



OpenTSST VR

Users' Guide

2022/11/23

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Change Log

Version 2022/11/23:

Added manual content:

- User's Manual: Preliminary English Versions Appendix A & B added.
- User's Manual: Appendix C added.

Added program content:

- Action "2023-17" added in stress protocol.

Added content overall:

- Added file "GER_VL_Instruktionen" (German version of the experimenter instructions).
- Added file "GER_VL_Protokoll" (German version of the experimenter protocol).

Changed program content:

- Allocated time for phase "enter" in stress protocol reduced: ~~50s~~ → **20s**

Changed in TSST protocol:

- Wait time for participant answers reduced: ~~20s~~ → **3s**

1 Introduction

The OpenTSST VR is an open version of a virtual reality adaptation of the Trier Social Stress Test (TSST; Kirschbaum, Pirke & Hellhammer, 1993). The TSST was developed as a short laboratory stressor for experimental and clinical stress research. It has proven to induce robust activation of the HPA-axis and sympathetic-adrenal-system, inducing robust elevations of cortisol, adrenalin, noradrenalin, heart rate and blood pressure. In brief, the TSST contains two tasks in front of a panel of three (virtual) judges: (1) a 5 min mock job-interview, and (2) a serial subtraction task under time pressure. The panel is programmed to instruct the participant, asks questions during the job interview, gives feedback on errors during subtraction, but does not reveal facial feedback.

The OpenTSST VR has been designed to resemble the main features of the real-world TSST as closely as possible. However, there are some minor differences from the real-world TSST:

- All components of the OpenTSST VR are enacted in the same room. There is no separate preparation room.
- After the preparation period, the panel is faded in and begins the interactions by asking the participant to start the presentation.
- Preparation time was reduced to five minutes, and no paper and pencil for taking notes can be used.

Note. Although the real-world TSST is quite robust against minor protocol variations (Goodman, Janson & Wolf, 2017), it is possible that these differences will induce more variance or have an impact on the reliability of the OpenTSST VR. This should be kept in mind while planning studies using the OpenTSST VR. Another note of caution concerns the experimenter's role in the OpenTSST VR. Our impression is that the experimenter's behavior is more influential, since he/she is the only real interaction person during the procedure. Therefore, we strongly recommend thorough training and constant monitoring of the experimenter's behavior.

Disclaimer and license agreement

Disclaimer. The OpenTSST VR has been developed in the hope that you will find it useful for your research. It is provided "as is" and "with all faults." We make no claims and can issue no warranties of any kind concerning the safety, suitability, lack of viruses, inaccuracies, typographical errors, or other harmful components of the OpenTSST VR. There are inherent dangers when using any software, and you are solely responsible for determining whether OpenTSST VR is compatible with your equipment and other software installed on your equipment. You are also solely responsible for the protection of your equipment and for backing-up your data, as we will not be liable for any damages you may suffer in connection with using, modifying, or distributing the OpenTSST VR.

License. The OpenTSST VR is distributed under the GNU GPLv3 license ("copyleft") – for details see here: <https://www.gnu.org/licenses/gpl-3.0.en.html>. In short, this means that you are allowed to copy, distribute, change code, recompile, and publish the OpenTSST-VR, as long as this new version is distributed under the GNU GPLv3 and thus remains open.

- **Download** the OpenTSST VR here: <http://www.uni-trier.de/index.php?id=88863>
- The Open TSST VR is still being developed. If you are interested in taking part in a large-scale evaluation of the OpenTSST VR, please write an e-mail to: domes@uni-trier.de
- **Please cite** the OpenTSST VR: von Dawans, B., Standard, W., Zielasko, D., Seel, S., Weyers, B., Domes, G. (2022) The Open TSST VR. An open tool for inducing psychosocial stress in virtual reality. URL: <http://www.uni-trier.de/index.php?id=88863>

2. Installation

The OpenTSST VR setup includes the layout of the room where the VR sessions are conducted, the setup of PCs and other hardware, the installation of required software, the specific OpenTSST VR program files, and the OpenTSST VR control GUI.

Overview

The basic OpenTSST VR setup consists of the following two main components:

- **OpenTSST VR environment** generated with Steam VR and presented with an HMD
- **OpenTSST VR control GUI** which allows for (remote) control over the TSST-protocol

The main hardware comprises:

- **Main PC** running Steam VR
- **Client PC** running control GUI with Ethernet connection to Main PC
- **HMD** e.g. VIVE PRO Eye with a Wireless Adapter Set
- **VR Wireless Adapter** connected to Main PC
- **VR Base stations** positioned in two opposite corners of the play area

Fabric privacy screens or other elements can be used as a neutral environment and to optimize sound recording. In our setup, we use a curtain around the play area.

Additional equipment is needed to assess physiological or behavioral measures (ECG, EEG, Video, etc.): we recommend using additional computers to prevent the VR system from overload and thus program errors or freezing.

Room and technical setup

As **an example**, we are using a one room setup with two PCs. The exact room dimensions and distances between all elements are displayed below (see figure 1).

