

VizFix User Manual

Created: 6/25/10 Last Update: 7/22/10

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1. Introduction

VizFix is a research tool for visualizing gaze fixations and other data from eye tracking experiments. VizFix can replay an experimental session with real-time eye movement data superimposed on the display. It can also provide a summary visualization for the data within a period of time. VizFix provides facilities for defining regions of interests and collecting a range of statistics from eye movement data.

VizFix is developed at the University of Oregon Cognitive Modeling and Eye Tracking Laboratory. It has been revised several times in order to make it adaptable to many different eye tracking experiments. For example, the current version VizFix 1.0 was adapted to a multimodal multitasking experiment, in which the visual stimuli can appear at any locations and move. VizFix can also work with the the eye movement data generated by the E-Prime Extension for Tobii.

This manual explains the basic functionality and features of VizFix 1.0. The eye movement data used in this manual are from our multimodal multitasking experiment. The data file can be found in the sample data folder that comes with the manual.

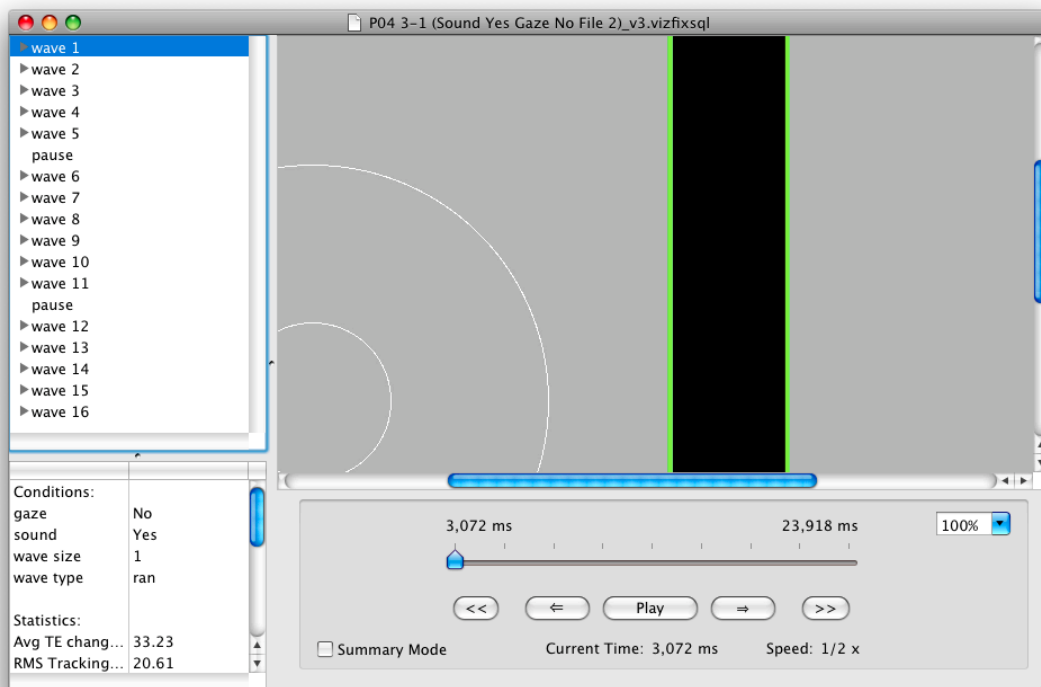
2. Installation

VizFix only runs on Mac, so make sure you have Mac OS X 10.5 or above.

VizFix software consists of two components: the visualization program (VizFix.app) and a framework (VizFixLib.framework) that provides basic functions for developing tools that can work with VizFix data files.

To install VizFix, just put the VizFixLib.framework folder in /Library/Framework/, which is a standard location for storing frameworks. The VizFix.app program can run from anywhere, although typically it should be put in the Application folder.

