Gaze3DFixGUI - Manual

With Gaze3DFixGUI you can **calculate 3D gaze points** and **detect 3D fixations** from binocular gaze data. Gaze3DFixGUI is a simple graphical user interface for the offline use of the Gaze3D and Fixation3D libraries.

Data:

For the computation of 3D gaze points, the positions of the left and the right eye as well as the 2D gaze points on the calibration plane from a binocular eye tracker are required. For the detection of 3D fixations the positions of the left and the right eye as well as 3D gaze points are necessary. All positions must be in the **same global three-dimensional coordinate system** using the **same measurement unit.**

The calculation uses **integer values** with no thousands separator. Non-integer values will be rounded but need to have a comma as decimal separator.

We recommend using **millimeters (mm)** as global measurement unit.

The coordinate axes are labeled having regard to the 2D calibration plane, which is usually a xy-plane. The software uses a **right-handed (or positive) coordinate system** with a **vertical xy-plane** and the z-axis is pointing towards the user or participant.

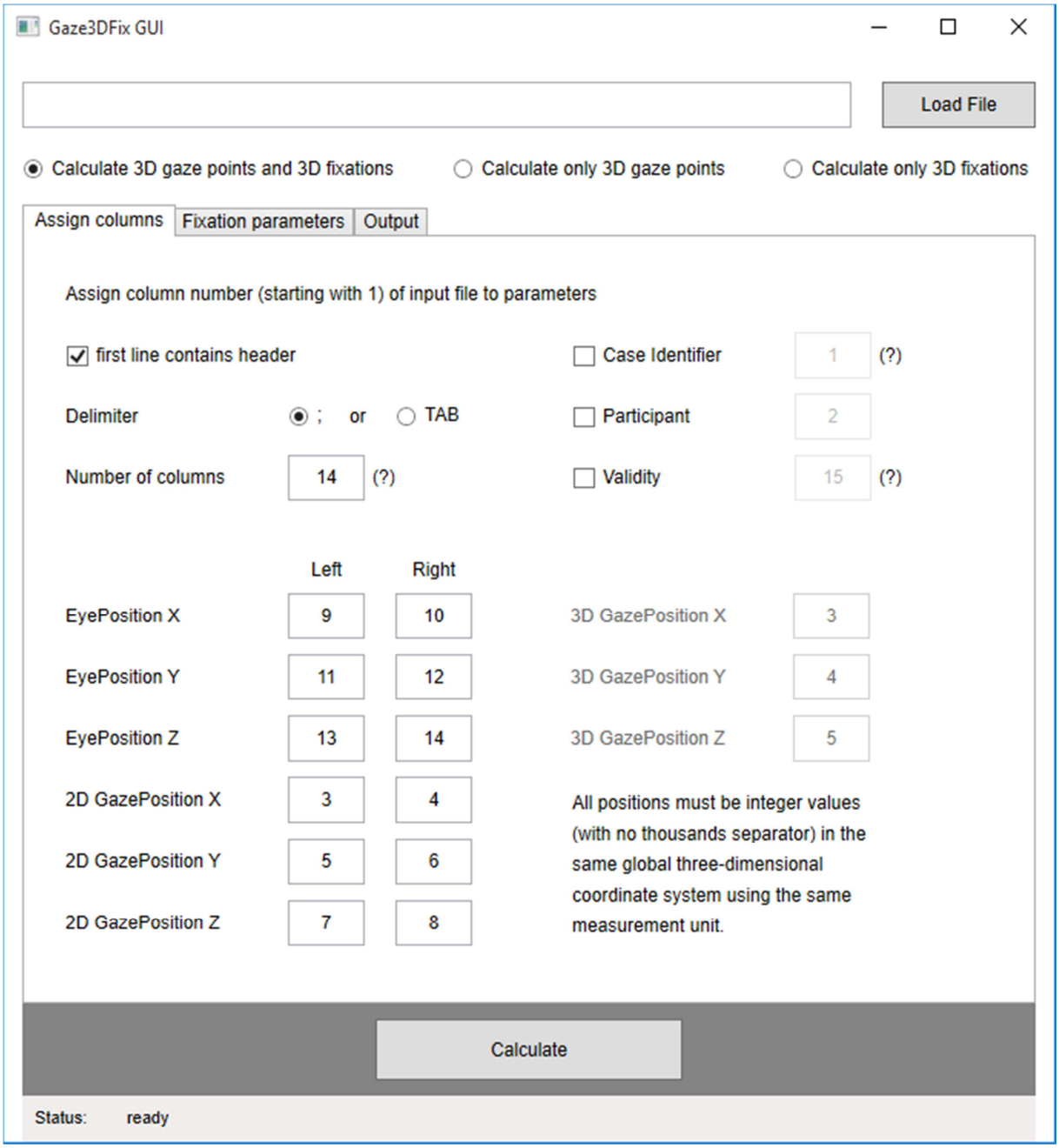
It is recommended to use the center of your eye tracker's calibration plane (the plane of the 2D gaze coordinates e.g. the center of your screen) as the **origin of your uniform coordinate system**. In this case the z position of the 2D gaze points should be 0 in the coordinate system.

