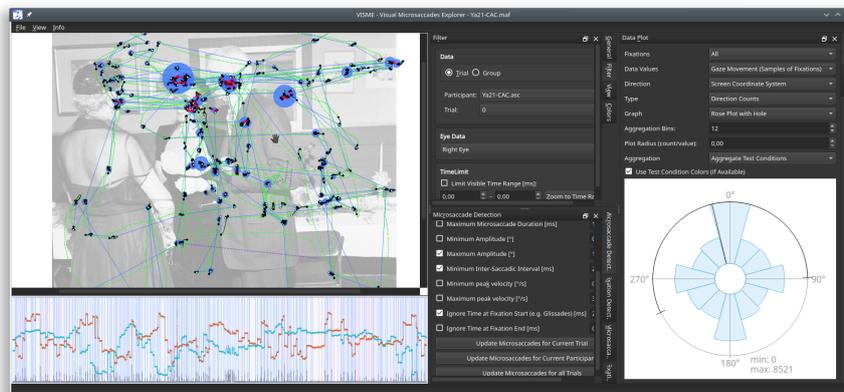


# VISME – Visual Microsaccades Explorer

## Introduction: Views and Features

**VISME** (Visual Microsaccades Explorer) is a visual analytics system to explore high frequency eye tracking data with a special focus on **microsaccades**. Microsaccades are small and fast involuntary eye movements within fixations; they can be seen as small versions of saccades. Their exploration can take place on different levels, for fixations, participants, trials, and test conditions using data of individuals as well as groups of participants. The system provides multiple views, eye movement filters, visibility filters and further options to support users in their exploration.



## Eye Movement Filters

The system provides two eye movement filters with adaptable parameters; they can be found in the settings tabs *Microsaccade Detection* and *Fixation Detection*. The *Microsaccades filter* is based on the algorithm by Engbert and Kliegl (2003). The *Fixation filter* uses the same algorithm to detect saccades and areas that are not labeled as saccades are considered as fixations. Both filters allow the definition of different parameters. These include a velocity threshold, minimum duration and minimum inter-saccadic interval.

## Exploration Modes

Two *Exploration modes* are available to explore trials; these can be found in the settings tab *Filter*:

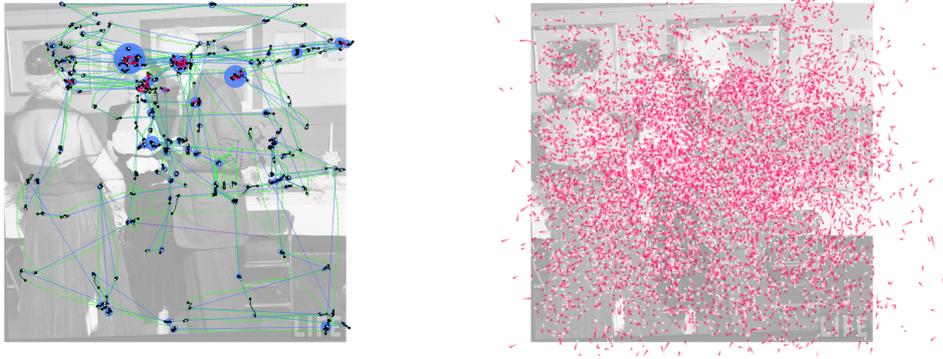
- *Trial Mode* to explore a specific trial of one participant.
- *Group Mode* to explore aggregated data for multiple trials of possibly multiple participants.

Additionally, the eye type (left, right or averaged values from both eyes) can be selected.

## Views

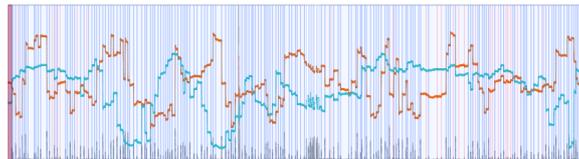
### Stimulus View

The *Stimulus View* shows the background image of a trial and the eye movement. In *Trial Mode* the raw eye movement is shown; fixations and microsaccades can be highlighted and a scanpath can be shown. In *Group Mode* only microsaccade directions are visible.



### Timeline View

The *Timeline View* is only available in *Trial Mode*. It shows the x (orange) and y (turquoise) position of the eye movement as well as velocity values (gray), fixation (blue) and microsaccade (pink) areas.



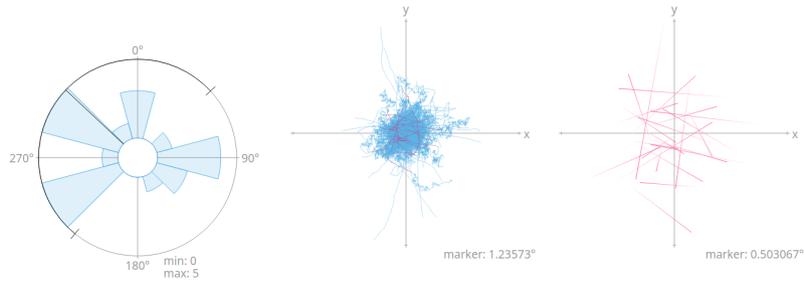
Elements visible in these two views can be adapted in the settings tab *View*. Selecting a fixation in either of these two views highlights the fixation in the other one as well. Additionally, the fixation is marked in the list of fixations (settings tab *Fixations*) and a list of its microsaccades can be found in the settings tab *Microsaccades*.

### Data Plots

The data plots (settings tab *Data Plot*) can show directional information on microsaccades.

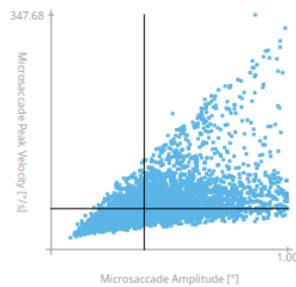
The direction of microsaccades (*Direction Counts*) can be visualized either according to the screen coordinate system or in relation to neighboring saccades. It can be used for all available fixations or a set of fixations (e.g. the currently selected one) to see how many microsaccades moved to each direction. The black line shows the mean direction and the arc the standard deviation.

The movement direction, amplitude and position of gaze samples and microsaccades in relation to the fixation center (*Movement in Relation to Fixation Center*) can also be explored. For gaze samples, this is a close-up visualization of fixation samples plotted on top of each other with highlighted microsaccades. For microsaccades, the start and end positions are connected by a line and a color gradient is used for the direction: from pink to white.



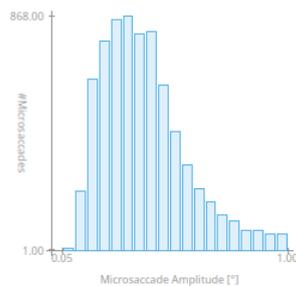
## Scatterplots

Scatterplots (settings tab *Diagrams*) can be used to visualize the relationship between amplitude, velocity and duration of microsaccades. It is possible to visualize the main sequence.



## Bar charts

Bar charts (settings tab *Diagrams*) can be used to visualize the start position of microsaccades within fixations as well as the duration, amplitude and peak velocity of microsaccades.



## General Information

General information about the data set (e.g. microsaccades per second) can be found in the settings tab *General*. Minimum, maximum, mean and median values are provided.

## Further Remarks

Our system has additional features but these are the most important ones for getting started and to explore the data set.