Now you can start VizFix.app. After the start up, VizFix will not show anything but a menu. You can select from the menu “File -> Open...” to open the sample VizFix data file or any other vizfixsql files. If you choose to open the sample data, you will see a window like the following. Maximize the window to see the full layout of the sample experiment (shown in the top right panel).



The remainder of the manual will explain what needs to be done to visualize your experimental data and what you can do with the visualization program VizFix.app.

3. Background

This section explains what the extension programs are and how they work in general. This section is not an instruction for building such extension programs. If you are familiar with Objective-C and Core Data, you can study the code and write extension programs.

3.1. VizFix Data File

A VizFix data file is basically a database which contains various information about the experiment. VizFix does not rely on screen recordings to create visualizations. Instead, it uses the information stored in the database such as when and where a visual stimulus appeared, what the stimulus looks like, and when it disappeared to recreate the experiment layout, and it uses the eye movement information to create the visualizations for the eye movements.

The sample data file, “P04 3-1 (Sound Yes Gaze No File 2)_v3.vizfixsql” is created by a VizFix extension program which translates the log data from the sample experiment into VizFix data files. If you want to use VizFix for your eye tracking experiment, typically you need to do the following things:

1. Decide what data in your experiment you want to visualize with VizFix. This typically includes eye movement data and locations of some visual stimuli. Other data such as key presses and audio events can also be stored in VizFix data files.
2. Design the experimental software so that it logs the eye movement data and other data you want to visualize later in VizFix.
3. Build a VizFix extension program to translate the log files into VizFix data files.

3.2. More about VizFix.app and VizFixLib.framework

The visualization program VizFix.app is the main component of VizFix, and the name “VizFix” generally refers to this application. VizFix.app displays static and moving visual stimuli, and notify other events such as key-presses and custom events, as long as these events were logged during the experiment and were appropriately imported.

The VizFixLib.framework is a collection of classes and functions that can be used to:

- Access entities that are stored in VizFix data files.
- Detect fixations.
- Define regions of interests (ROIs).
- Assign fixations to stimuli or ROIs.

3.3.Tools for Importing and Analyzing Data

As explained earlier in the Installation section, extension programs needs to be developed for importing (translating) raw data and analyzing data for a specific experiment. Since VizFix is written in Objective-C and runs on Mac OS X, knowledge of building software on Mac is needed for developing such tools.

Data Importing Programs: If there is no existing program to translate the specific experimental data format into VizFix format, then researchers need to create their own data importing tool. Mainly, three types of information needs to be imported:

- experimental design such as structures of blocks and trials, as well as their time spans,
- the shapes and appearances of visual stimuli, and their locations at various points in time, and
- gaze samples reported by an eye tracker.

These are the minimum requirements of a data importing program, other information can be imported if needed.

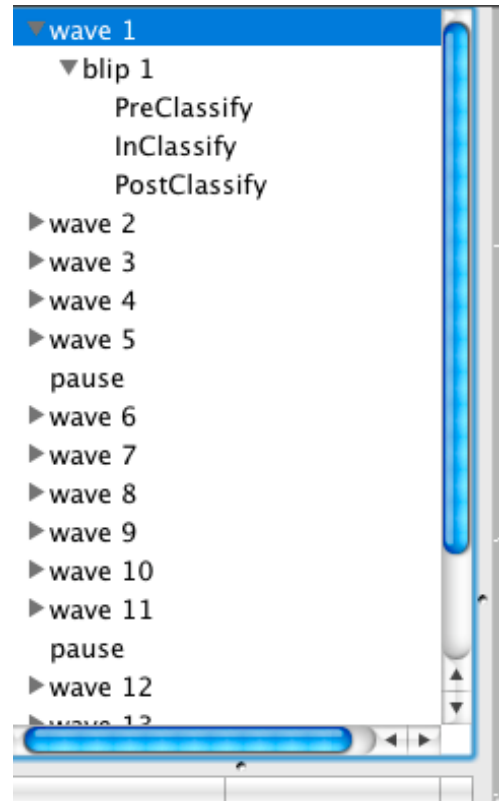
Data Analyzing Programs: Based on the VizFix framework, researchers can write analysis programs that are tailored to their own experiments. In addition, some analysis programs can be applied more generally, e.g. a program that output fixation scanpaths, fixation duration, or number of fixations within every experimental group. At this point, these general analysis programs are still under development. Since VizFix data format is structured, analyzing VizFix data is much easier than analyzing raw log files. With the help of the framework, the process of writing analysis tools should be further simplified.

