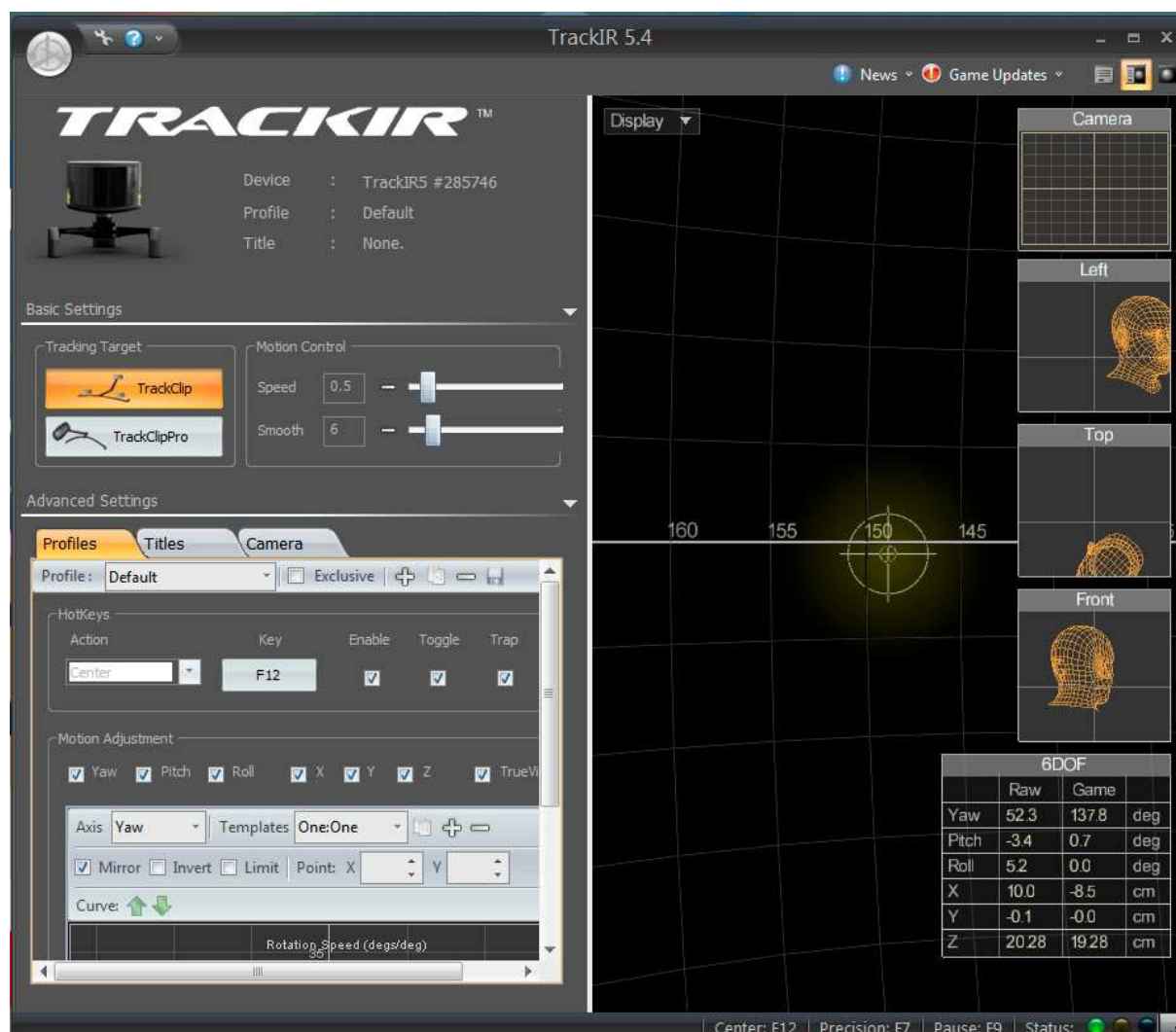
The simulator accesses the head yaw (horizontal angle) and pitch (vertical angle) that is detected by the trackIR via an intermediate program.

This is a python interface program, called FreePie. It is installed by FreePie.1.9.629.0.msi. After this installation it is installed in:
c:\Program Files (x86)\FreePie\FreePie.exe

When the simulator starts, FreePie is started and starts to send data to the simulator. This program ends when the simulator is terminated.

4. Automation training

Automation training is an important aspect of the driver training curriculum. All Automation training lessons are preceeded by the word 'AUTOM', as in AUTOM_Steering. During these lessons the respective driving task is trained for about 15 minutes, and the emphasis is on that specific task. For example, during AUTOM_ChangeLanes, the student has to change lanes a large number of times. During every lane change, the student has to scan, look over the shoulder, apply the indicator and do the lane change manoeuvre.

The next part of this paragraph can be skipped, because the PDT is not used very often in the driver training simulator system. Its used more often in behavioural research applications (experiments).

The level of task automation can be measured by the PDT (Peripheral Detection Task, or Detection Response Task). During the PDT task, a little red block is displayed on the middle display, and the student has to press the PDT button as soon as he/she detects the red block. When a driving tasks requires a lot of controlled attention, PDT signals are not detected by the student or reaction time is larger. When automation sets in, PDT signals are detected more frequently while reaction time to the PDT stimuli becomes smaller. This results in an automation index that is stored in the student assessment system.

The use of the PDT task is optional: it can be switched on or off in IOConfig by eanabling the 'Use PDT (during automation training' checkbox.

Enabling the use of the PDT
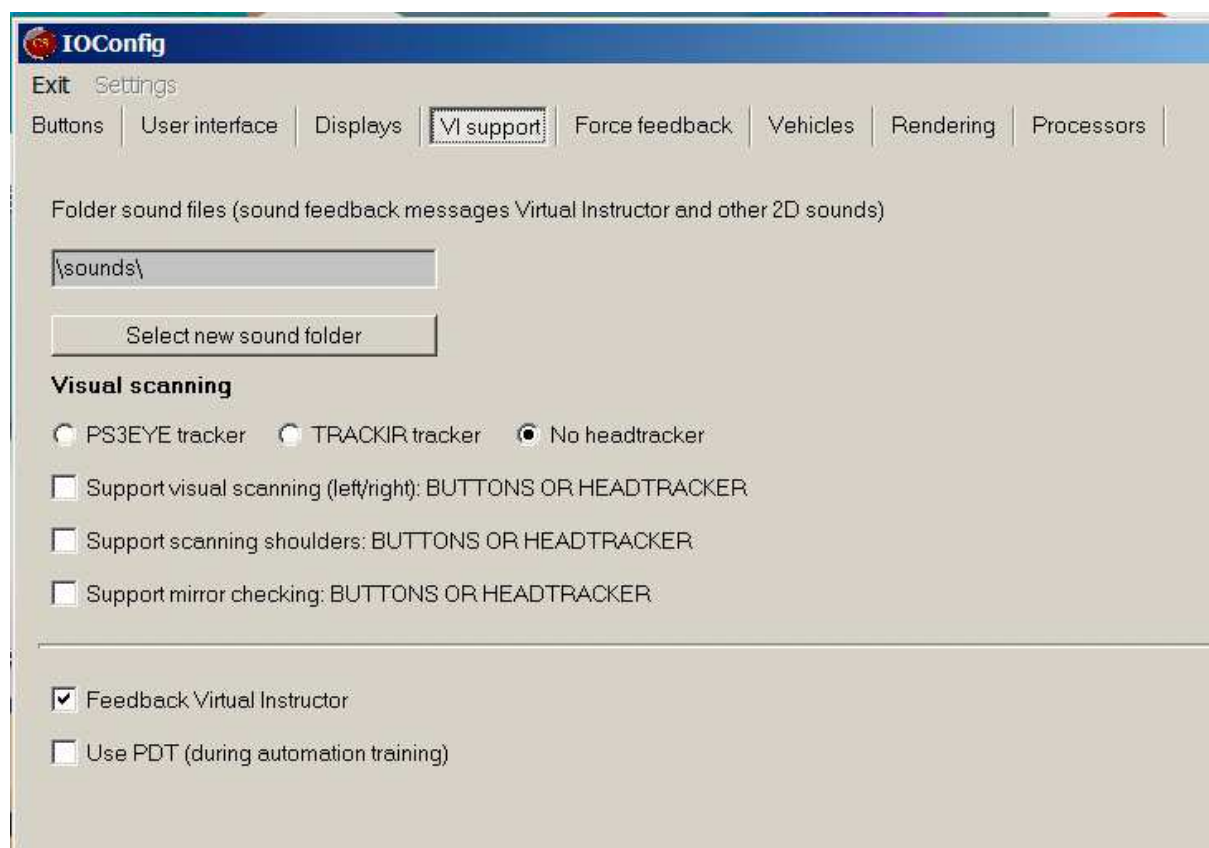
Applying the PDT during the automation training adds a little bit of additional task complexity, and some users may prefer not to use the PDT. In that case, the checkbox 'Use PDT' should be unchecked: no PDT is activated during the automation training lessons, and no automation index results will be stored in the student assessment system.