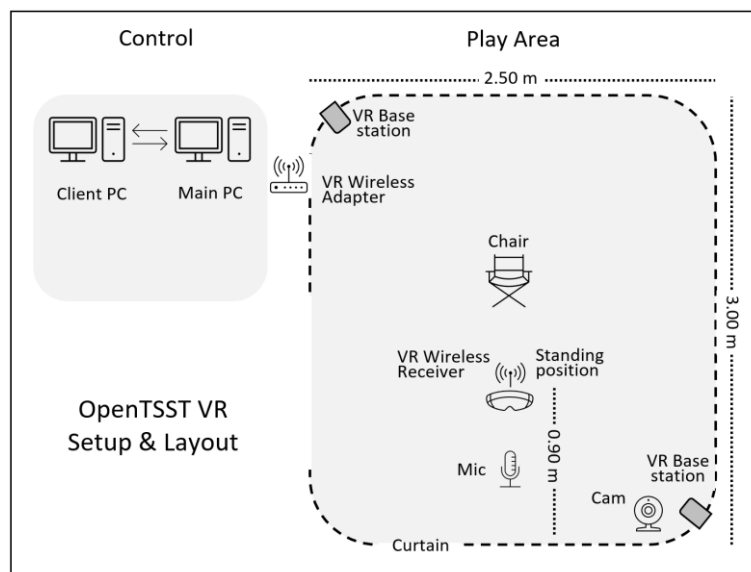


Figure 1: Example for a VR setup: Room layout, distances and main equipment

Additional setup/hardware:

- **Audio:** To record participants' responses, a microphone and a pre-amp are needed. The microphone is put in front of the participant on a tripod.
- **Video:** A webcam can be used to enable observation of the participant from an adjacent room and for behavioral analyses. In our example setup, we use a standard USB webcam mounted on the same pole as one of the base stations.



Figure 2: Some impressions of how the setup looks in reality

System requirements

The OpenTSST VR runs on **Windows 10**. Although we have tested performance and stability based on the specification below, we strongly recommend in-depth testing of the specific setup using the specific hardware before running experiments.

The following minimum system requirements have been tested for stable performance with 90 fps in VR at the full resolution of the Vive Pro HMD in a two-computer setup:

- **Head mounted display**
 - Recommended HMD: VIVE Pro Eye (for eye-tracking) with the Wireless Adapter Set
 - Recommended base stations: SteamVR 2.0 Base Stations
- **Main PC** minimum requirements:
 - OS: Windows 10®
 - Processor: i7-9700
 - RAM: 8GB
 - Graphic Card: NVIDIA Geforce RTX 2080 with 8GB GDDR6
 - Software: Installed Steam with SteamVR

Note. The graphic card is especially crucial; it is the main limiting factor for frame rate and resolution. Less powerful graphic cards will result in reduced frame rate and/or resolution. With the minimal configuration, CPU and graphic card will likely run on 100% load most of

the time, leading to increased fan noise. Sound-dampening CPU housing and proper cooling are recommended to reduce noise during testing.

- **Client PC** minimum requirements:
 - OS: Windows 10®
 - Processor: i3 or higher
 - RAM: 8GB
 - Graphics: Onboard, no graphic card needed

Hardware setup

Ethernet connection between Main and Client PC

The VR environment generated on the Main is controlled by the Client PC GUI. Therefore, the Main and Client PC need an **ethernet connection**. The most convenient way is the connection via a switch (that can also be connected to a LAN and/or the internet). Make sure that latencies are low enough to ensure control and feedback with no noticeable lack. The second possibility is the direct Ethernet connection between the two computers. Follow the instructions in the many tutorials available on the internet.

VR Base Stations

Prior to installing the **Base Stations**, please make sure of the following: To prevent damage or performance problems, make sure that the Base Stations are properly set up and installed in the corners of the play area. Do not remove the protective film on the front plate until the Base Stations have been securely set up. Only use power cords and the DC adapters provided with the Base Station.

1. Set up both Base Stations in the opposite corners of the room.
2. Make sure that the front side of the Base Station points toward the center of the play area.
3. To activate the Base Stations, connect the power cord.

VR Wireless Adapter

After installation, the **Wireless Adapter** needs to be able "to see" the whole play area. We recommend installing it at the chest height of the average user, but installation requirements can differ between user setups. Please refer to the VIVE user manual for further information and clarification.

Software installation

2.1.1. Main PC VR software

To run OpenTSST VR, make sure you have the following programs or services properly installed and in working order on your **Main PC**. If you encounter any problems during installation or when using these programs, please contact the responsible Support Services.

- **VIVE Wireless:** Connects your HMD to the Main PC. Download here and follow the instructions (<https://www.vive.com/de/setup/wireless>)
- **SRanipalRuntime** (only needed for eye-tracking) 1. Apply for free developer access by creating an account (<https://hub.vive.com/en-US/vivepro-eye>); 2. Log in and download software (<https://hub.vive.com/en-US/profile/material-download>); 3. Follow installation routine provided.
- **SteamVR:** A free software provided in Steam. Download and install. You will automatically be using the most recent version (<https://store.steampowered.com/>)
- **Microsoft .NET 2.0 Framework** (or later): <https://dotnet.microsoft.com/>

2.1.2. OpenTSST-program files

OpenTSST-VR software (**OpenTSST-VR control GUI** and **OpenTSST-VR program files**) are provided in a zipped folder **OpenTSST-VR.zip** (.zip or .rar). In this folder, you will find two subfolders: the **TSST-VR_URP** and **OpenTSST-VR-client**.

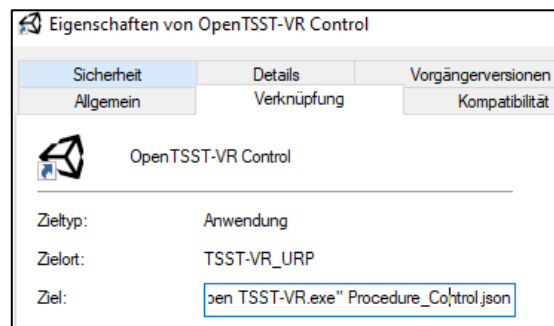
Main PC Setup

The Main PC runs the VR environment. Install the software as follows:

- Copy the folder **TSST-VR_URP** onto the desktop of your Main PC. In this folder, you will find an executable file named **OpenTSST-VR.exe**. This file is the base used to run the OpenTSST-VR application on the Main PC.
- In the standard version of the OpenTSST VR, two conditions are included (see folder "Procedure"):
 - **Stress condition** protocol in German (Procedure)
 - **Control condition** protocol in German (Procedure_Control)

Note. We are working on an English version of both conditions that will soon be available.