One important function of analysis programs is to collect statistics for each experimental unit or group. Such statistics can be stored in VizFix's data files and displayed in the visualization program so that they can be easily compared across groups.

4. Use VizFix

4.1. Browse Experimental Groups

An experimental session often has multiple blocks and a block often has multiple trials. This structure is shown in VizFix as a tree view in the top-left panel. In the sample data, a block is called a wave, a trial is called a blip, and inside the trial there are subtrials as you may notice in the graph shown on the right. You can view the information about an experimental group by selecting that group. Only one group can be selected at a time.

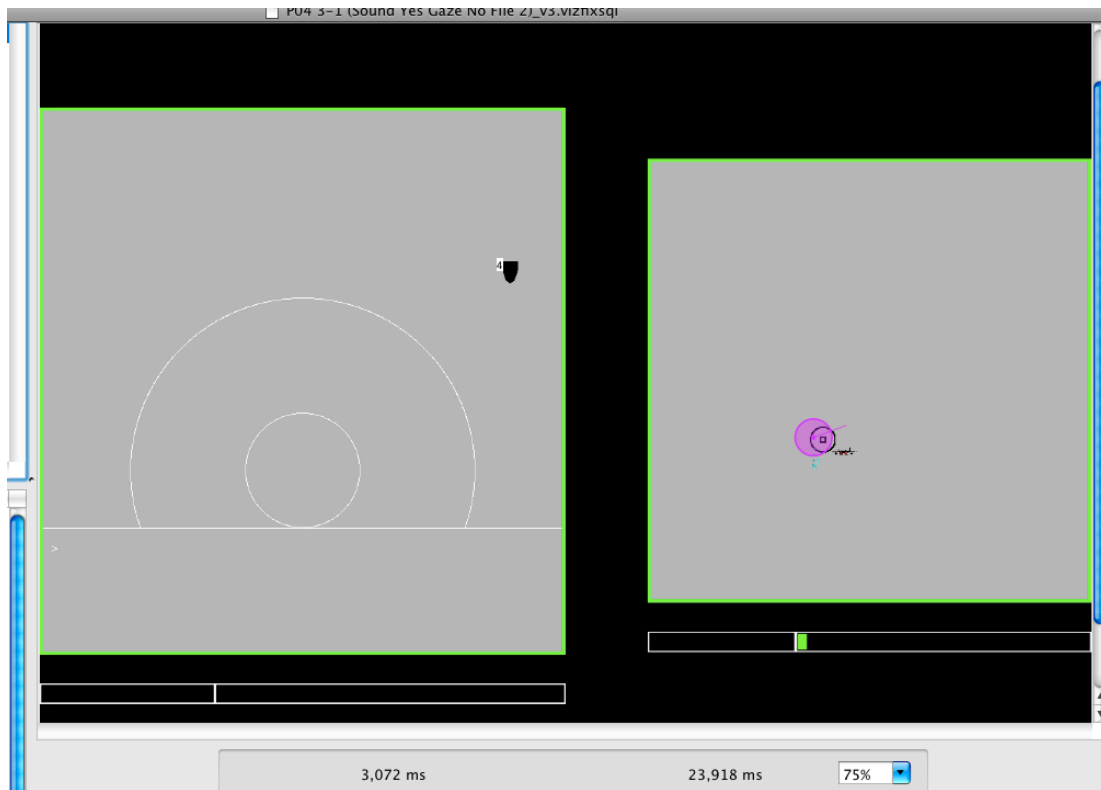


Conditions:	
gaze	No
sound	Yes
wave size	1
wave type	ran
Statistics:	
Avg TE changes per s...	33.23
RMS Tracking Error	20.61
number of transitions	4
radar duration	502
tracking duration	23861
valid gaze rate	100%
Session Info:	
Experiment	NRL Dual Task
Date	Jul 31, 2008
Time	4:32:37 PM
Subject	P04
Session	3-1
Duration (seconds)	528

4.2. Inspect Conditions and Statistics of An Experimental Group

After selecting an experimental group, the bottom-left panel is updated with the conditions and statistics about the selected group. The left graph shows information about the group “wave 1”. This information is either created when importing the experiment log files or added afterwards by VizFix data analyzing extension programs. Therefore, developers of the importing and analyzing programs can decide what information to show in the bottom-left panel.

