

A person wearing a full-body motion capture suit and a VR headset is riding a bicycle simulator. The person is in a dynamic, forward-leaning posture, mimicking a cyclist. The background is dark, and the scene is lit to highlight the person and the bicycle. The bicycle is a standard road bike with a black frame and wheels. The person's suit is a fine, grid-like mesh that covers their entire body, including their head and hands. The VR headset is a white, modern-looking model. The overall scene is a high-tech, futuristic representation of a cycling simulator.

# MANUAL VELO RIDING SIMULATOR

INSTALLATION AND USE



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## Setting up the simulator

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The scope of the simulator includes:

- a bike with removable luggage rack box
- a big gray box
- a monitor with monitor stand
- a bar table

In the gray box you will find the TacX- home trainer with stabilizers, a black box with VR goggles, a bag with notebook and accessories and a cable reel. In the carrier box you will find the complete cabling. Cables that need to be terminated to equipment are color coded yellow or pink. All other connections can remain in the box as they are.

Make sure that you have connected all cables properly before you start the notebook.

### 1. Positioning (*cover image*):

- Place the bike at the desired location (Attention: choose the straightest possible surface!)
- Put monitor with stand in front of the bike
- Place the standing table to the right of the monitor in the direction of travel

### 2. TacX- Home trainer:

- TacX- home trainer unfold so that it stands on four feet
- Place the stabilizers from the gray box across the TacX exercise bike and connect its rear feet to the stabilizers (pictures and 12).
- Place the TacX home trainer under the rear bicycle and make sure that the lower blue lever is released (turned upwards) (picture 3).

- Clamp the rear axle of the bike with the upper blue lever (picture 4) in the TacX home trainer. To do this, the bike stand must be folded up.
- Now push the lower blue lever down so that the TacX exercise bike touches the wheel.

### 3. Notebook:

- Place notebook folded up on ventilation platform on standing table
- Connect ventilation platform right through with notebook (USB cable)

### 4. Luggage carrier box:

- The carrier box is at all times connected to the bike through the cable hose
- Remove the box from the luggage carrier (press the gray key under the box and lift the box) and place it on the floor in front of the bike between the monitor and the bar table, together with the cable.
- Lay the power cable (yellow marking), which protrudes from the cable tube at the height of the front wheel, along the bicycle to the rear, around the rear wheel and plug it into the TacX home trainer at the gray roller (Fig. 5).
- Place the other three cables marked in yellow in a separate cable tube in the yellow opening and connect them to the monitor (power extension cable, HDMI cable) and to the socket (power cable).
- Place the cable bundle with the three pink marked cables in the pink opening and connect to notebook (power supply, USB and HDMI cable)
- Now the carrier box can be closed. The cables can now also be attached to the standing table or monitor stand with the Velcro strips

### 5. VR Glasses:

- Connect the VR goggles to the notebook with the double cable (the controllers in the box are not needed).
- If you would like to use the simulation program without VR goggles, the VR goggles do not have to be connected to the notebook.

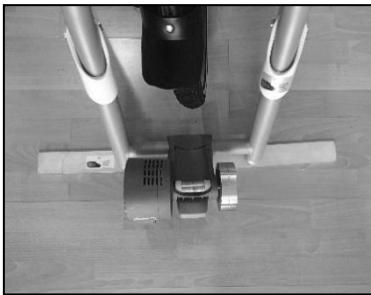
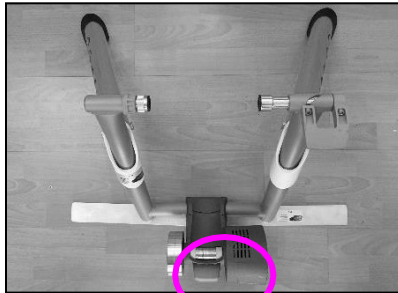
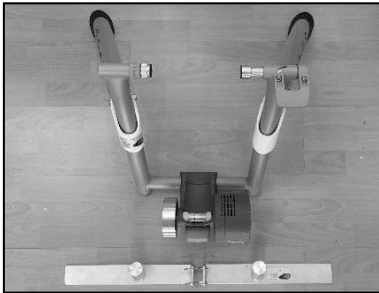