The PDT button can be defined in the Buttons tab of IOConfig.exe.

5. Start the simulator

The simulator is started by double-clicking the Start Simulator icon on the desktop. The simulator then starts in 'paused' mode, and Graphical User Interface (Gui) is displayed in the main display.

A lesson can then be started in either of 2 different ways:
1) By pressing the 'Start Lesson' button
2) By pressing the 'Student data' button

Method 1 is used when you want to start a lesson and not store data for a specific student. In this case, no performance data are stored. Method 2 is used when you want to store data for a specific student. After a lesson is stopped by the operator of completed by the student, performance data are stored in the database of the student.

Start Simulation button

Method 1 works as follows.
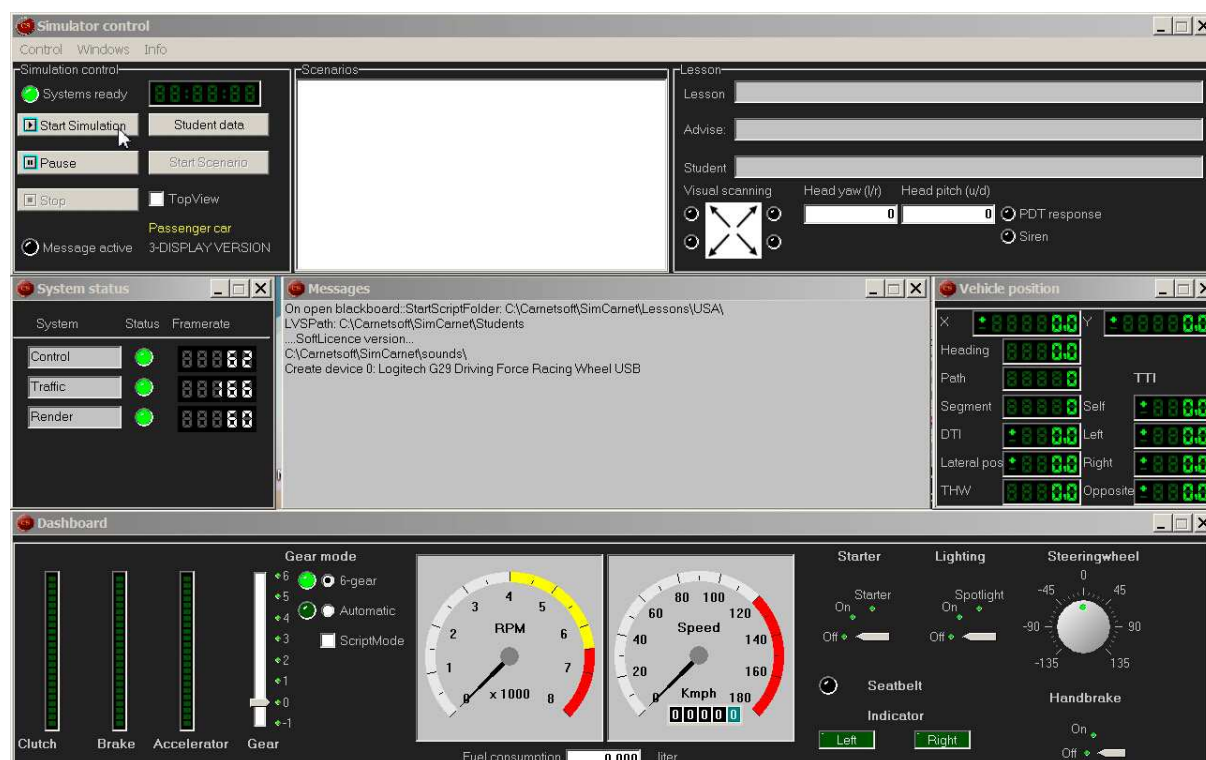
When you press the 'Start Simulation button', a file selection dialog is displayed. All lessons are categorized in three separate folders:
- 1-VehicleControl: contains all 'Level 1' lessons related to learning vehicle control tasks.
- 2-TrafficParticipation: contains all 'Level 2' lessons related to learning traffic participation tasks.
- 3-SpecialCircumstances: contains all 'Level 3' lessons of advanced driver training, related to special circumstances such as reduced visibility and slippery road.

- TrainingModules: contains lesson modules that consist of a series of lessons that are played sequentially.

To select a specific lesson or module, click the folder and then click on a lesson or module. To start the lesson or module, press the 'Open' button.
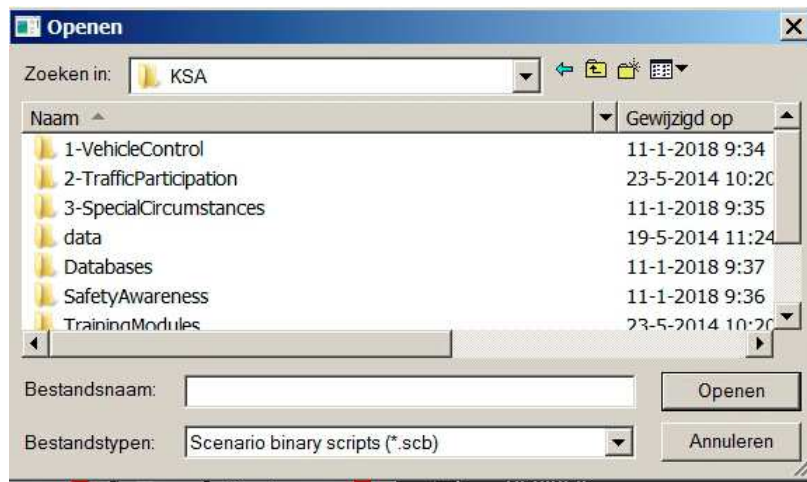
Student data button

When you press the 'Student data' button, the student assessment system (SAS) opens.
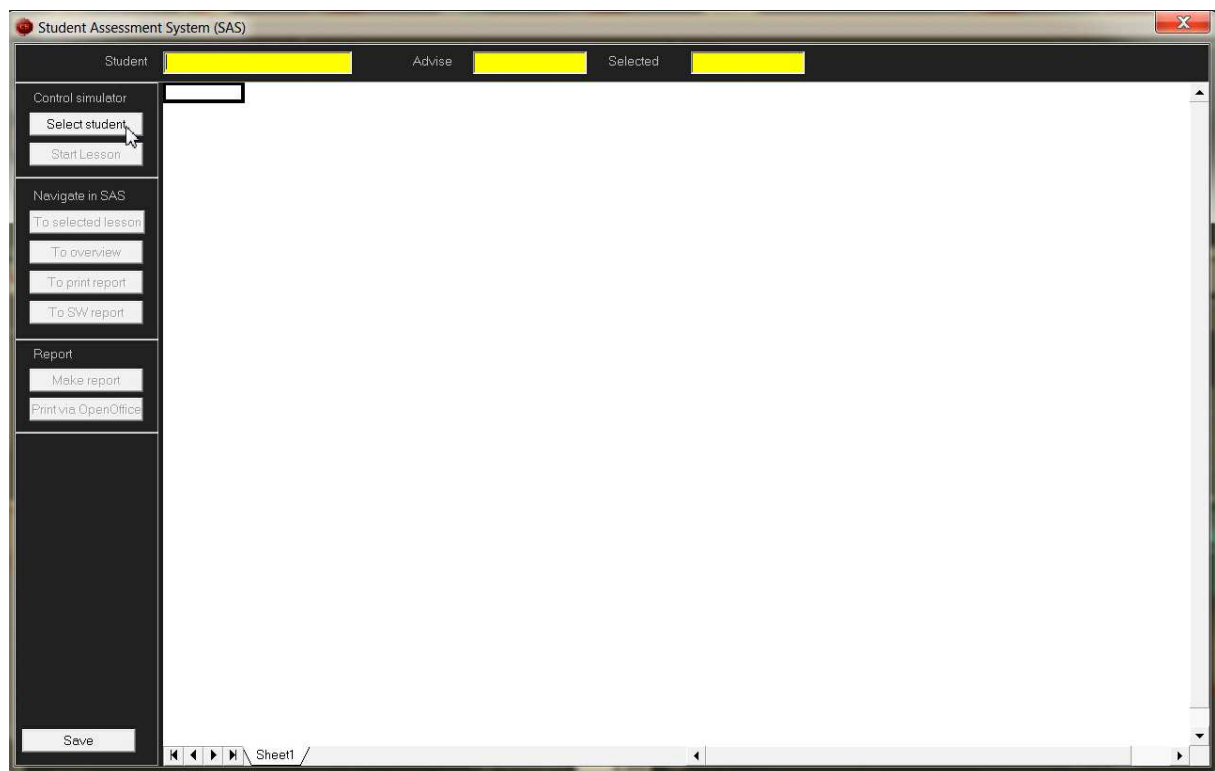
In this method, select a student, followed by a lesson or module, see the next paragraph.