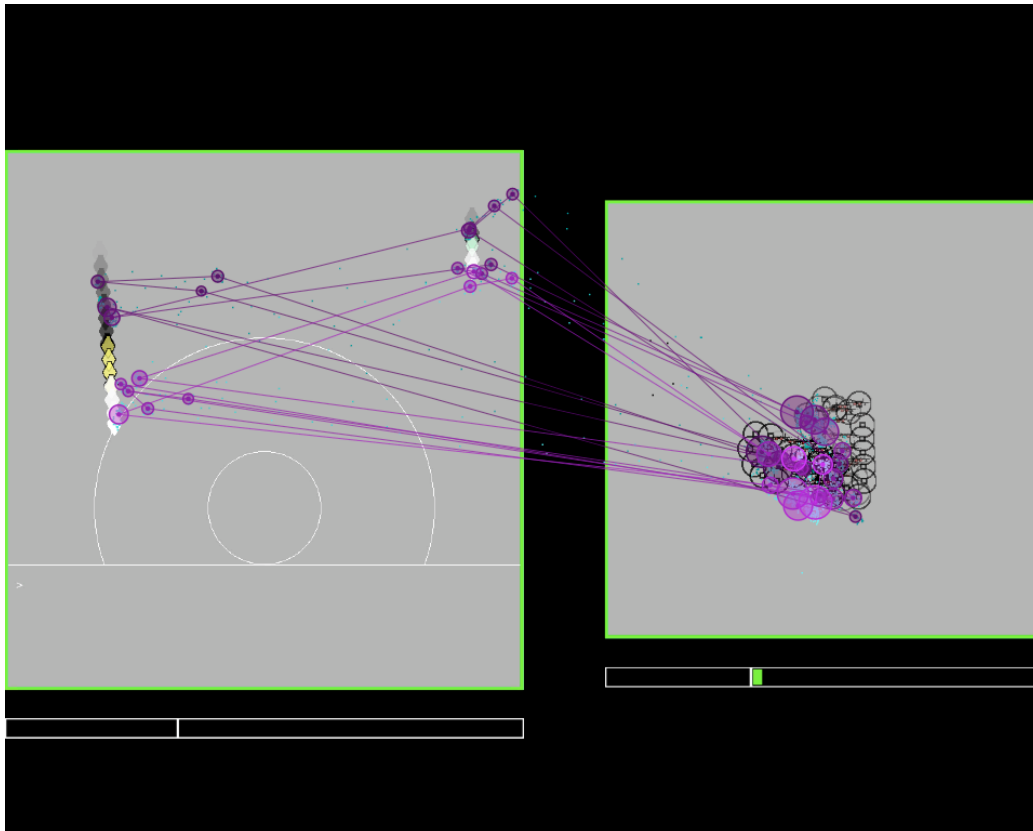
4.3. Visualization



The top-right panel displays the visualization for the selected group. The above figure shows an example of the visualization at a particular point in time. In this figure, the visual stimuli include: the background, the black oval in the left rectangle, the reticle and the black circle in the right rectangle. If you click the “Play” button in the bottom-right panel, you can see that some of these stimuli can move. This is not done through playing a screen recording, but by recreating every frame from the information provided in the data file. The fixation is shown in the visualization as a translucent purple circle (the color can be changed in the preferences), and the raw gaze samples that occur within 100 ms of the current time are shown as blue dots. You can choose to show gaze samples or not by checking or unchecking the “View -> Show Gaze Samples” menu item.

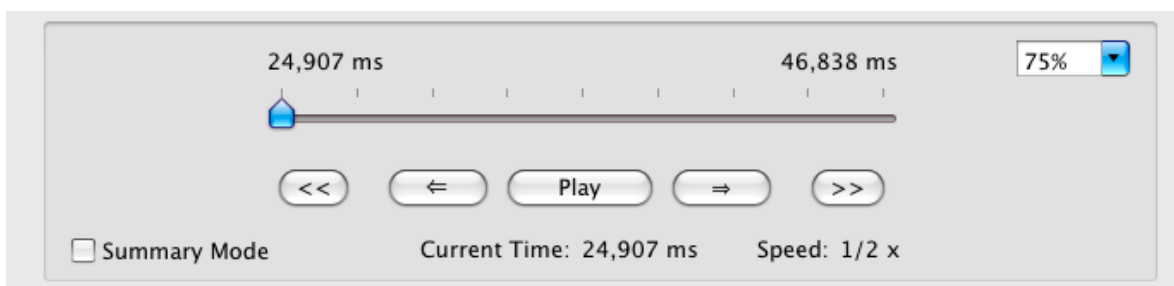
VizFix can display some other visual elements that help researchers to examine the data. These elements include:

- Labels. You may want to assign labels (e.g. trial ID) to some stimuli to help you distinguish them. These labels can be created in the importing process. Then you can choose to show them by checking menu “View -> Show Label for Visual Stimuli”.
- Distance guides. Distance guides give you a sense of how large the distance is between some objects. They are shown as gray circles around some visual stimuli. The radius of distance guides can be changed in the preferences. You can choose to show distance guides by checking menu “View -> Show Distance Guides”.