Figure 1:  
stabilizers

Figure 2: TacX  
3: Lower blue lever released

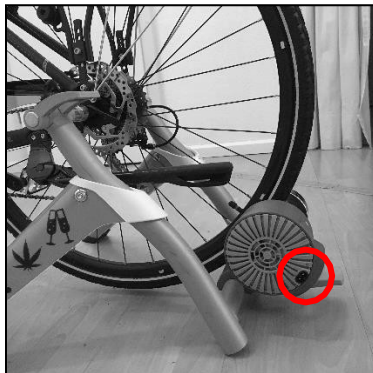


Figure 4: upper blue lever  
Figure 5: TacX power connection

Now start the notebook (PIN: 1949) and turn on the monitor with the remote control. Make sure that you have selected the correct source (HDMI1). If there are cables along the floor, use the gaffa tape to securely fix it to the floor. This will prevent any possible tripping hazards.

## Start simulation program

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IMPORTANT: The notebook must remain in flight mode at all times. Connecting to the Internet may result in unexpected updates, which may have negative consequences for the simulation program.

1. Wait until the notebook is fully started
2. The "Oculus" program starts automatically. If not, manually open on desktop
  - ATTENTION: Do not close windows, only minimize them (Do not press "Set up Rift")
  - Make sure that the VR goggles are connected. To do this, click on "Devices" in the Oculus program and then on "Rift S and Touch". This will show if the goggles are connected. If it shows a red X (Figure 6), disconnect and reconnect the USB connection of the VR goggles to the notebook and wait a moment.
  - If you would like to use the simulation program without VR goggles, the VR goggles do not have to be connected to the notebook.
3. Open the current simulation program "Velo driving simulator" centered on the desktop

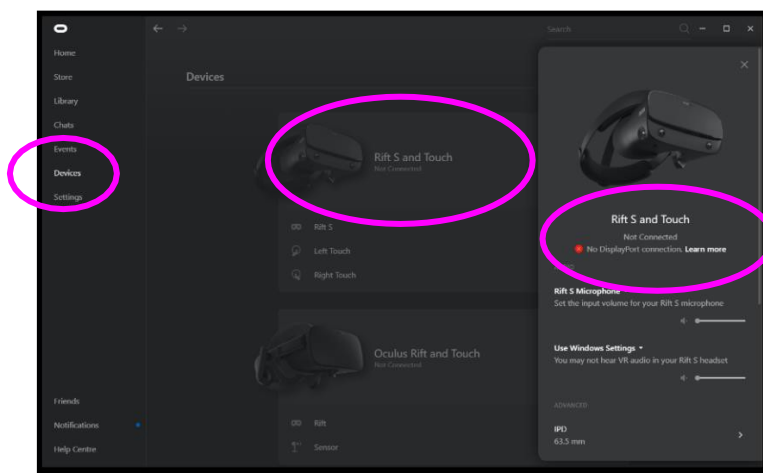


Figure 6: Checking the connection of the goggles

## 2.1 Set up VR goggles

If you would like to use the simulation program in general without VR goggles, the VR goggles do not even need to be connected to the notebook and this point can be skipped (see also 3.1 Using the simulator without VR goggles)

The VR goggles have a safety program ("Guardian") that wants to detect the area you are in. If you restart the Velo driving simulator and the goggles are not working correctly, this may be the case. You will then see your surroundings through the VR goggles as well as a floating action window in front of you (*Figure 7*). Take an Oculus controller from the black box in which the VR goggles were stored. You can now use it to click through the program.

Important: Your controller virtually shows a laser beam. This serves as your mouse. You can click/select with the large switch pointing to the front, which you operate with your index finger (*Figure 8*).