6. Student Assessment System (SAS)

The SAS is the central part of the simulator training. Every student has a spreadsheet (Excel spreadsheet) with the results stored. The open source software package 'OpenOffice' is installed on the computer. This is used for opening the spreadsheets and for printing reports. Each student has a separate spreadsheet to store the progress data. When a new student starts the training, a new spreadsheet has to be created for that student.

Add a new student

On the desktop, there's an icon 'NewStudent'.
- Double click the icon 'NewStudent'
- Type the name of the new student, for example, John Miller, then press the button 'Add'.
- Check if the new spreadsheet with that name has been created by pressing the 'Show students' button.
- When you're ready, press the 'Done' button.

Select a student

When the SAS is opened ('Student data' button, see previous paragraph), a student must be selected. On the left side of the SAS panel there are a number of buttons:
Control simulator:
- **Select student**. With this button a file of an existing student can be opened. To create a new file for a new student, see the previous paragraph.
- **Start Lesson**. This button starts a selected lesson for the selected student.

Navigate in SAS: these buttons can be used to navigate to a certain tabsheet in the spreadsheet.
- **To selected lesson**. In the 'Overview' tabsheet there's an overview of all lessons. A lesson can be selected by clicking on the row with the name of the lesson.
- **To overview**. Navigate to the 'Overview' tab.
- **To print report**. Navigate to the report tab (print page) to print the report.
- **To SW report**. Navigate to the strength/weakness report.

Report: After each lesson is finished, the results of the lesson are stored in the tab sheet of the respective lesson: each lesson has it's own tab. But the system also makes a report of a single page which gives the results in summarized form. There are two possibilities: after each lesson is finished, the SAS creates a report. This can be printed by the operator. Another option is to make a report of another lesson that has been driven before (and thus was not the latest lesson). For that purpose the 'Make report' function can be used.
- **Make report**. To make a new report (apart from the automatically generated report of the latest lesson), do the following. First go to the 'Overview' tab and select a lesson by clicking on the name of the lesson. Then jump to the tab of that lesson by clicking on the 'To selected lesson' button. This shown the tab of that lesson. When that lesson has been driven at least one time, a report can be generated of the last time this lessen was done (by the present student). To do so, click on the 'Make report' button. This can take a few

seconds, and then the SAS jumps automatically to the 'Report' tabsheet. This then gives a summary of the results of that lesson. Some fields are empty, such as fuel consumption, because that data is only available if the lesson has just been finished: it is not stored in the SAS.

- **Print via OpenOffice**. This is to print the report, by calling the program 'OpenOffice'.

Select a student by clicking on the 'Select student' button (step 1). A file selection dialog opens and a student can be selected by clicking on the name (step 2). When the button 'Open' is pressed (step 3), the student data are loaded. This takes some time because of the large excel spreadsheets.
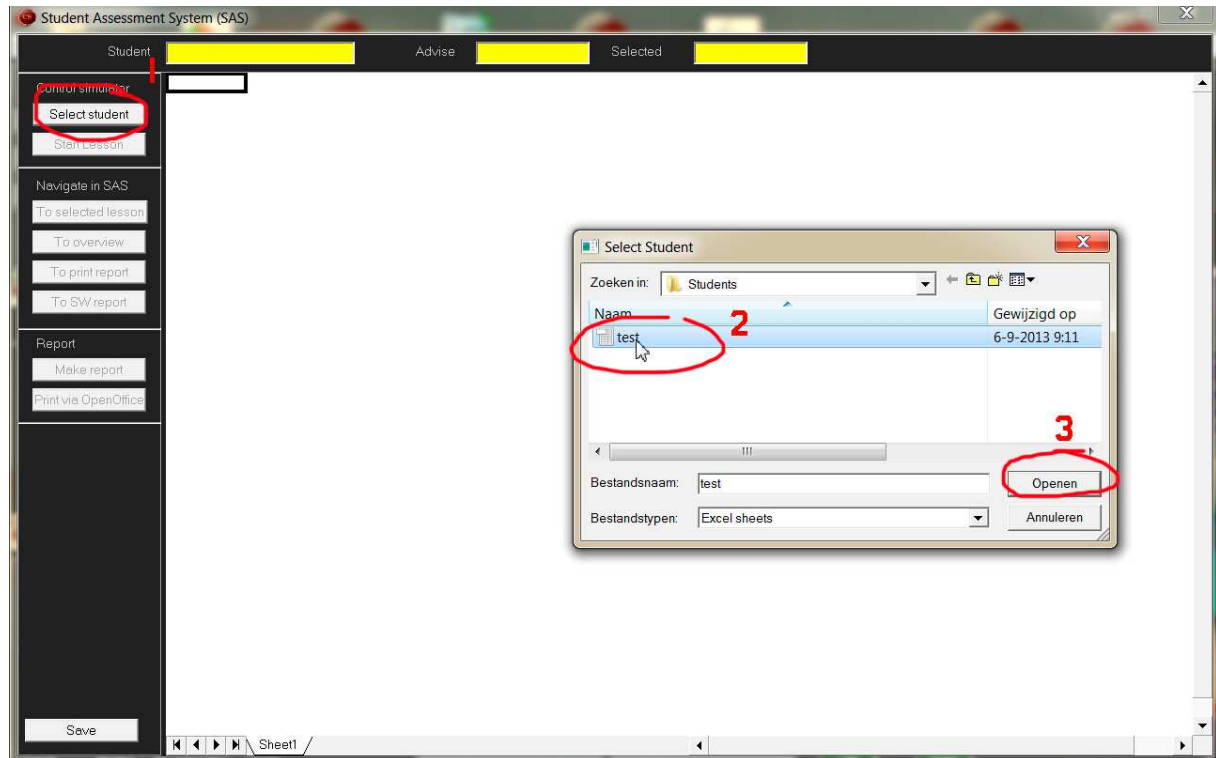
Start a lesson
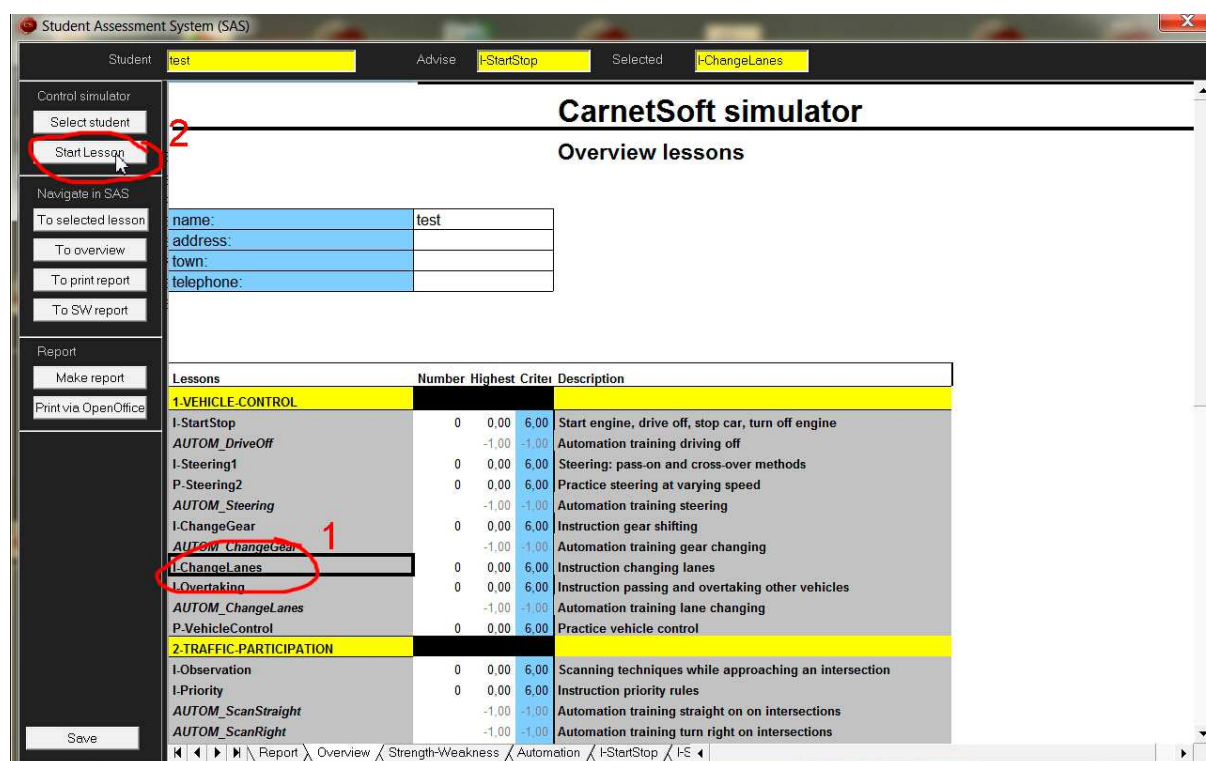
When the student data are loaded, a number of things happen:

- The system gives an advise on the lesson to be selected. In this case, this concerns the first lesson and the system advises the lesson I-StartStop (see on top in the 'Advise' field).
- The name of the student is shown in the 'Student' field (test).
- The system opens the tab 'Overview' (see bottom of image). This is the central part of the SAS. It gives an overview of all lessons, with a name and a short description. When the lesson has not been done yet, the background colour is gray. The column 'Number' shows the number of times the lesson has been done by the present student. In this case this value is 0 for all lessons. If the value is larger than 0, the column 'Highest' shows the highest grade for that lesson. This means that, for example, when the lesson has been done twice with a 6.0 for the first time and a 5.0 for the second time, the column 'Highest' shows a 6.0. The column 'Criterion' contains the pass/fail criterion. In this case this is a 6.0 for all lessons, on a scale from 0 (lowest grade) to 10 (highest grade). This means that a grade of 6 or higher must be obtained in order to pass for the lesson. When a lower grade is obtained, the SAS advises to do the lesson again. When the student is passed for the lesson, the background colour is green. When the student has failed, the background colour is red.