Input file:

First you choose your input file. Your input data should be organized in a text file with columns delimited by semicolon or TAB. Supported file types are *.TXT and *.CSV. The input file doesn't require a special structure as the GUI enables you to assign the correct columns for each variable. Several data files can be loaded at once, as long as they have the same structure. Choose "Load File" to load your input file.

Second, depending on whether you choose to calculate only 3D gaze points, only 3D fixations or both, the GUI requires you to assign different input parameters.

The parameters are organized in up to three tabs.



Assign columns:

The first tab is called "Assign columns". Here you can specify your input file by assigning column numbers (starting at 1) to parameters. Please be sure to define the correct number of columns in your input file as well as setting the checkbox concerning header and delimiter. Some of the parameters are optional and can be enabled or disabled.

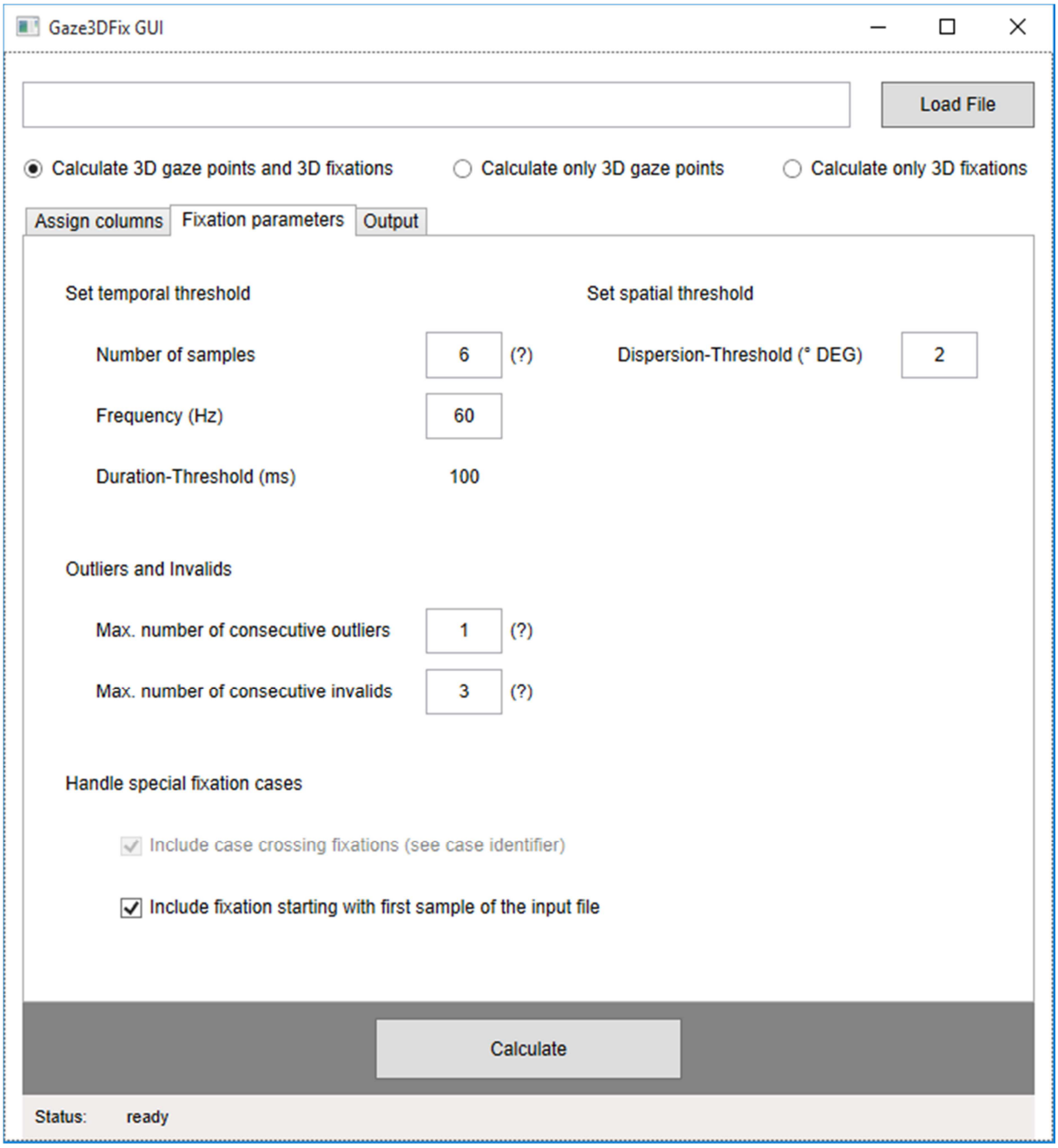
The variables for the columns "Participant" and "Case Identifier" will be copied to the output files. A "Case Identifier" can be the name of a trial or stimuli. Please note the additional information for "Special fixation cases" in Fixation parameters. If desired, you can use "Validity" to assign a column containing 0s and 1s indicating whether a sample is valid or not.

Validity is only relevant for the calculation of 3D fixations as a single fixation cannot include more than one invalid sample (outlier). See algorithm for more details. The application will categorize every sample as valid (1), if "Validity" is not enabled.