- Create a **shortcut** to the file **OpenTSST-VR.exe** on your desktop for easy access. A session using the standard Stress condition (on the Client PC) can be started by using this standard shortcut. To start a session using the Control condition (or any other condition available in the folder "Procedure"), create another shortcut and edit the target line in the Access Control Settings of that shortcut by adding the name of the procedure (here: "Procedure_Control.json").
- **Configure IP & open port:** You are able to set the IP address and the port in the file **TSST-VR_URP/Config/cfg.json**. We recommend that you leave those details empty though; the program automatically retrieves the IP address and an open port on the first run of the OpenTSST-VR as a default.



Note. Do *not* rename the **TSST-VR_URP** folder, nor place it anywhere else than the desktop. Main PC (program files) and Client PC (.json files) are related by absolute paths, and thus communication between the two computers will fail if folders have been renamed or relocated.

Client PC Setup

The Client PC provides a simple GUI and controls the start and progress of the TSST protocol and controls the judges' behavior.

- Copy the folder **OpenTSST-VR-client** to your Client-PC. In this folder, you will find an executable file named **TSST-VR_client**. This client is needed to control the session on the Client-PC.
- Place a shortcut to **TSST-VR_client** on your desktop for easy access.

3. Running a session

Basic preparation

- Make sure the HMD battery pack is **fully charged** and ready to use.
- Have a **small bag** ready in case the participant is not wearing trousers with pockets or a belt

Note. For more hygienic use, we recommend exchanging the foam face cushion for a leather face cushion. For additional material protection, single-use hygiene covers can be used.

Preparing the participant

- Place the participant on the chair in the play area.
- **Turn on** the fully charged HMD **battery pack** by briefly pressing the center button t. Four green lights should turn on and remain illuminated. If this happens, give the battery pack to the participant to either store in their pocket or in the small shoulder bag provided.
- Explain the HMD's handling to the participant and help them put it on:
 - Hold the HMD on its upper **band** when putting it on or off.
 - The **adjustment wheel on the back** of the head tightens the device and keeps it from slipping.
 - The smaller **adjustment wheel on the front** right side adjusts the interpupillary distance (IPD) and will be needed in eye-tracking (ET) calibration.
- Make sure the device fits snugly, that the headphones are positioned correctly, and that the lens distance is adjusted correctly.

Note. For **additional information** on handling the HMD, please see the manufacturer's website: <https://www.vive.com/de/support/vive-pro>

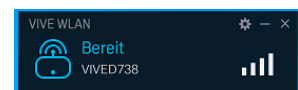
Setting up the computers

Before running a session with a participant, the Main PC and Client PC must have been prepared, and the session needs to be loaded and initialized. Start with the **Main PC**, connect the HMD, start the eye tracker (if needed), load the correct condition file, and activate the VR view for the experimenter. In the last step, start the control GUI on the **Client PC**, enter the subject ID, and connect to the Main PC.

3.1.1. Main PC

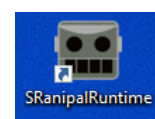
Step 1: Connect the HMD

- Start the application "VIVE Wireless"
- A new window "VIVE WLAN" opens
- After about 20 seconds, the HMD should be connected.
You should see a strong signal (4 bars) and the message "Bereit" (English: ready)



Step 2: Start the eye-tracking application

- Start the application "SranipalRuntime"
- Check status under "Show hidden icons" in the Windows taskbar
 - Black eyes: No connection
 - Orange eyes: Connection, but not active

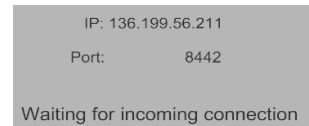
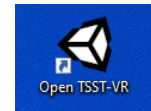


- Green eyes: Connection, active
- Green eyes are expected during eye-tracking calibration, validation and recording



Step 3: Start an OpenTSST-VR condition file

- Start one of the .exe-files of the OpenTSST-VR by double clicking on one of the shortcuts to a specific condition
- A new window with IP & port information of the main PC opens. You will need this at the start of running a session (see 3.4 Start a session)

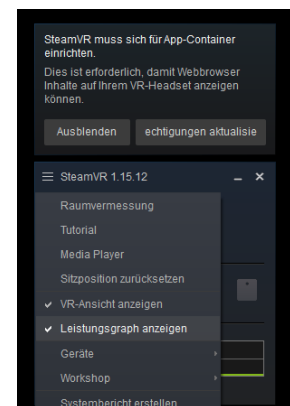


Step 4: Activate VR view in Steam VR

To have a first-person view of the VR environment

- Open SteamVR
- Click on settings in the SteamVR 1.15.12 context menu
- Activate "VR-Ansicht zeigen" (Eng: „Show VR view“).

With this setting activated, the participant's view of the VR is visible to the researcher; the researcher sees the participant's view in the first person

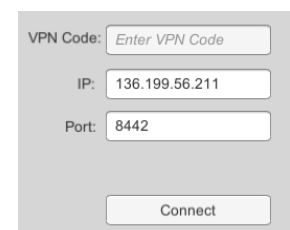
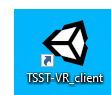


3.1.2. Client PC

Step 5: Start the OpenTSST-VR Client on the Client PC

- Start the Client Application TSST-VR_client
- Enter subject ID ("VPN Code")
- Check the given IP and Port. They must match the IP and Port on the Main PC (Step 3). If they do not match, correct the IP and Port on the Client PC accordingly. You should only have to do this when first using the OpenTSST-VR.

If everything has been done correctly, the client input field will disappear. A new window named "TSST-VR_client" opens with the control buttons to run the session.



Do not run the "TSST-VR_client" window in fullscreen mode! If you run it in fullscreen, your session's control elements might not show up properly

Starting a session

The OpenTSST VR is **NOT** entirely automatic, as the experimenter monitors the participant's behavior and controls the VR agents accordingly. For this purpose, the **Client PC GUI** is used to control the progress of the TSST, to trigger the active judge's behavior and to monitor the progress during the various phases of the TSST session.