After this, a lesson can be started. Use can select a lesson by clicking on the name of the lesson (step 1, I-ChangeLanes). When you have not selected a specific lesson, the advised lesson is started. The lesson starts after the button 'Start Lesson' has been clicked (step 2).

When the button 'Start Lesson' is pressed, a file selection dialog appears with the name of the selected lesson filled out. By pressing the button "Open" the lesson is started. The SAS disappears from the screen and the control panel of the simulator is put on the foreground.

The lesson now starts, and continues until the student has driven the complete route, or until the operator stops the lesson.

End of lesson

A lesson can be ended in two ways:
- When the lesson is finished, this is detected by the simulator software and the Virtual Instructor (VI) asks the student to stop the car. The student then has to follow these instructions (stop the car and turn off the engine). Then the simulator closes the lesson and sends all performance data to the control program. This stores the data in the SAS of the selected student.
- The operator can finish the lesson by pressing the 'Stop Lesson' button. The lesson then stops and all data are sent to the control program. This stores the data in the SAS of the selected student.
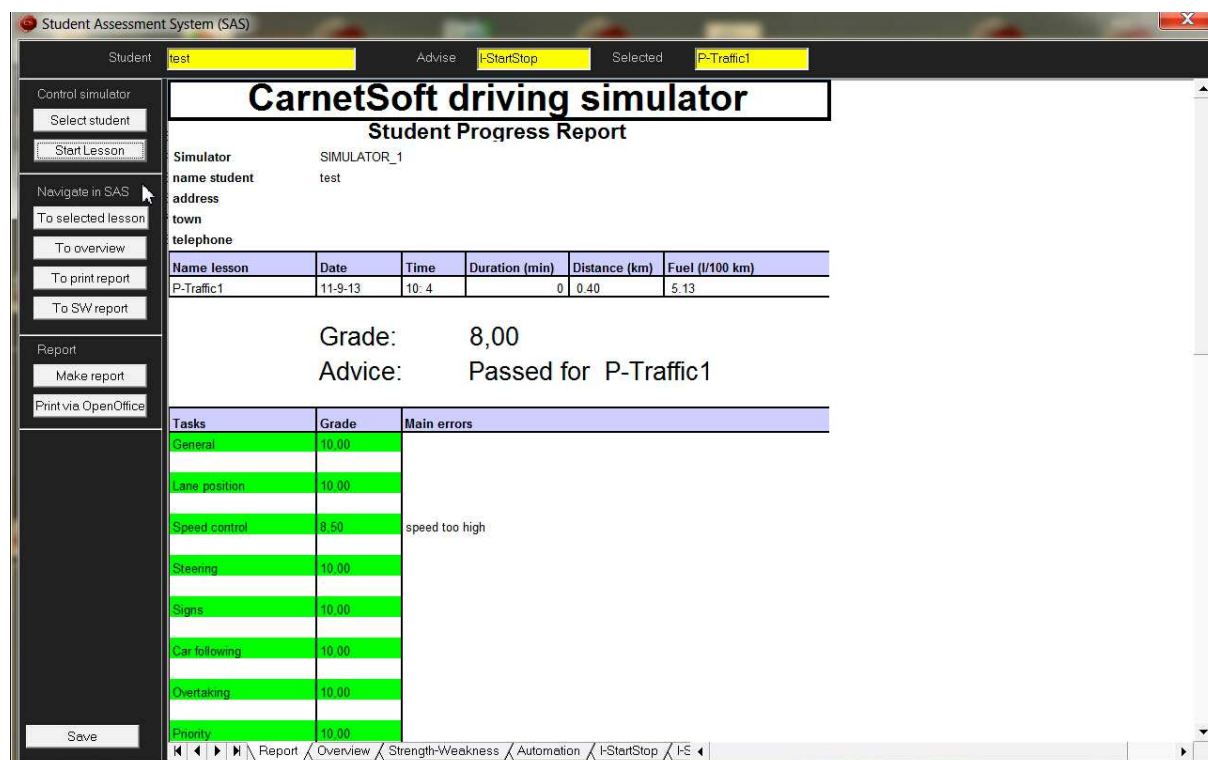
The SAS creates a report ('Report' tabsheet) and the Report tab is shown. When the lesson has been started from a sequential lesson module, the simulator continues with the next lesson in the module without showing the report after a lesson has been finished. A lesson module consists of a sequence of lessons that are played one after the other.

When a lesson has been started from the SAS, which is the typical case, the report is shown after the lesson has been finished, see the figure above. This shows the summarized results of P-Traffic1, together with the date, time, distance driven and fuel consumption. The grade was a 8 and the student passed the lesson: each lesson is also a test. There have been a couple of errors:
- On the task 'Speed control' speed was too high. This did not occur often, resulting in a 8.5 for that task.

When the button 'To selected lesson' is pressed, the SAS navigates to the P-Traffic1 lesson tab sheet. This gives more detailed information for each driving task. For example, the driver error 'Speed too high' has been registered once.

When the 'To Overview' button is pressed, the Overview tab is shown, see next illustration. It shows that the lesson P-Traffic1 has been done once and the grade was a 8.0. That was sufficient to pass and the background colour of that lesson is green.

When the 'To print report' button is pressed, the report can be printed and the printout can be filed. It is recommended to make 2 prints: one for the file and one for the student.

When the 'To SW report' button is pressed, the Strength-Weakness tab sheet is shown, see next figure.

The Strength-Weakness analysis is a matrix of driving tasks by lessons. As the curriculum progresses, this matrix is filled, and can be used to see which driving tasks (for example Speed control or Priority rules) require more attention. Green fields indicate sufficient results. Red fields indicate poor results.

7. Lesson modules

Lesson modules can be created with the "ModuleConfig" program. A module is a sequence of lessons that are executed sequentially, without intervention of the operator. Modules have the extention 'pac'. There have been 12 modules predefined, but you can make new modules with any combination of lessons. The predefined modules are:

- DriveOff
- Steering
- ChangeGear
- ChangeLanes
- Intersections
- Roundabouts1
- Roundabouts2
- Traffic
- Highway
- ReducedVisibility
- SlipperyRoad
- NightDriving

As an example, the module ChangeGear consists of 2 lessons with a total duration of approximately 20 minutes. In the following illustration, an overview of LessonConfig is displayed with all lessons of this module in the lower box. The upper box displays all lessons that can be added.
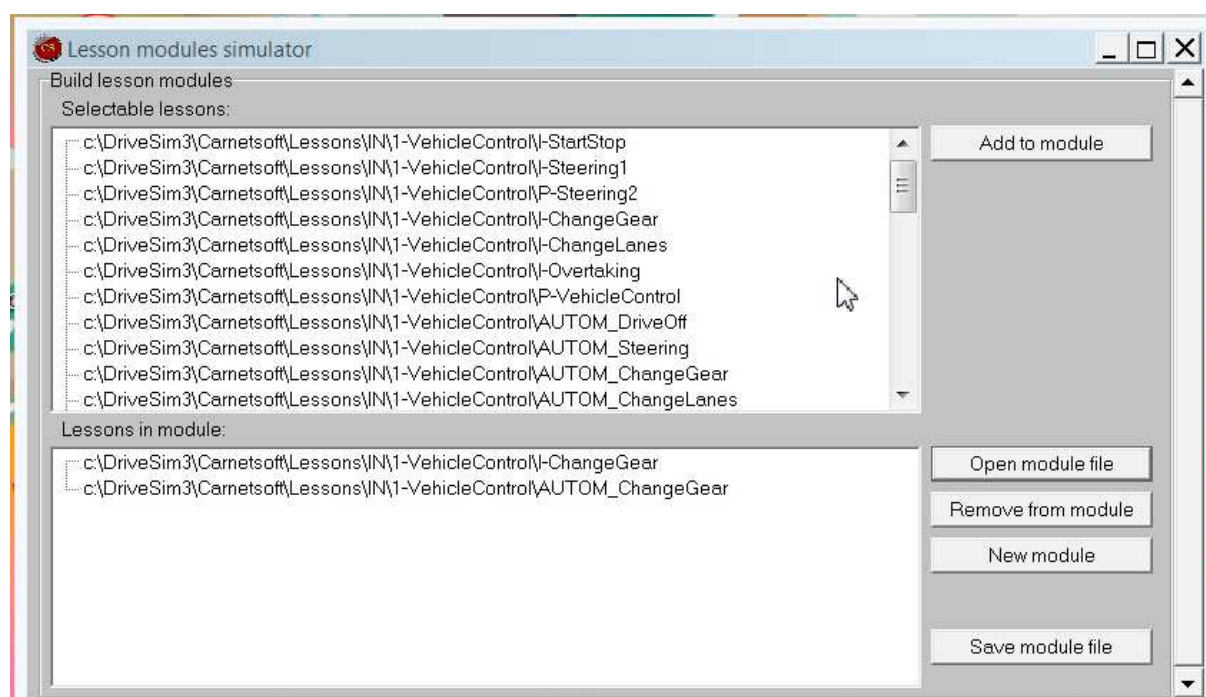
When this module is started in the simulator (after selecting the name of the module), these two lessons are executed sequentially.