If you are going to calculate only 3D gaze points or both 3D gaze points and 3D fixations, you will need to define columns for the x, y and z positions of the left and the right eye (EyePosition) as well as the positions of the 2D gaze points on the calibration plane (2D GazePosition). For the 2D gaze points the z position in the uniform coordinate system is required, too.
In order to calculate only 3D fixations, you have to assign columns for the x, y and z positions of the left and the right eye (EyePosition) and the positions of the 3D gaze points (3D GazePosition).

Fixation parameters:
If you choose to calculate 3D fixations or both 3D gaze points and 3D fixations, the second tab will be named "Fixation parameters". If not, the tab will be hidden. Here the spatial and temporal thresholds for the detection of 3D fixations need to be specified. Since the algorithm uses a minimum number of samples, the temporal threshold can be set directly via entering the minimum number of samples. The frequency of the used eye tracking system is needed to calculate the duration of each fixation in milliseconds and is also used to display the minimum temporal threshold in milliseconds. The spatial threshold, the threshold of gaze point deviation, should be entered in degrees (1° = $\frac{1}{57,3}$ rad) and refers to the visual angle.

Use outliers to define the maximum number of consecutive samples that can be outside of the ellipsoid tolerance area and invalids to define the maximum number of consecutive sampes that are untracked.