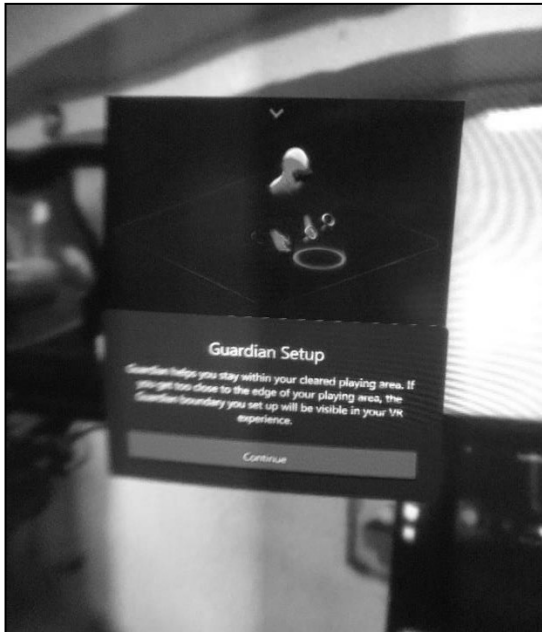


Figure 7: View in VR

goggles Figure 8: Oculus

controller

## Simulation program: Operation

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The simulator may be driven by persons aged 10 years and older. The VR goggles may be used by persons aged 13 and over (Oculus requirement).

Various driving situations are available. Use the arrows to scroll through the selection. The following situations are available:

	Brake reaction test A test area is drive between two rows of pylons until a stop sign provokes emergency braking. This track is also available without steering in case a test person has problems with the simulator operation.
	Night scene Without lights, cycling until a car overtakes the cyclist (replay with perspective change and manually changing equipment of the cyclist).
City A car door is opened	1 between a stationary line of cars and parked cars
City	2 From a stationary line of cars, a car turns right into a driveway.
City	3 A pedestrian crosses the road through a stationary line of cars.
Downtown	1 In a 30 zone with parked cars on both sides a car door is opened (replay with perspective change).
Downtown	2 On a street, a truck turns right in front of the cyclist (replay with perspective change).
Downtown	3 A car reverses out of a blind parking space onto the street (replay with perspective change).
Traffic	1 circle If you don't drive correctly in the center, you will be overtaken by a car in the traffic circle and be forced out of the way (replay with perspective change).
Traffic	2 circle If you do not drive correctly in the center, you will be overtaken by a car in the traffic circle and thus be overlooked by a car entering the traffic circle (replay with perspective change).
Traffic circle	3 If you don't drive correctly in the middle, you will be overlooked by a car entering the traffic circle due to a road works (replay with perspective change).
Driving	with music Through the music, the ambulance behind you is barely audible, which is slowed down by the cyclist (replay with perspective change). Other cyclists Other cyclists ahead overlook the child wants to cross the road at the pedestrian crossing.

The three city tracks as well as the three traffic circle tracks take place on the same road with the same conditions but different triggers.

Some situations can be driven with different strength alcohol filters. In addition, a cell phone can be triggered as a distraction. For this operation, use the "Keyboard mapping" laminate. Some situations offer a replay (playback of the experienced situation) with perspective change.

Adjust the goggles each time before driving (see 4. Simulation program: Control).

### 3.1 Use simulator without VR goggles

The simulator can also be used individually without VR goggles, for example, if a person feels sick while driving with the VR goggles. To do this, put the VR goggles aside, but they should remain connected to the notebook.

In the selected scene, first press F2 and then F4 to obtain a still image with a straight-ahead view. IMPORTANT: The handlebars must be straight when doing this, because pressing F2 will center them in the simulation. The simulated deflection is so ineffective, but it can be brought here manually. The perspective changes can be shown manually by turning the glasses in the hand (to do this, you must switch back to the glasses view by pressing F2 before selecting the replay).

Important: Do not place the glasses in direct sunlight, the lenses could be damaged

## Simulation program: Control

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The control works via mouse operation and the keyboard. Important: The numeric keypad must be activated!

Adjust VR goggles Straighten the handlebars, place the VR goggles on the MIK adapter plate on the rack facing forward and press "F2"

Riding without goggles Put the VR goggles to the side of the handlebars and press F2, then F4 to get a still image with a straight view

Main menu To return to the menu from a route, press "ESC" or the "Menu" button.