Starting a module works as follows:
- First, select a student, as described earlier.
- Then, don't choose a lesson from the tabsheet 'Overview', but simply press the button 'Start Lesson'.
- In the file selection dialog that follows, click on the folder 'TrainingModules' and open the module you want. Modules have the .pac extention, as in ChangeGear.pac.
- Then press the 'Open' button and all lessons will start one at a time in the order listed in the module file.

The following table shows the contents of all modules together with the duration.

Modulename	Lessons	Duration (minutes)
DriveOff	I-StartStop	5
	AUTOM_DriveOff	15
	TOTAL DURATION:	**20**
Steering	I-Steering1	11
	P-Steering2	9
	AUTOM_Steering	15
	TOTAL DURATION:	**35**
ChangeGear	I-ChangeGear	4
	AUTOM_ChangeGear	15
	TOTAL DURATION:	**19**
ChangeLanes	I-ChangeLanes	10
	I-Overtaking	5
	AUTOM_ChangeLanes	15
	TOTAL DURATION:	**30**
Intersections	I-Observation	18
	I-Priority	10
	AUTOM_ScanStraight	15
	AUTOM_ScanRight	15
	AUTOM_ScanLeft	15
	TOTAL DURATION:	**73**
Roundabouts1	I-Roundabout1	5
	P-Roundabout1	6
	I-Roundabout2	5
	P-Roundabout2	7
	TOTAL DURATION:	**23**
Roundabouts2	AUTOM_RoundFirst	15
	AUTOM_RoundSecond	15
	AUTOM_RoundThird	15
	TOTAL DURATION:	**45**
Traffic	P-Traffic1	12
	P-Traffic2	8
	P-Traffic3	11
	P-Carriageways	11
	TOTAL DURATION:	**42**
Highway	I-Merging	9
	P-Highway1	4
	P-Highway2	4
	P-Highway3	5
	P-Highway4	20
	TOTAL DURATION:	**42**
ReducedVisibility	P-Fog1	14
	P-Fog2	5
	P-Rain	14
	TOTAL DURATION:	**33**
SlipperyRoad	P-Snow1	16
	P-Snow2	16
	TOTAL DURATION:	**32**
NightDriving	P-Night1	9
	P-Night2	12
	P-Night3	5
	TOTAL DURATION:	**26**
	GRAND TOTAL:	**420**

When all lessons are finished, the SAS shows the report of the last lesson. To generate a report of other lessons take the following steps:
- Go to the 'Overview' tab.
- Click on the one of the other lessons.
- Click on the 'To Selected lesson' button. The tab of that lesson is displayed.
- Click the 'Make report' button. The SAS makes a report of the latest specified lesson and then navigates to the 'Report' tab.
- Then print the report: OpenOffice opens with the present spreadsheet and you can print with the OpenOffice print function.

8. General characteristics of the lessons

The simulations are displayed on three monitors, with the central one containing the most information.

- Each display shows an out-of-the window view plus a rearview mirror.

- The central display shows a dashboard with:
  - speedometer
  - RPM meter
  - left/right indicator indicators
  - light indicators
  - indicators for parking brake and contact

- On the bottom-right is a navigation display that shows the current gear, and the next direction to take. It also shows a green arrow when your present RPM is too high and you have to gear up (eco). During the lessons verbal route instructions are given by the Virtual Instructor (VI) (for example, 'turn left at the next intersection') and this is accompanied by a pictogram on the navigation display. When there's a oneway road and/or no-entry sign, and there's really no choice but to enter one road after the junction, no route instruction is given. All students MUST follow the fixed route. When the student deviates from the route he/she is put back to a point before the last intersection. The car has to be started again and the student has to proceed according to the proper route.

- At the start of a lesson, or when the lesson is split into several subparts, an overlay with the text 'Wait a minute please' is projected, together with a spoken instruction 'press the horn to continue'. The student then has to press the horn/claxon to proceed.

- Instructions or additional explanations are often delivered by means of 'graphical popups'. These are transparent blue panels with a grey border with extra information or instructions. More than one popup may be seen at the central display at the same time. For example, a traffic sign that must be given attention to, a reminder concerning a traffic rule, an explanation of the order in which certain actions must be taken, etc.

- Voice messages (from the Virtual Instructor or VI) are used for instructions and feedback. For example an instruction about the direction to be taken at the next intersection, or feedback that the clutch was not pressed fully while changing gears. The VI watches a large number of things simultaneously, but takes care that the messages are scheduled according to importance and order, such that the messages are delivered sequentially. Sometimes the student commits a number of errors almost at the same time, and in that case only feedback on the most important errors is given in order not to overload the student.

- Driver errors are stored in the Student Assessment System (SAS) after each lesson (if a student has been selected, **otherwise nothing is stored**). Progress during the complete training is stored for each student in this way.

- Each lesson is driven in one of three modalities: Automatic, Manual or AutoDrive. This information is displayed in the Navigation panel. Automatic is in automatic gear: the gear MUST be set in second ('drive'), first gear is reverse. Manual is manual gear (5 or 6 gears + reverse). In AutoDrive the simulator controls the speed completely (although the student can brake if he feels speed is too high), but the student has to steer (or control the pedals if needed). During a few of the first instruction lessons the student drives in Automatic (gear). During the lesson the current driving mode is displayed in the navigation panel. See next illustration.

9. Order of lessons

Lessons differ in length: durations may vary from a few minutes to 20 minutes per lesson. Within each level (level 1 to 3, going from vehicle control skills to advanced lessons in special circumstances) the naming of the lessons is as follows:
- I or P lesson: An I-lesson is an **I**nstruction lesson where the focus is on procedures or instructions on how to perform a certain task. P-lessons are **P**ractice lessons where certain skills or tasks are practiced. For example, **I**-StartStop trains the order of operations for the tasks of starting a car, driving off, stopping and turning off the engine via structured instructions and teaching specific procedures. In the **P**-VehicleControl lesson, the student can practice a number of different vehicle control skills, that have been learned in earlier lessons. Automation training lessons are preceded by AUTOM, as in AUTOM_ChangeGear.
- Short description. The last part of the name of the lesson gives a short description of the contents of the lesson.

The lessons are organized in 3 different levels:
1) Vehicle control (level 1). The student has to have sufficient skills in vehicle control tasks before the lessons in traffic participation are recommended. So, make sure that the student has grades >= 6 on the vehicle control lessons before continuing the course. It is recommended to repeat lessons when needed.
2) Traffic participation (level 2). When the vehicle control skills are sufficient, the student may proceed with the traffic participation lessons. Traffic participation trains specific skills related to car following, scanning and observation, traffic rules, overtaking, priority on intersections, roundabouts, highway driving etc. When the student masters these skills sufficiently, it is recommended to continue with the level 3 lessons or to continue driver training in a real car.
3) Special circumstances (level 3). These are more advanced lessons related to reduced visibility, slippery roads and night driving.

In the documentation folder there's a file named 'LessonForm.pdf', that contains a list of all lessons in the recommended order. You can print that and use a copy for each student as a concise administration of progress. See next two pages.