Special fixation cases:
If you have specified a column for "Case Identifiers", fixations that span across more than one "Case Identifier" will be associated with the identifier from the fixation start. You can choose to exclude case crossing fixations by unchecking "Include case crossing fixations".
A fixation that starts with the first sample of an input file will be included in the output file by default. If you want to exclude fixations that may have started prior to the first sample and that are still ongoing, uncheck "Include fixations starting with the first sample of the input file".



Output:

The last tab is called "Output". You can choose the output file type (*.TXT and *.CSV) and whether the output file should be opened after the calculation. Depending on the output file type the output data will be separated by semicolons (*.CSV) or TABs (*.TXT).

Calculate:

Press "Calculate" to start the computation. The user interface will be locked during the calculation except for the cancel button. Press "Cancel" to abort the calculation.
See the status bar at the bottom for information on the progress.

Done:

Once the calculation has finished, the notification "Done" will pop up. Click "OK" to regain access on the rest of the user interface.

Output files:

For each loaded data file one output file containing the assigned columns of the data file plus the computed 3D gaze points per sample and one output file containing the parameters of the detected 3D fixations are created. The output files will be named exactly like their input file starting with the prefix "output_Gaze3D_" or "output_Fixations3D_". All output files will be created in the same directory as the application.

Caution: Files with identical names will be overwritten!

Output Gaze3D

parameter name	Description
Gaze3D_SampleID	id of the data sample in ascending order
CaseIdentifier*	indentifier value from the original input file (e.g. trial)
Partipcipant*	participant information from the original input file
Validity*	validity of the sample copied from the original input file
EyePosX_left	x value for the position of the left eye
EyePosY_left	y value for the position of the left eye
EyePosZ_left	z value for the position of the left eye
EyePosX_right	x value for the position of the right eye
EyePosY_right	y value for the position of the right eye
EyePosZ_right	z value for the position of the right eye
Gaze3DX	x value for the 3d gaze position of the right eye
Gaze3DY	y value of the 3d position of the right eye
Gaze3DZ	z value of the 3d position of the right eye

* optional.

Output Fixations3D

parameter name	Description
Fixation3D_SampleID	id of the data sample in ascending order
CaseIdentifier*	indentifier value from the original input file (e.g. trial)
Partipcipant*	participant information from the original input file
FixationPosX	x position of the fixation centroid
FixationPosY	y position of the fixation centroid
FixationPosZ	z position of the fixation centroid

EllipsoidRadiusX	x radius of the 3D fixation ellipsoid
EllipsoidRadiusY	y radius of the 3D fixation ellipsoid
EllipsoidRadiusZ	z radius of the 3D fixation ellipsoid
EllipsoidYaw	the ellipsoid's rotation around the y axis
EllipsoidPitch	the ellipsoid's rotation around the x axis
SaccadeDuration_Samples	number of samples in the saccade
SaccadeDuration_MS	saccade duration in milliseconds
FixationDuration_Samples	number of samples in the fixation
FixationDuration_MS	fixation duration in milliseconds
Start_Gaze3D_SampleID	first Gaze3D_SampleID in the fixation
End_Gaze3D_SampleId	last Gaze3D_SampleID in the fixation

* optional.

Installation:

There is no installation necessary.

The executable application file is called "Gaze3DFixGUI.exe".

The application comes with two dynamic link libraries (Gaze.dll and Fixation3D.dll). Both libraries need to be placed in the same directory as "Gaze3DFixGUI.exe" in order to run the application. There is also a "settings.xml" file that will be generated at runtime containing default parameters. Once created, it serves as a persistent storage and holds all the parameters entered in the user interface for the next application start, until it gets deleted. The settings file is a template file and can be exchanged and saved for reuse.

System requirements (tested):

- Windows operating system (Windows 7 or later)
- Microsoft .NET Framework version 4.5 or later must be installed on the client machine. (see https://www.microsoft.com/de-DE/download/details.aspx?id=40773)