3.1.3. Control GUI overview

The TSST is composed of **phases** with some containing specific **actions**. Especially the TSST job interview and TSST subtraction task demand the experimenter's full attention to ensure that the judges' appropriate reaction will be triggered. A specific description of the pre-programmed actions available is found in section 3.4.2.



Figure 3: Screenshot of the Client PC GUI

- (1) **Drop Down:** Opens/closes phase overview section.
- (2) **Experimental Phase Overview:** Shows which phases will be logged in the data set (see 3.4) and highlights the current phase while running OpenTSST VR sessions.
- (3) **Position indicator:** Indicates whether or not the participant is correctly positioned in the play area: green indicates correct position, red indicates incorrect position. Important once TSST instructions (see 3.3.2) have started.
- (4) **Timer:** Estimated time: allocated time for the active phase. Elapsed time: lapsed time in the active phase.
- (5) **Next Phase button:** Ends the current phase and immediately starts the following phase. Turns red when estimated time has run out.
- (6) **Connection:** Green: Indicates the client's viable connection to the server and application. Red: Indicates connection loss. Should reconnect automatically.
- (7) **Quit Button:** Stops and shuts down the client application on client set-up, as well as the OpenTSST-VR application on the Main-PC.

3.1.4. TSST phases

With the OpenTSST-VR client, you start the automatic session by pressing the next phase-button (see 3.3.1, figure 13), which indicates "Set Marker". By doing so the session will run automatically.

The sequence of phases below are included in a standard TSST session:

- (1) **Set marker:** Sets a start marker of the whole OpenTSST-VR-session.

- (2) **Calibrate ET**: 5-point eye-tracking calibration (60 sec). Participants need to fixate target points.
- (3) **Validate ET**: Independent 5-point eye-tracking validation sequence with targets in the VR environment at the pane location
- (4) **Baseline sit**: 5 min sitting for baseline recording.
- (5) **Baseline stand**: 5 min standing for baseline recording.
- (6) **TSST1 instructions**: Automatically reads OpenTSST VR instructions to the participant (about 60 seconds). Starts the 5 min. preparation timer.
- (7) **Entrance judges**: Entrance of judges after 5 minutes' preparation.
- (8) **TSST1 job interview**: 5 min free speech about the job application. The experimenter triggers questions about specific issues (TSST1 actions, see below).
- (9) **TSST2 subtraction task**: 5 min serial subtraction task. The experimenter triggers feedback on errors or gives instructions to speed up (TSST2 actions, see below).
- (10) **Goodbye**: Ends TSST VR routine.

A list of instructions provided in German is found in Appendix A.

3.1.5. Controlling actions

During the **job interview (TSST1)** feedback can be given (e.g. "There is some time left. Please continue") or questions can be asked ("Why do you think you are well-suited for this job in particular?") by the active judge. Pressing the button triggers the verbal reaction without a delay. Once a button has been used, the button turns gray.

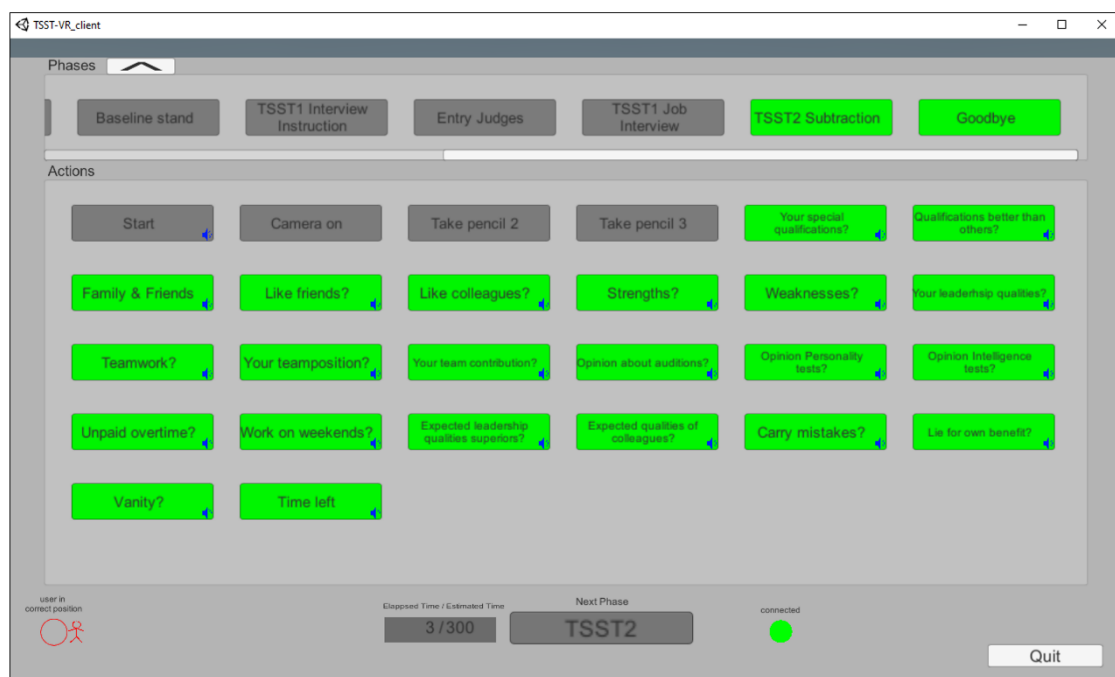


Figure 4: Screenshot of the TSST1 (job interview) active judge's actions that can be triggered by the experimenter

Similarly, feedback can be triggered during the **serial subtraction task (TSST2)**. Here the Client PC GUI provides the list with correct answers. The experimenter has to decide whether to give feedback on errors ("Wrong! Please start with...") or whether to put the participant under time pressure ("Please calculate faster!"). Again, the options are displayed and can be used more than once.