Pass Criterium: Grade >= 5.5   Name student:

Lesson	Duration (minutes)	Date	Grade	Remark
PDT_Practice	4		Not relevant	Do not start from Student Assessment System
BrakeRT	5		Passed/Failed	Start from Student Assessment System
1-VEHICLE-CONTROL				Start all lessons from the Student Assessment System
I-StartStop	5			
AUTOM-DriveOff	15			
I-Steering1	11			
P-Steering2	9			
AUTOM-Steering	15			
I-ChangeGear	4			
AUTOM-ChangeGear	15			
I-ChangeLanes	10			
I-Overtaking	5			
AUTOM-ChangeLanes	15			
P-SteeringSidewind	5			
P-VehicleControl	8			
P-Reversing	5			
I-ParallelParking	4			
I-BayParking	4			
P-Parking	5			

Lesson	Duration (minutes)	Date	Grade	Remark
2-TRAFFIC-PARTICIPATION				
I-Observation	18			
I-Priority	10			
AUTOM-ScanStraight	15			
AUTOM-ScanRight	15			
AUTOM-ScanLeft	15			
I-Roundabout1	5			
P-Roundabout1	6			
I-Roundabout2	5			
P-Roundabout2	7			
AUTOM-RoundFirst	15			
AUTOM-RoundSecond	15			
AUTOM-RoundThird	15			
INTEGRATION TRAINING				
P-Traffic1	12			
P-Traffic2	8			
P-Traffic3	11			
P-Carriageways	11			
I-Merging	9			
P-Highway1	4			
P-Highway2	4			
P-Highway3	5			
P-Highway4	20			

Lesson	Duration (minutes)	Date	Grade	Remark
3-SPECIAL CIRCUMSTANCES				
P-Fog1	14			
P-Fog2	5			
P-Rain	14			
P-Snow1	16			
P-Snow2	16			
P-LowSun	5			
P-Night1	9			
P-Night2	12			
P-Night3	5			

10. Description of lessons

1-VehicleControl lessons

During the instruction (I) lessons, the proper order of actions is trained in a number of cases. These are *procedure training* lessons. The Virtual Instructor (VI) then 'tells' the trainee what to do, and the trainee is expected to perform these actions. Simultaneously, there's often a popup on the middle rendering display that lists the complete order of actions.

I-StartStop: Start engine, drive off, stop the car, turn of engine

Modus	Duration (minutes)
Manual	5

I-StartStop is the first lesson in the curriculum. It is a procedure training lesson in which the following procedures are trained:
- Starting the engine
- Driving off
- Stopping the car
- Turning off the engine

Because this is a procedure training in which the order of actions matters, it is important that the student listens well to the instructions of the VI, and does not initiate actions independently. The training has two levels:
- Follow my steps: Step by step explanation of all actions in the correct order: the VI tells which actions have to be performed and the student then performs the actions, one at a time. The student thus follows the VI and does not start doing actions on his own. For example, the VI may tell the student: "We are going to start the car. Listen to me and wait after each action".
- Do by yourself: Perform the complete procedure by yourself from beginning to the end in the correct order. During this, a popup is displayed as a reminder, with the proper order of actions. As an example, the VI may tell the student: "Start the engine".

The order of the training scenarios in the lesson I-StartStop is:
- Follow my steps: Start the engine
- Follow my steps : Turn off the engine

- Do by yourself: Start the engine
- Do by yourself: Turn off the engine

- Do by yourself: Start the engine
- Follow my steps: Drive off
- Follow my steps: Stop the car
- Do by yourself: Turn off the engine

- Do by yourself: Start the engine
- Do by yourself: Drive off
- Do by yourself: Stop the car
- Do by yourself: Turn off the engine

The proper order of actions:

Task	Order of actions
Start the engine	Check if the hand brake is pulled
	Check if the gear is in neutral position
	Check if the lights are off
	Press the clutch
	Switch on the power (contact)
	Start the engine
	Switch the lights on
Drive off	Check around the car if it's safe to drive off
	Press the clutch
	Switch to first gear
	Release hand brake
	Look around the car
	Switch the indicator on
	Release the clutch and press accelerator simultaneously
	(switch off indicator after driving off)
Stop the car	Look ahead to see where you are going to stop
	Look in interior mirror
	Switch the indicator on
	Press clutch and brake
	Look in interior mirror
	Reduce brake pressure just before you stop
	When stopped, switch into first gear
	Switch off indicator
Turn off the engine	Pull hand brake
	Switch gear in neutral position
	Switch lights off
	Switch off engine and power
	Release clutch and brake pedals

AUTOM_DriveOff: Automation training driving off

Modus	Duration (minutes)
Manual	15

During this lesson, the driver drives off repeatedly, in first gear, while a vehicle in front pulls off and stops. During this training, the student has to scan around the vehicle before driving off, and make sure the engine does not stall.

I-Steering1:   Steering: pass-on and cross-over methods

Modus	Duration (minutes)
Automatic	11

I-Steering1 is a procedure training lesson in which the following procedures are trained:
- Steering with the pass-on method
- Steering with the cross-over method

During the lesson, popups are displayed with the order of actions. Training occurs on a simulated special practice area with a number of curves to left and to right and intersections where the student has to turn left or right.

First, a number of complete instructions are given for the pass-on method for curves to left and to right, followed by the 'do by yourself' method.

Then, the full instructions for the cross-over method are given a number of times, followed by the 'do by yourself' method.

For some students it may be helpful if the operator demonstrates both methods.

P-Steering2:   Steering at higher speed

Modus	Duration (minutes)
AutoDrive	9

In P-Steering2, the simulator starts to drive slowly, but then speeds up to higher speeds. People who have difficulties with steering accurately, often compensate for that by driving slowly. However, in this method, the student is forced to learn to steer while driving at higher speed. When speed is too high for the student, speed may be reduced by pressing the brake.

Training takes place is in a rural area with a speed limit of 80 km/h. There are a large number of oncoming vehicles to force the student to steer accurately. The car drives in AutoDrive to ensure a fixed speed. When the simulator turns left or right at an intersection, speed is reduced by the system in a quiet manner, allowing the student to steer quietly to turn left or right. The student is supposed to use the pass-on method and to use the indicator before turning left or right on the intersections. During the lesson the VI gives feedback if steering is not accurate or when the curve on the intersection is taken too narrow or too wide.

When, after this lesson, the student still is not able to steer accurately (has failed the lesson) the lesson should definitely be repeated, because adequate steering ability is a prerequisite for the next lessons.

AUTOM_Steering: Automation training steering

Modus	Duration (minutes)
Automatic	15

During this lesson, the student drives on a curved road without intersections. There are several speed limit signs and the student has to make sure that the speed limit is obeyed.

I-ChangeGear: Change gears

Modus	Duration (minutes)
Manual	4

In this lesson the student learns to change gears according to fixed procedures. First, a few general reminders are given:
- Always change one gear up.
- When stopped, gear down to first or second gear.
- Always press the clutch when changing gears and just before you make a stop.
- But never press the clutch without a good reason.

The first time the student gears up, the 'follow my steps' method is used: the VI tells the student what to do, and the student then performs this action. After that, the students gears up by himself, while the proper order of actions is displayed on a popup. In the same way, when the student gears down for the first time, the follow my steps method is used, followed by the 'do by yourself' method. The student pulls up to 2200 rpm's and then shifts up, from first, to second, third, fourth and fifth gear. The order of the procedures is:

Gear up: Start engine → Drive off → 2nd → 3th → 4th → 5th →
Gear down: 5th → 4th → 3th → 2nd →
Gear up : 2nd → 3th → 4th →
Gear down: 4th → 3th → 2nd → Stop the car → Turn off engine

The proper order of actions:

Task	Order of actions
Gear up	Pull up to 2200 rpm (eco-driving)
	Release accelerator and press clutch
	Hand to the gear stick
	Shift up to next gear
	Hand to the steering wheel
	Release clutch gently and press accelerator
	Check the mirrors
Gear down	Check the mirrors
	Release accelerator and reduce to 1200 rpm (eco-driving)
	Press the clutch
	Hand to the gear stick
	Shift down (eco-driving allows more than 1 gear down at a time)
	Hand to the steering wheel
	Release clutch gently and press accelerator
	Check the mirrors

AUTOM_ChangeGear: Automation training gear changing

Modus	Duration (minutes)
Manual	15

During this lesson, the student drives on a curved road without intersections. The VI tells the student to gear up or down repeatedly. There are several speed limit signs and the student has to make sure that the speed limit is obeyed.

I-ChangeLanes: Lane changing

Modus	Duration (minutes)
Manual	10

Instruction training in which the procedure for lane changing is explained.

I-Overtaking: Passing and overtaking

Modus	Duration (minutes)
Manual	5

In this lesson the procedures for passing stationary vehicles and overtaking driving vehicles are trained.

This lesson consists of the following parts:
- Passing a number of stationary vehicles is trained 3 times. The proper order of actions is explained during execution of the passing manoeuvre.
- Overtaking a driving vehicle is trained 3 times. The proper order of actions is explained during execution over the overtaking manoeuvre. The student performs these actions at the right moment in time during passing and overtaking.

The proper order of actions:

Task	Order of actions
Passing	Look ahead to see if you can pass safely (oncoming vehicle etc.)
	Look in the mirrors and over the right shoulder to see if you are being overtaken.
	Signal to right.
	Change to the right lane.
	Pass the stationary car(s).
	Check the mirrors if you see the passed vehicle(s) and look over your left shoulder.
	Signal to left.
	Change to the left lane.
Overtaking	Check if overtaking is allowed here (signs, road markings).
	Look ahead to see if you can overtake safely.
	Keep sufficient headway to the lead vehicle.
	Look in the mirrors and over the right shoulder to see if you are being overtaken.
	Signal to right.
	Change to the right lane.
	Overtake quickly.
	Check the mirrors if you see the overtaken vehicle(s) and look over your left shoulder.
	Signal to left.
	Change to the left lane.

AUTOM_ChangeLanes: Automation training lane changing

Modus	Duration (minutes)
Manual	15

During this lesson, the student drives on a curved road without intersections. The VI tells the student to change to the left or the right lane repeatedly, and checks the use of indicator and visual scanning behaviour. There are several speed limit signs and the student has to make sure that the speed limit is obeyed.