Reset To start the journey again at the starting point, press "R". This is necessary if you get lost or have to reverse. Make sure that the rear wheel of the bike no longer turns.

Exit If you want to exit or restart the entire simulation program, press "ESC" twice, then you are on the Windows interface

Further control options can be found in the laminate  
, "keyboard mapping".

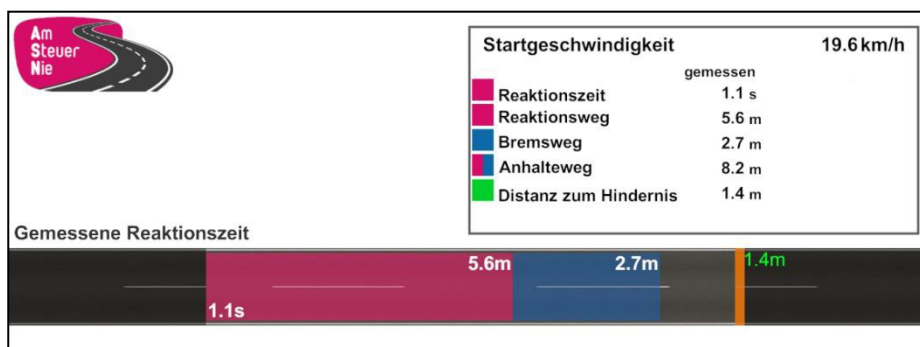
# Analysis and replay with perspective change

## 5.1 Analysis

After each route you can decide whether you want to return to the menu or see an analysis of the situation. There, the reaction distance, braking distance, distance to the obstacle and impact speed are shown in a graphic. In addition, the start speed, reaction time and total stopping distance are shown in a table. The test person has to take off the VR goggles so that he can see the analysis.

Depending on the restriction set, other things can be read out from the analysis. The following three situations are for illustration:

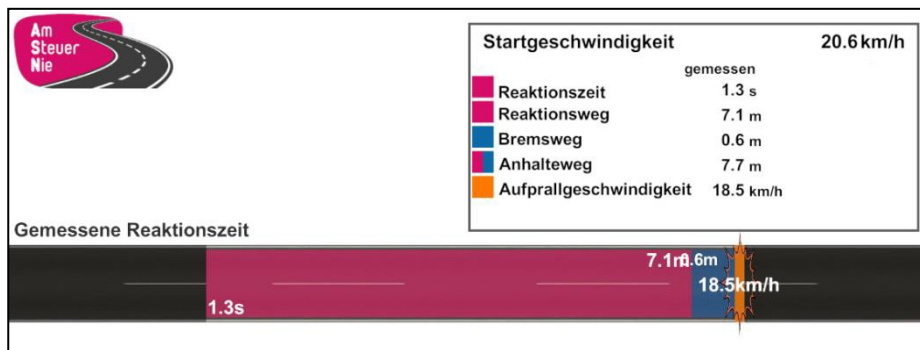
- Example: City sober1 (without restrictions) (Fig. 9)
- The person had a reaction time of 1.1 seconds. In this time, she drove a distance of 5.6 meters at a takeoff speed of 19.6 km/h. The braking distance at this speed and with full braking is 2.7 meters. The person thus came to a halt meters1,4 before the obstacle.