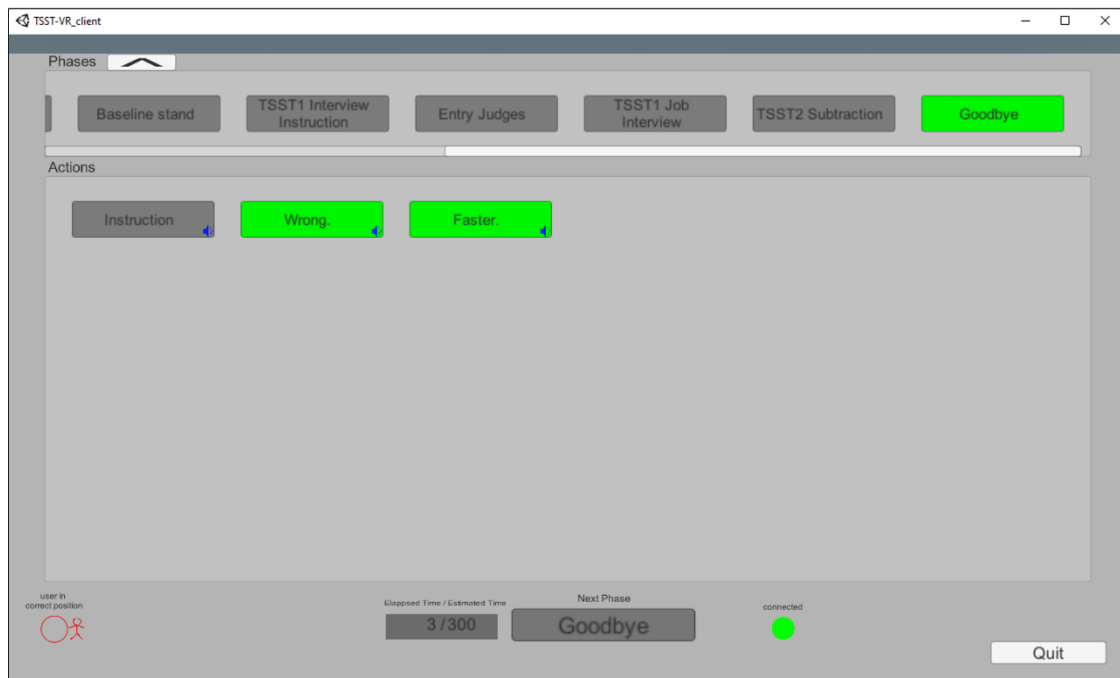


Figure 5: Screenshot of the TSST2 (subtraction task) active judge's feedback options

A complete list of actions with the text in German is provided in Appendix B.

Data Output

The OpenTSST VR records some data and log files. This data will be saved in the folder "TSST-VR_URP\Recordings" (see figure 15). The program will create a subfolder for each participant with the following naming scheme: "SubjectID_date_timestamp_condition".

Note. In the present version, a European time and date format is used.

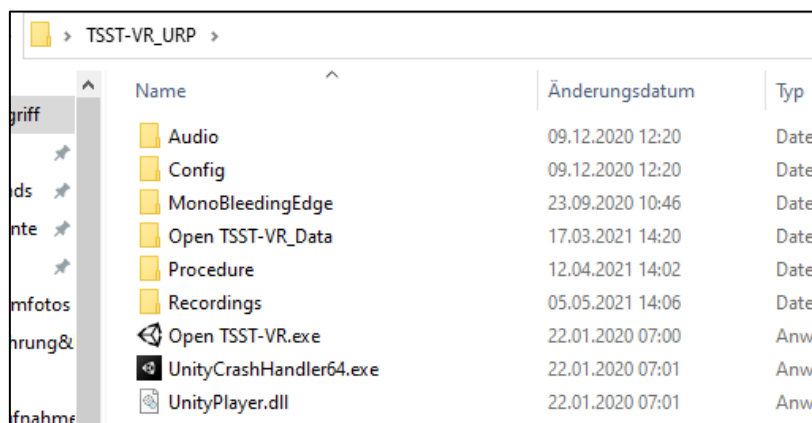


Figure 6: Folders and files typically found in the TSST-VR_URP\Recordings folder

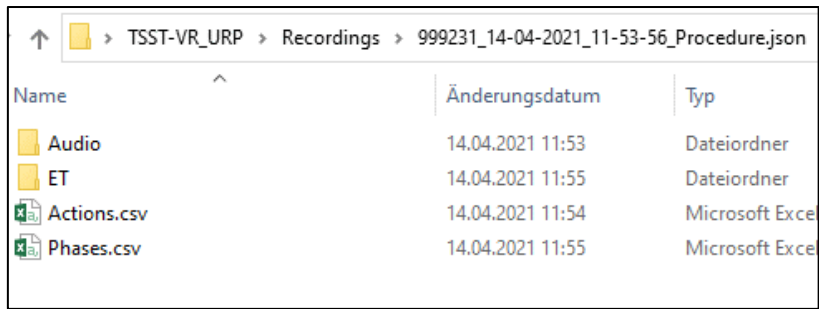


Figure 7: Data folders and files of a single participant

In every participant folder, you will find the following data structure and file set-ups:

- Audio: Voice recordings of the participants answers to both TSST assignments.
- ET: Eye-tracking Data.
- Actions: Logs of instructor input into the client set-up while performing a session.
- Phases: Time logs of each phase.

Audio recording and eye-tracking data will only be recorded in the treatment condition. In the control condition, they will not be recorded.

4. How to customize the OpenTSST-VR protocol

Customization of the OpenTSST-VR protocol is now possible in several general areas: audio files used, eye-tracking recording, background noise and phases used. In the following section, we outline the basic steps and requirements for these changes.