P-SteeringSidewind: Driving and accurate steering with windgusts fro left and right

Modus	Duration (minutes)
Manual	5

During this lesson, the student drives on a curved road and experiences unpredictable windgusts from left and right. There's oncoming traffic on the opposite lane and the student has to be alert and make corrective steering actions in order to drift of the road and avoid collisions.

P-VehicleControl: Practice vehicle control skills

Modus	Duration (minutes)
Manual	8

In this lesson the student drives a fixed route during which steering, gear shifting, speed control and other vehicle control skills can be practiced a little bit more.

P-Reversing: Driving in reverse gear

Modus	Duration (minutes)
Manual	5

During this lesson, the student has to drive in reverse gear over a stretch of road while driving around 90 degrees corners.

I-ParallelParking: Instruction lesson parallel parking

Modus	Duration (minutes)
Manual	4

The student gets step by step instructions on how to park while driving in reverse gear, in a parking lane between two vehicles.

I-BayParking: Instruction lesson bay parking

Modus	Duration (minutes)
Manual	4

The student gets step by step instructions on how to park while driving in reverse gear, in a parking bay.

P-Parking: Practice parking

Modus	Duration (minutes)
Manual	5

The student can practice both parallel parking and bay parking in a specially designed practice area.

2-TrafficParticipation lessons

Traffic participation is a more advanced topic that addresses more complex skills such as
- Perceptual skills related to looking at and detecting hazards, traffic signs, other road objects
- Recognizing signs and other traffic participants and decide which rules applies
- Multitasking in which the student has automatized vehicle control skills in order to be able to give sufficient attention to traffic related tasks

A sufficient level of automatization of vehicle control skills is needed in order to be able to pay sufficient attention to traffic related tasks. Traffic participation is generally much more difficult and attention demanding compared to vehicle control. Accidents are more often related to a breakdown in traffic-related tasks than to insufficient vehicle control skills. For beginner drivers, it is important to learn these tasks well enough to prevent them from being suddenly overloaded when traffic complexity increases.

I-Observation: Scanning (viewing techniques) and preparatory actions while approaching junctions

Modus	Duration (minutes)
Manual	18

This is an extensive, and for learning to drive safely, very important lesson that practices visual scanning while approaching an intersection. In addition, all actions while approaching a junction are practiced. The objective is to teach the student to complete all actions in time before arriving at the intersection. Turning left, turning right and going straight through are practiced separately. In some cases, the student has to stop before entering the intersection to give way to traffic.

The lesson consists of the following subjects:
- Scanning, turn right, low speed: the student approaches an intersection 3 times and turns right. The scanning is explained with the 'follow my steps' method.
- Scanning, turn left, low speed: the student approaches an intersection 3 times and turns left. The scanning is explained with the 'follow my steps' method.
- Scanning, going straight through, low speed: the student approaches an intersection 3 times and goes straight through. The scanning is explained with the 'follow my steps' method.
- Actions while approaching intersection, turn right, higher speed: 3x with gearing down and reducing speed before the intersection.
- Actions ehile approaching intersection, turn left, higher speed: 3x with gearing down and reducing speed before the intersection.

Concerning the actions while approaching the intersection, the VI gives the following instruction:
"Decide by yourself whether to stop or drive on. When you stop, switch into first gear. When you drive on, reduce speed to 20 km/h before the intersection and switch down to second gear".

In addition to the scanning techniques, the VI checks the correct use of indicator, whether speed is reduced in time before the junction, shifting down to second gear when turning left or right and the proper application of the priority rules.

For each subject, the order of procedures is:

Start engine → Drive off → approach intersection and turn right/left (or straight through) → approach intersection and turn right/left (or straight through) → approach intersection and turn right/left (or straight through) → Stop car → Switch off engine

The proper order of actions:

Task	Order of actions
Scanning, turning right	Interior mirror
	Look ahead
	Right mirror, right shoulder
	Indicator on
	Look ahead
	Look left
	Look right
	Right shoulder
Scanning, turning left	Interior mirror
	Look ahead
	Left mirror, left shoulder
	Indicator on
	Look ahead
	Look left
	Look right
	Left mirror, left shoulder
Scanning, going straight through	Interior mirror
	Look ahead
	Look left
	Look ahead
	Look right

I-Priority: Traffic rules for priority and turning left/right at intersection

Modus	Duration (minutes)
Manual	16

This lesson concerns the traffic rules for priority and turning left or right at intersections. The following subjects are covered:
- General remarks concerning priority.
- Uncontrolled intersection: drivers from right have priority.
- T intersection: drivers on the road that continues have priority.
- Straight ahead: drivers going straight ahead have priority.
- T-junction ongoing road: drivers on main road have priority.
- Left over right: drivers turning right at an intersection have priority over oncoming vehicles turning left.
- Give way and stop signs: priority sign and stop sign.
- Major road: you have priority over all traffic.

In this lesson, the student drives in the respective traffic environments, with the traffic signs along the road and traffic coming from various directions. Each rule is explained to the student and he must then decide whether to stop or drive on. Because these rules are often quite abstract on paper, it is

illuminating for the student to experience the situations from the perspective of the driver. The students learn the rules in relation to the position of other traffic and signs and road markings.

AUTOM_ScanStraight: Automation training approaching and crossing intersections

Modus	Duration (minutes)
Manual	15

In a village-like database, the trainee crosses a large number of intersections with different priority regimes and traffic approaching the intersection. Visual scanning, speed control and priority rules are trained in this lesson.

AUTOM_ScanRight: Automation training approaching intersections and turning right

Modus	Duration (minutes)
Manual	15

In a village-like database, the trainee turns right at a large number of intersections with different priority regimes and traffic approaching the intersection. Visual scanning, speed control and priority rules are trained in this lesson.

AUTOM_ScanLeft: Automation training approaching intersections and turning left

Modus	Duration (minutes)
Manual	15

In a village-like database, the trainee turns left at a large number of intersections with different priority regimes and traffic approaching the intersection. Visual scanning, speed control and priority rules are trained in this lesson.

I-Roundabout1: Instructions for approaching and driving on small roundabouts

Modus	Duration (minutes)
Manual	5

This lesson covers the procedures for taking the first, second and third exit on small single-lane roundabouts. The following subjects are treated:
- Roundabouts general.
- Roundabouts first exit (turn right)
- Roundabout second exit (straight ahead)
- Roundabout third exit (turn left)

The student approaches the roundabout and receives instruction on the proper timing of actions concerning observation, use of indicator and lane position.

In this instruction lesson, there's no other traffic to ensure the student can focus on the procedure.

P-Roundabout1: Practice approaching and driving on small roundabouts

Modus	Duration (minutes)
Manual	6

This lesson covers practicing taking the first, second and third exit on small single-lane roundabouts with traffic approaching the roundabout and on the roundabout. The following subjects are treated:
- Roundabouts first exit (turn right)
- Roundabout second exit (straight ahead)
- Roundabout third exit (turn left)

I-Roundabout2: Instructions for approaching and driving on large roundabouts

Modus	Duration (minutes)
Manual	5

This lesson covers the procedures for taking the first, second and third exit on large two-lane roundabouts. The following subjects are treated:
- Roundabouts general.
- Roundabouts first exit (turn right)
- Roundabout second exit (straight ahead)
- Roundabout third exit (turn left)

The student approaches the roundabout and receives instruction on the proper timing of actions concerning observation, use of indicator and lane position.

In this instruction lesson, there's no other traffic to ensure the student can focus on the procedure.

P-Roundabout2: Practice approaching and driving on large roundabouts

Modus	Duration (minutes)
Manual	7

This lesson covers practicing taking the first, second and third exit on large two-lane roundabouts with traffic approaching the roundabout and on the roundabout. The following subjects are treated:
- Roundabouts first exit (turn right)
- Roundabout second exit (straight ahead)
- Roundabout third exit (turn left)

AUTOM_RoundFirst: Automation training roundabout first exit

Modus	Duration (minutes)
Manual	15

In a database with a number of roundabouts, the trainee approaches a roundabout and takes the first exit a large number of times. Use of indicator, visual scanning, speed control and priority rules are trained in this lesson. Traffic approaches the roundabout and the student has to decide whether to give way before entering the roundabout or drive on.

AUTOM_RoundSecond: Automation training roundabout second exit

Modus	Duration (minutes)
Manual	15

In a database with a number of roundabouts, the trainee approaches a roundabout and takes the second exit a large number of times. Use of indicator, visual scanning, speed control and priority rules are trained in this lesson. Traffic approaches the roundabout and the student has to decide whether to give way before entering the roundabout or drive on.

AUTOM_RoundThird: Automation training roundabout third exit

Modus	Duration (minutes)
Manual	15

In a database with a number of roundabouts, the trainee approaches a roundabout and takes the third exit a large number of times. Use of indicator, visual scanning, speed control and priority rules are trained in this lesson. Traffic approaches the roundabout and the student has to decide whether to give way before entering the roundabout or drive on.