■ Figure 9: Example 1

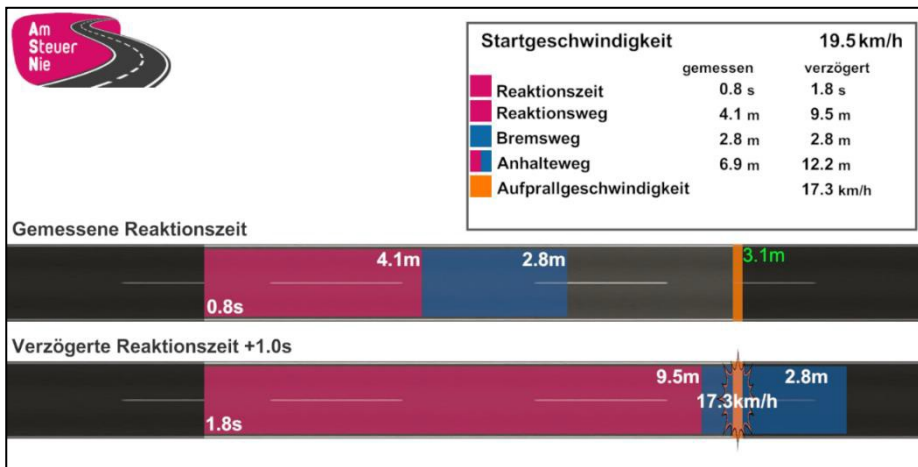
- Example: City alcoholized2 (0.5 per mille; key 7) (Fig. 10)

- The person had a delayed reaction time of 1.3 seconds. In this time, she drove 7.1 meters with a starting speed of 20.6 km/h. The braking distance was therefore insufficient. The braking distance was thus no longer sufficient and there was an impact with a speed of 18.5 km/h. A similar result can be shown if the cell phone is triggered before the obstacle (see keyboard layout).



■ Figure 10: Example 2

- Example: Brake reaction test sober (without restrictions) (Fig. 11)
- In the brake reaction section, a direct comparison can be made with a delayed reaction time. Therefore, it only makes sense here to let the participant drive sober and without restrictions.
- The person had a reaction time of 0.8 seconds. In this time, she drove a distance of 4.1 meters at a starting speed of 19.5 km/h. The braking distance is 2.8 meters at this speed and with full braking. The person thus came to a stop 3.1 meters before the obstacle. If the person had had 1 second longer to react (due to the influence of alcohol or distraction, for example), the reaction distance would have been extended to 9.5 meters and he would have crashed into the obstacle at an impact speed of 17.3 km/h. By the way: The delay of the reaction time can also be changed manually here (see keyboard layout).



■ Figure 11: Example 3

## 5.2 Replay with perspective change

For some routes, the simulation program also offers a replay with perspective change in the analysis. This means that the driver experiences the situation again, this time from the perspective of the other road user involved. In this way, it can be shown where possible risks are taken by both actors and how they can be prevented. The replay must be started manually using the player after the selection in the analysis.

If the situation was experienced without VR glasses, you have to switch to the glasses view with F2 before selecting the replay so that you can show the situation with the glasses in your hand.

# Troubleshooting

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## 6.1 Error messages

If the simulator does not work as desired, please go through the following problem causes before contacting support. Some errors can already be solved by making sure that all cables are plugged in correctly and restarting the simulation program or the notebook.

Steering does not work in mode without VR goggles	Press F2 once and then press F4 again
One decrease does not work (speed, brake, steering)	Restart the simulation program. If this does not solve the problem, shut down the notebook and wait a minute before restarting it. Now don't forget to open the Oculus program.
No sound	<p>The sound runs through the VR goggles and is therefore not audible to the surroundings.</p> <p>If you want to change this (for example, if you want to use the simulation program without VR glasses), proceed as follows:</p> <ol style="list-style-type: none"><li>1. Close the simulation program and select the screen in the audio playback (bottom right on the desktop, <i>picture12</i> )</li><li>2. In the Oculus program under Devices &gt; Rift S and Touch (large green dot) "Windows-</li></ol>



Use settings"  
select, minimize and restart the  
simulation program

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VR goggles do not work (black image, three dots [ "load" ]	Check if the VR goggles are plugged in correctly (Attention: cable on goggles is also a connection, <i>Figure 13</i> ), check in the Oculus program if the connections are recognized ( <i>Figure 16</i> ), otherwise unplug and plug in the cable again and wait for a short time
View in VR goggles is not correct (settings window is displayed)	The VR Goggles wants to set up its security program again. Proceed as described in 2.1 Setting up VR Goggles
Keyboard commands do not work	Make sure that the number pad is activated ("Num Lock" key above the number pad)
Bicycle goes fast backward	This happens when the scene is started while the rear wheel is turning. Restart the simulation program and make sure that the rear wheel is stationary
Image in VR goggles/ride in VR goggles stalls	Make sure that the notebook is connected to the power. Start the Simulation program new.