Adding procedures

The OpenTSST-VR procedures are controlled by .json-files in TSST-VR_URP/Procedure

To add a new procedure, we recommend cloning one of the existing .json files there and adjusting it to your needs. You can connect this new procedure then to your own .exe-file; create a shortcut to the .exe-file "OpenTSST-VR [DE_Stress]" and specify which protocol to use by editing and changing the accessed .json-file in the Access Control Settings of each individual .exe-file.

Changing audio files

The OpenTSST-VR uses .ogg-audio files, which are stored in the TSST-VR_URP/audio folder. We recommend creating new subfolders in the audio-folder to store new audio files; doing so keeps standard audio files accessible for later use.

- The general audio subfolder being used during the chosen procedure can be customized in the specific procedure or control .json-file in the folder TSST-VR_URP/procedure by editing the line "audio_folder" (string).
- Audio files used in specific phases or actions of the OpenTSST-VR can be changed in the specific .json-file. So e.g., to change the audio file used in the phase "TSST1", you need to change the audio line in the TSST-VR_URP/procedure/phases/tsst1.json

Enabling/disabling the Eye-tracking recording

Eye-tracking is enabled in the standard version of the OpenTSST-VR. To change this, access the specific procedure.json and set the argument in the line „enable_eyetracking“ to false.

Enabling/disabling & editing background noise

White noise as background noise is enabled in the standard version of the OpenTSST-VR. To change this, access the specific procedure.json and set the argument in the line „background_sound_on“ to false.

The specific background noise audio file can also be changed by editing the line „background_sound_clip“ and simultaneously changing the audio file in the TSST-VR_URP\Audio\Background_noise subfolder

Changing phases and actions

Phases used in a procedure, as well as the specifics to a phase and actions can also be customized by editing the corresponding .json file.

- Remove or add phases in TSST-VR_URP/procedure/procedure.json in the argument „phases“.
- When adding a new phase, you also need to add a corresponding phase specific .json file in Procedure\Phases\
- For every phase, the random frequency of occurrence of some animations can be set for every agent as a list in agentproperties. The name of the agent needs to be specified, along with the probability of the occurrence per second:
 - checkNotesFrequency: Agent glances at the clipboard in front
 - takeNotesFrequency: Agent writes on the clipboard
 - gazeWanderFrequency: Agent looks at different body parts (participant)

- switchPositionFrequency: Agent switches to leaned-back position and back

5. FAQs

Is it possible to run all applications needed on one set-up?

- Running all components on one computer set-up is feasible if the system's performance is high enough (CPU und GPU). So far, our lab has used a two-PC set up.

Is it possible to remove the PCs from the experimental setting to a different room?

- It depends on the VR-base station cable length. Since the VR base station's cable of the HTC Vive is quite short, we have not been able to remove the Main PC from the experimental setting yet.
- The Client PC however can be moved to any location required as long as it is connected to the Main-PC over Ethernet.

Can new characters and animations be created, room features changed, etc.?

- At this point, animations and characters and other features can only be modified in the source code. The agent models are not licensed by our lab, so changes must be negotiated with the license holder.

I have problems running any other protocol than the standard stress protocol (DE_Stress). What is the problem?

- Check the target line in the Access Control Settings of each individual shortcut file and make sure that the link is properly set up. You might have to adjust the target line to your own setup.

We're having problems running the OpenTSST-VR when starting the 3rd party programs first. What should we do?

- According to a solution reported to us: Simply try starting the VR-procedure without starting the 3rd party programs first. They should start automatically in that process.

When we start the OpenTSST-VR exe on the Main PC, the IP and Port are blank. We didn't change anything. What do we do?

- Check for proper placement of the folder **TSST-VR_URP** on the desktop of your Main PC. Also, recreate the shortcut of the **OpenTSST-VR.exe** on your desktop and check for mistakes in the target-line. If this doesn't resolve the issue, feel free to contact us for further support.

6. References

- Goodman, W. K., Janson, J. & Wolf, J. M. (2017). Meta-analytical assessment of the effects of protocol variations on cortisol responses to the Trier Social Stress Test. *Psychoneuroendocrinology*, *80*, 26–35. <https://doi.org/10.1016/j.psyneuen.2017.02.030>
- Kirschbaum, C., Pirke, K. M. & Hellhammer, D. H. (1993). The 'Trier Social Stress Test'--a tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology*, *28*(1–2), 76–81.

Appendix A - Instructions

Instructions during the OpenTSST VR are presented in print on the screen as well as spoken. Some parts are spoken by a narrator from the off, while other parts are spoken by the active panel member.

DE – German Version

Stress condition

Calibrate ET (printed)	Bitte befolgen Sie die eingeblendeten Anweisungen.
Validate ET (printed)	Bitte fokussieren Sie den blauen Punkt.
Baseline sit (printed & spoken)	Bitte bleiben Sie für die nächsten Minuten sitzen.
Baseline stand (printed & spoken)	Bitte stehen Sie auf und bleiben Sie für die nächsten Minuten stehen.
TSST1 Instruction (printed & spoken)	„Bitte stellen Sie sich vor, dass Sie sich auf eine Arbeitsstelle Ihrer Wahl bewerben. Ein Auswahlgremium, welches gleich hier am Tisch Platz nehmen wird, entscheidet darüber, ob Sie diese Stelle bekommen oder nicht. Das Gremium ist geschult in Verhaltensbeobachtung. Es wird sich Notizen machen und insbesondere auch auf Ihre Gestik und Mimik achten. Das Gespräch wird auf Video aufgezeichnet, damit später Analysen Ihres Verhaltens gemacht werden können. Gehen Sie davon aus, dass dem Gremium all Ihre Bewerbungsunterlagen bereits vorliegen. Sie sollen das Gremium davon überzeugen, dass Sie die beste Person für diese Stelle sind. Im Anschluss an das Gespräch wird Ihnen noch eine zweite Aufgabe gestellt. Diese wird Ihnen jedoch zur gegebenen Zeit vom Gremium erklärt. Sie haben nun 5 Minuten Zeit, sich gedanklich auf das Bewerbungsgespräch vorzubereiten.“
TSST1 Preparation end (printed & spoken)	„Die 5 Minuten Vorbereitungszeit sind nun zu Ende.“
TSST1 Job interview (spoken by judge)	„Guten Tag! Bitte beginnen Sie jetzt mit Ihrer Vorstellung.“
TSST2 Subtraction task (spoken by judge)	„Danke, das genügt. Wir kommen nun zur nächsten Aufgabe. Es handelt sich dabei um eine Rechenaufgabe. Rechnen Sie bitte in 17er Schritten rückwärts von der Zahl „2023“. Bitte rechnen Sie so schnell und fehlerfrei wie möglich. Wenn Sie sich verrechnen, machen wir Sie darauf aufmerksam und Sie beginnen bitte wieder bei „2023“. Bitte beginnen Sie jetzt.“