One great feature of VizFix is its ability to show summary visualization for a period of time. One can enable the summary visualization mode by checking the “Summary Mode” box in the bottom-right panel. For example, the above graph shows the summary visualization for the entire “wave 2” of the sample data. In the summary visualization mode, all the fixations and gaze samples occurred in the selected period of time would be shown simultaneously, and the darker the fixations or gaze samples appears to be, the earlier they occurred. If the visual stimuli were moving, their locations will be sampled so that the sampled locations indicate their moving trail.

4.4. Playback Control



The bottom-right panel contains several buttons to control the playback of the visualization. You can directly drag the slider to see the visualization at a certain point in time. You can click the “<=” and “=>” buttons to step forward to the next fixation or

backward to the previous fixation. You can also control the playback speed by clicking “<<” and “>>” buttons. The box on the top-right corner controls the scale of the visualization. Finally, if the “summary mode” box is checked, the visualization will become a summary of the selected group.

4.5. Detect Fixations

VizFix provides the dispersion-based fixation detection algorithm. You can use this algorithm by clicking “Tools -> Detect Fixations...”. Then you can set the parameters for the algorithm in the popup dialog and choose to detect fixation for either the selected group or the entire session. If there are already fixations in the data file, this process will delete the original fixations and create new fixations based on the new parameter settings. After detecting fixations, you can save the new fixations by clicking “File -> Save”.

4.6. Capture Visualization

The visualization can be saved to an image file via “Tools -> Capture Visualization”. The image file will be put on the desktop with the name “visualization [date-time].tiff”.