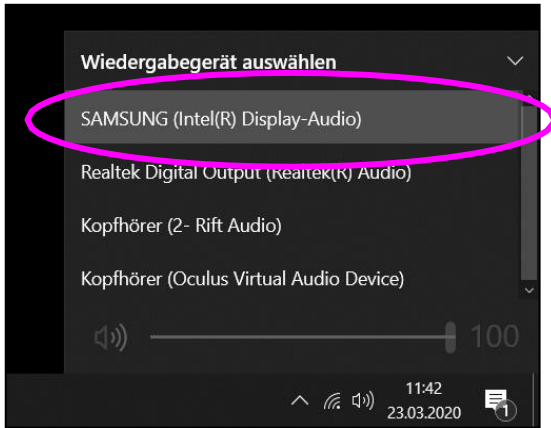


Figure 12: Sound settings on

desktopFigure13: VR goggle connection

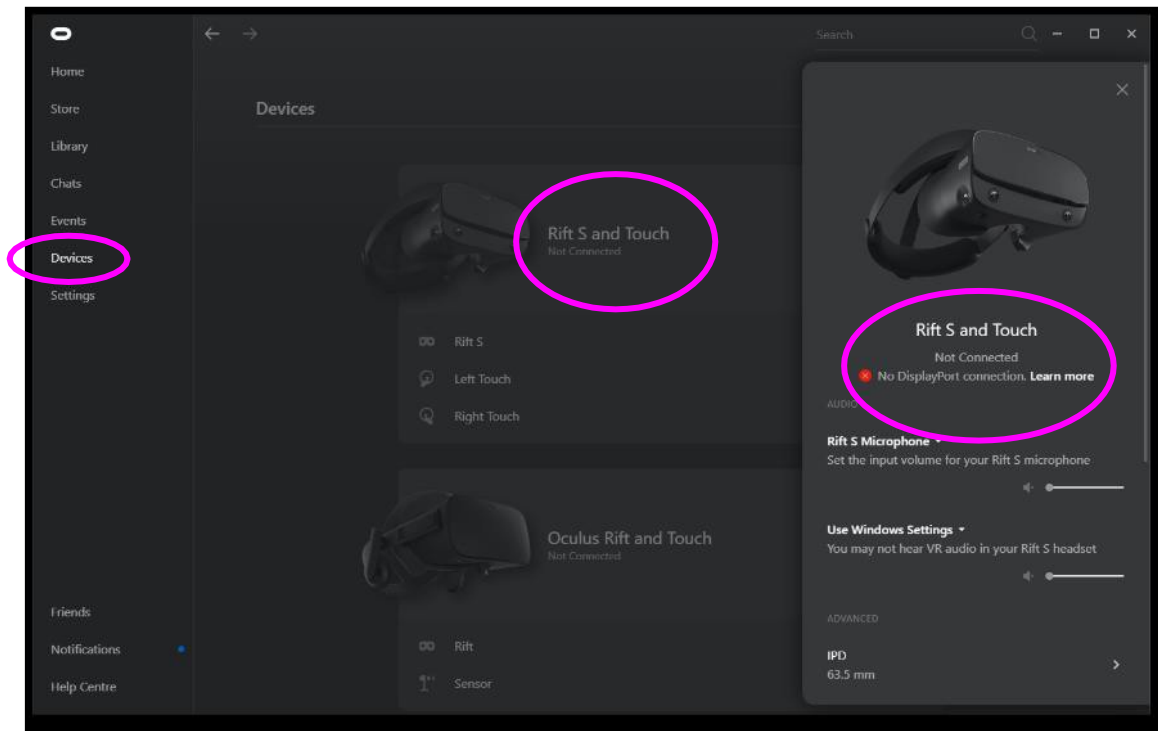


Figure 14: VR glasses connection