Control condition

TSST1 Instruction
(printed & spoken)

„Ihre Aufgabe wird es gleich sein, einige Minuten lang frei über einen Film, den sie gesehen, ein Buch, das sie gelesen oder den letzten Urlaub, den sie gemacht haben, zu erzählen. Sie haben gleich 5 Minuten Zeit um darüber nachzudenken, von welchem Thema Sie im Anschluss erzählen möchten. Während Sie von Ihrem Thema erzählen, werden Sie weder aufgezeichnet noch in irgendeiner Form bewertet. Wenn die Vorbereitungszeit vorüber ist, werden Sie aufgefordert, zu beginnen. Haben Sie noch Fragen? Wenn ja, wiederholen wir die Instruktionen gerne für Sie.“

TSST1 Preparation
(printed & spoken)

„Bereiten Sie sich nun bitte darauf vor, von einem Film, einem Buch oder einem Urlaub Ihrer Wahl zu berichten.“

TSST1 Start
(printed & spoken)

„Die Vorbereitungszeit ist nun vorbei. Bitte beginnen Sie nun, über das von Ihnen gewählte Thema zu sprechen. Versuchen Sie bitte, solange zu erzählen, bis Sie von uns andere Anweisungen erhalten.“

TSST2 Instruction
(printed & spoken)

„Vielen Dank! In den nächsten Minuten möchten wir Sie bitten, bei der Zahl „0“ zu beginnen und in 15er Schritten hochzuzählen. Also „0“, „15“, „30“ und so weiter. Bitte sprechen Sie die Zahlen laut aus. Auch dabei werden Sie weder aufgezeichnet noch bewertet. Sie werden informiert, wenn Sie mit dem Hochzählen aufhören können. Sollen Sie dazu noch Fragen haben, wiederholen wir die Instruktionen gerne für Sie.“

TSST2 Start
(printed & spoken)

„Bitte beginnen Sie nun mit dem Zählen.“

End
(printed & spoken)

„Vielen Dank! Dieser Teil der Aufgabe ist nun beendet. Der Versuchsleiter wird nun wieder eintreten und Sie über den weiteren Verlauf der Untersuchung informieren.“

ENG – English Version

This version is preliminary and not yet implemented!

Stress condition

Calibrate ET (printed)	Please follow the onscreen instructions.
Validate ET (printed)	Please focus on the blue dot.
Baseline sit (printed & spoken)	Please remain seated for the next few minutes.
Baseline stand (printed & spoken)	Please get up and remain standing for the next few minutes.
TSST1 Instruction (printed & spoken)	"Please imagine that you are applying for a job of your choice. A selection committee, which will take a seat right here at the table, will decide whether you get this position or not. The panel is trained in behavioral observation. It will take notes and pay particular attention to your gestures and facial expressions. The conversation will be recorded on video so that analysis of your behavior can be made later. Assume that the committee already has all your application documents. Your job is to convince the board that you are the best person for the job. After the interview, you will be given a second task. However, this will be explained to you by the panel in due course. You now have 5 minutes to mentally prepare for the interview."
TSST1 Preparation end (printed & spoken)	"The 5 minutes of preparation time are now over."
TSST1 Job interview (spoken by judge)	"Hello! Please begin your introduction now."
TSST2 Subtraction task (spoken by judge)	"Thank you, that's enough. We will proceed to the next task now. This is an arithmetic task. Please calculate backwards in steps of 17 from the number "2023". Please calculate as quickly and accurately as possible. If you miscalculate, we will draw your attention to it and ask you to start again from "2023". Please start now."

Control condition

TSST1 Instruction (printed & spoken)	"Soon, your task will be to spend a few minutes freely talking about a movie you saw, a book you read or the last vacation you took. You have 5 minutes to think about which topic you would like to talk about afterwards. As you talk about your topic, you will not be recorded or evaluated in any way. When the preparation time is over, you will be prompted to begin. Do you have anymore questions? If so, we would be happy to repeat the instructions for you."
TSST1 Preparation (printed & spoken)	"Now, please prepare to report on a film, book, or vacation of your choice."
TSST1 Start (printed & spoken)	"The preparation time is now over. Please start talking about the topic you have chosen. Please try to keep talking until you receive different instructions from us."

TSST2 Instruction
(printed & spoken)

"Thank you! In the next few minutes we would ask you to count up in increments of 15 starting with the number "0". That means "0", "15", "30" and so on. Please say the numbers out loud. Again, you will not be recorded or evaluated. You will be informed when you can stop counting up. If you have any further questions, we will be happy to repeat the instructions for you."

TSST2 Start
(printed & spoken)

"Now please start counting."

End
(printed & spoken)

"Thank you! This part of the experiment is now complete. The researcher will now re-enter and inform you of the further course of the study."

Appendix B – Actions

Feedback and questions by the active panel member can be triggered from the control GUI. The following options are available.