P-Traffic1:   Practice traffic interactions outside built-up area

Modus	Duration (minutes)
Manual	12

In this lesson outside built-up area the following aspects are trained:
- 100 km/h roads with zones with a 60 km/h limit.
- The student encounters 10 intersections, of which there are 4 right turns, 4 straight throughs, and 2 left turns.
- Car following and maintaining a safe headway to vehicles in front.
- When turning right, there's oncoming traffic going straight through, or oncoming traffic turning left, that has to be given the right of way.
- Approaches to a major road with a stop sign where there's traffic from left that has priority.
- Roads with a no-entry sign.
- Major roads where the student has priority over traffic from right and left.
- In addition, a number of signs indicate:
  o Curved road
  o Overtake prohibition
  o Mandatory driving direction
  o Major road, priority junction, stop sign

This lesson offers a pleasant training in driving in a relatively quiet environment. On each stretch of road there are oncoming vehicles, and there's traffic at each intersection. However, because of the

rural environment and the long stretches of road, this lesson is a good lesson to start practicing what has been learned before.

P-Traffic2:   Practice traffic participation 2

Modus	Duration (minutes)
Manual	8

In this lesson on a training circuit the student traverses a large number of intersections with traffic interactions. This lesson is more demanding compared to P-Traffic1, because the task demands are higher:
- more steering required on shorter stretches of road
- more intersections with intensive traffic interactions
- more different speed limits

P-Traffic3:   Practice traffic participation 3

Modus	Duration (minutes)
Manual	11

In this lesson in a small town the student traverses a large number of intersections with traffic interactions. This concerns zebra crossings, traffic lights and different types on intersections

P-Carriageways: Practice lesson dual carriageways and multi-way intersections

Modus	Duration (minutes)
Manual	11

This lesson concerns driving on dual carriageways (trunk roads) and crossing and turning left/right on multi-way intersections. When the central reserve is not large enough, the student has to wait until traffic from both left and right is clear before he crosses the intersection or turns left.

The most important situations in this lesson are:
- Crossing dual carriageways with high traffic density with narrow central reserve.
- Crossing single carriageway with high traffic density.
- Entering dual carriageway with high traffic density and narrow central reserve via right turn.
- Leaving dual carriageway by turning left on a deceleration lane (choose correct lane position).
- Railroad crossing with and without crossing barrier

When leaving the dual carriageway by turning left, it is important to mind traffic from rear and to choose the proper lane position in time.

I-Merging: Merging and leaving the highway

Modus	Duration (minutes)
Manual	9

This lesson teaches procedures for merging and leaving the highway. The following subjects are covered:
- Entering and leaving the highway general.
- Merging on a highway with no traffic. Explanation of order of actions while entering a highway.
- Leaving a highway with no traffic. Explanation of order of actions while leaving a highway.
- Merging on a highway with traffic. Explanation of order of actions while entering a highway.
- Leaving a highway with traffic. Explanation of order of actions while leaving a highway.
- Merging traffic on the highway.
- Merging in a traffic-jam. Explanation of order of actions while merging into a traffic-jam on a highway.

The proper order of actions:

Task	Order of actions
Entering the highway	Look ahead where to merge: observe traffic on the highway.
	Use the acceleration lane to increase speed and adapt your speed to the traffic stream.
	Check the mirrors, and look over right shoulder to see if it's safe to enter the highway.
	Switch indicator on, wait a few seconds and merge.
	Switch the indicator off.
Leaving the highway	Make sure you drive on the left lane in time.
	Switch indicator on at 300 meter sign.
	Check the mirrors.
	Change to the exit lane at the start of that lane and reduce speed.
	Switch off the indicator at the 'exit' sign.
Merging in a traffic-jam	Use indicator in time.
	Drive to the end of the acceleration lane.
	Communicate with eye contact with other drivers for an opportunity to merge.
	Leave indicator on and merge.
	Switch the indicator off.

P-Highway1: Practice lesson highway 1, entering and leaving the highway

Modus	Duration (minutes)
Manual	4

This is a lesson on a highway with a high traffic intensity, and with driving at high speed. Especially entering and leaving the highway, together with the proper use of the indicator and position on the road are important aspects in this lesson.

The most important situations that are practiced are:
- 2 x entering on a highway.
- 2 x leaving a highway.

P-Highway2: Practice lesson highway 2, merging traffic

Modus	Duration (minutes)
Manual	4

This is a lesson on a highway with a high traffic intensity, and with driving at high speed. Taking care of traffic entering the highway is an important aspect in this lesson.

The most important situations trained are:
- 1 x entering a highway.
- 1 x leaving a highway
- 1 x passing a highway entrance with traffic entering the highway

P-Highway3:   Practice lesson highway 3, entering highway with traffic jam

Modus	Duration (minutes)
Manual	5

This is a lesson on a highway with a high traffic intensity, and with driving at high speed. Entering the highway while there's a traffic jam on the highway is an important aspect in this lesson.

The most important situations trained are:
- 1 x entering a highway with traffic jam
- 1 x entering a highway without traffic jam
- 2 x leaving a highway

P-Highway4:   Practice lesson highway 4, long stretch of driving

Modus	Duration (minutes)
Manual	20

The student drives for 20 minutes on a highway with a number of times entering and leaving the highway, traffic jams and overtaking.

3-SpecialCircumstances lessons

These are more advanced lessons related to reduced visibility, slippery roads, being blinded by sunlight and night driving. These lessons practice aspects of driving that are not so easily trained in a real car in the real world. Reduced visibility caused by sun scattering/blinding, fog, rain, snow or night conditions can be optimally trained in the simulator. Slippery road conditions caused by icy roads and snow is also a special condition that is often hard to train in the real world.

P-Fog1:   Practice lesson fog outside build-up area

Modus	Duration (minutes)
Manual	14

Driving in dense fog in a rural area with traffic. The following aspects are stressed:
- Switch lights on to see and be seen
- Increase headway
- Lower speed to make sure you can stop within the sight distance
- Be alert for unexpected hazards

P-Fog2:   Practice lesson fog highway

Modus	Duration (minutes)
Manual	5

Driving in dense fog on a highway with traffic. The following aspects are stressed:
- Switch lights on to see and be seen
- Increase headway
- Lower speed to make sure you can stop within the sight distance
- Be alert for unexpected hazards

P-Rain: Practice lesson rain

Modus	Duration (minutes)
Manual	14

Driving in rain in a rural area with traffic. The following aspects are stressed:
- Switch lights on to see and be seen
- Increase headway
- Lower speed
- Brake gently and slow down in time, avoid strong decelerations
- Anticipate earlier to give yourself more time to react

P-Snow1:   Practice lesson icy road

Modus	Duration (minutes)
Manual	16

Driving in a snowy landscape on a slippery road in a rural area with traffic. The following aspects are stressed:
- Drive off in second gear
- Drive slowly and in high gear
- Use engine braking as much as possible instead of pedal braking
- Brake gently and slow down in time, avoid strong decelerations
- Increase headway
- Anticipate far in advance

Because the engine stalls more easily and the tires loose their grip sooner, vehicle control is more difficult.

P-Snow2: Practice lesson snow: adverse weather, reduced visibility and slippery road

Modus	Duration (minutes)
Manual	16

Driving in a snowy landscape on a slippery road while it is snowing in a rural area with traffic. The following aspects are stressed:
- Lights on to see and be seen
- Drive off in second gear
- Drive slowly and in high gear
- Use engine braking as much as possible instead of pedal braking
- Brake gently and slow down in time, avoid strong decelerations

- Increase headway
- Anticipate far in advance

Because the engine stalls more easily and the tires loose their grip sooner, vehicle control is more difficult. In addition, visibility is reduced.

P-LowSun: Practice blinding effects of a sun at a low position

Modus	Duration (minutes)
Manual	5

Practice driving on a winding road with oncoming vehicles while experiencing blinding effects of sun scattering caused by a low standing sun.

P-Night1: Practice night driving 1, no traffic

Modus	Duration (minutes)
Manual	9

Night driving to learn to use the roadlines and light for guidance in the dark. There's no traffic in this lesson. The following aspects are stressed:
- Switch lights on to see and be seen
- Use roadlines and objects along the road to see the course of the road
- Look far ahead to see hazards in time

P-Night2: Practice night driving 2, rural area

Modus	Duration (minutes)
Manual	12

Night driving to learn to use the roadlines and light and the lights of other traffic for guidance in the dark. There's traffic in this lesson. The following aspects are stressed:
- Switch lights on to see and be seen
- Use roadlines and objects along the road to see the course of the road
- Look far ahead to see hazards in time

P-Night3: Practice night driving 3, Highway

Modus	Duration (minutes)
Manual	5

Night driving to learn to use the roadlines and light and the lights of other traffic for in the dark at high speed on a highway. There's a lot of traffic in this lesson. The following aspects are stressed:
- Switch lights on to see and be seen
- Use roadlines and objects along the road to see the course of the road
- Look far ahead to see hazards in time