DE – German Version

Actions that can be triggered in TSST1 (Job interview)

(spoken by Judge)

Opinion about auditions	„Was halten Sie von Bewerbungsgesprächen?“
Qualifications better than others?	„Warum halten Sie sich für geeigneter als andere Bewerber?“
Carry mistakes?	„Unter welchen Voraussetzungen wären Sie bereit, Fehler Ihrer Mitarbeiter mitzutragen?“
Family & Friends	„Was schätzen Ihre Familie und Freunde besonders an Ihnen?“
Your team contribution?	„Was können Sie konstruktiv zu einem Team beitragen?“
Opinion intelligence tests?	„Was halten Sie von Intelligenztests im Rahmen von Einstellungsverfahren?“
Your leadership qualities?	„Welche Führungsqualitäten besitzen Sie?“
Expected leadership qualities?	„Welche Führungsqualitäten erwarten Sie von Ihren Vorgesetzten?“
Lie for your own benefit?	„Würden Sie, um einen Vorteil zu erhalten, lügen?“
Like colleagues?	„Was schätzen Sie an Kollegen?“
Like friends?	„Was schätzen Sie an Freunden?“
Unpaid overtime?	„Wären Sie im Bedarfsfall bereit zu unentgeltlichen Überstunden?“
Opinion Personality tests?	„Was halten Sie von Persönlichkeitstestungen im Rahmen von Einstellungsverfahren?“
Expected qualities of colleagues?	„Welche Eigenschaften erwarten Sie von Ihren Mitarbeitern?“
Your special qualifications?	„Warum halten gerade Sie sich für besonders geeignet für diese Stelle?“
Strengths?	„Welche Stärken haben Sie?“
Your team position?	„Wo sehen Sie Ihre Position in einem Team?“
Teamwork?	„Was halten Sie von Teamarbeit?“
Time left	„Sie haben noch Zeit. Bitte fahren Sie fort.“
Vain?	„Sind Sie eitel?“
Weaknesses?	„Welche Schwächen haben Sie?“
Work on weekends?	„Würden Sie auch am Wochenende arbeiten?“

Actions that can be triggered in TSST2

(spoken by Judge)

Faster.	„Bitte rechnen Sie schneller.“
Wrong.	„Das war falsch. Bitte beginnen Sie bei 2023.“
2023-17.	„Rechnen Sie bitte in 17er Schritten rückwärts von der Zahl „2023““
Exit	„Danke, das genügt. Bitte bleiben Sie stehen. Die Versuchsleitung holt Sie ab.“

ENG – English Version

This version is preliminary and not yet implemented!

Actions that can be triggered in TSST1 (Job interview)

(spoken by Judge)

Opinion about auditions	„What do you think of job interviews?“
Qualifications better than others?	„Why do you think you are more suitable than other applicants?“
Carry mistakes?	„Under what conditions would you be willing to share in the mistakes of your employees?“
Family & Friends	„What do your family and friends appreciate most about you?“
Your team contribution?	„What can you constructively contribute to a team?“
Opinion intelligence tests?	„What do you think of intelligence tests as part of recruitment processes?“
Your leadership qualities?	„What leadership qualities do you possess?“
Expected leadership qualities?	„What leadership qualities do you expect from your superiors?“
Lie for your own benefit?	„Would you lie to gain an advantage?“
Like colleagues?	„What do you value in colleagues?“
Like friends?	„What do you value in friends?“
Unpaid overtime?	„Would you be willing to work unpaid overtime if needed?“
Opinion Personality tests?	„What do you think of personality tests as part of the recruitment process?“
Expected qualities of colleagues?	„What qualities do you expect from your employees?“
Your special qualifications?	„Why do you think you are particularly suitable for this position?“
Strengths?	„What are your strengths?“
Your team position?	„Where do you see your position in a team?“
Teamwork?	„What do you think of teamwork?“
Time left	„You still have time. Please continue.“
Vain?	„Are you vain?“
Weaknesses?	„What weaknesses do you have?“
Work on weekends?	„Would you also work on the weekend?“

Actions that can be triggered in TSST2

(spoken by Judge)

Faster.	„Please calculate faster.“
Wrong.	„That was wrong. Please start over at 2023.“
Exit	„Thanks, that’s enough. Please remain standing. The researcher will pick you up.“

Appendix C – Allocated time spans for phases

Here you can find an overview of the allocated time spans for each specific phase in the Open TSST-VR.

Phase name	Function	Time span
VR preparation phase		
(not included in time calculation for the TSST)		
set_marker	Starts the routine; opportunity to sync with other devices (e. g. ECG)	00:10
calibrate_et	Calibrates HMD eye-tracking.	01:00
validate_et	Validates HMD eye-tracking settings.	01:00
baseline_sit	Time for baseline measures while sitting.	05:00
baseline_stand	Time for baseline measures while standing.	05:00
		<i>sum:</i> 12:10
TSST phase in stress protocol		
(included in time calculation for the TSST)		
instruction	Automatic instructions for the TSST (1min) and preparation phase (5min).	06:00
enter	Automatic entry judges; data for eye-tracking.	00:20
tsst1	Automatic start to the presentation task.	05:00
tsst2	Automatic instructions of the arithmic task (1min) and performance phase (4min).	05:00
end	Gremium Good-bye.	00:40
		<i>sum</i> 17:00
TSST phase in control protocol		
(included in the time calculation for the TSST)		
introduction	Automatic instructions for the TSST with repeat option.	00:38
preparation	Preparation phase for the TSST1.	05:00
start1	Start trigger for TSST1 and performance time.	05:14
instruction2	Automatic instructions for the arithmic task with repeat option.	00:40
start2	Start trigger for TSST2 and performance time.	05:04
end	Gremium Good-bye.	00:40
		<i>sum</i> 17:16
VR end phase		
(not included in time calculation for the TSST)		
exit	Automatic wrap-up of the VR situation.	02:00