ViewPoint EyeTracker ®

DataAnalysis User Guide

Arrington Research
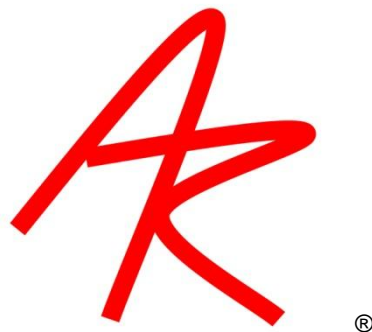
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Chapter 1. **Introduction**

The *ViewPoint EyeTracker ®* is provided with a basic and easy to use DataAnalysis program. You can use this program to view and play back your data.

While we welcome feedback, please note that this program is provided as a means to get you started with your data. In most cases this will be enough, although some users may require developing their own methods of analyzing the data.

Chapter 2. **Opening and Viewing a DataFile**

DataAnalysis.exe
ViewPoint DataAnalysis
Arrington Research, Inc.

Double click the DataAnalysis.exe program located in the Viewpoint folder.
Click on the file open icon at the top of the application, this will open the Viewpoint data folder and you can then select your data file.

2.1 **The Controls window > Play Tab**

This tab controls the play back of the data.

Figure 1.   Controls Window > Play Tab

- **Play Button:** Plays the current data file by advancing the current data point by 1. Once the last data point is reached, DA starts playback over at the first data point.
- **Rewind Button:** Stops playback and sets the current data point to the first data point.
- **Stop Button:** Stops playback and the current data point remains unchanged so the user can resume playback from the stopped position.
- **Play Speed Slider:** Adjusts the play speed for playback.
- **Frame Number Edit Box/Spin:** Displays the current movie frame. The *Frame Number* spin control allows the user to navigate through the movie frame by frame.
- **Data Point # Edit Box/Spin:** Displays the current data point. The *Data Point* spin control allows the user to navigate through the data points point by point.
- **Data Time Edit Box:** Displays the Total Time for the current data point. The user can change the time to navigate through the data points. DA automatically set the current data point to the data point that has a Total Time

greater than or equal to the data time and adjusts the data time to match the exact Total Time of the current data point.

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2.2 The Controls window > Signal Tab

Figure 2.   Controls Window > Signal Tab
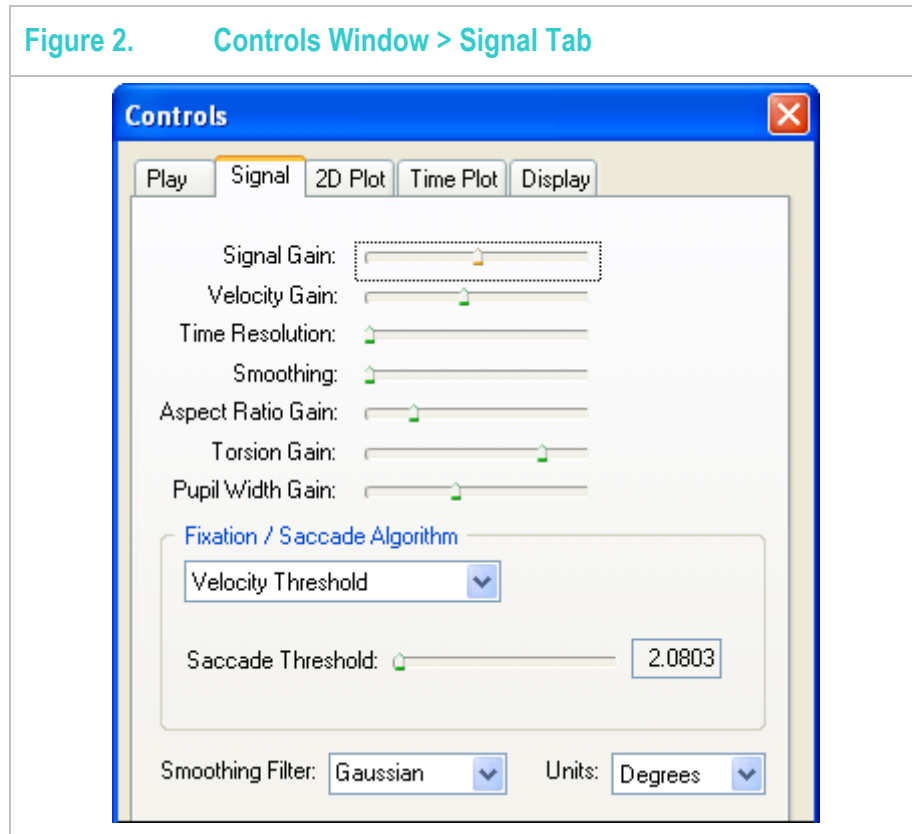
- **Signal Gain Slider:** Sets the gain for the x position and y position plots in the *Time Plot* window. The gain is a y-axis scale factor (multiplier) that allows the user to change the y-axis viewing resolution.
- **Velocity Gain Slider:** Sets the gain for the x velocity, y velocity, and the velocity magnitude plots in the *Time Plot* window. The gain is a y-axis scale factor (multiplier) that allows the user to change the y-axis viewing resolution.
- **Time Resolution Slider:** Sets the time resolution for all plots in the *Time Plot* window. The time resolution is an x-axis scale factor (multiplier) that allows the user to change the x-axis viewing resolution.
- **Smoothing Slider:** Sets the Kernel size for the selected *Smoothing Filter*. The formula used to calculate the Kernel is: Kernel = (2 * SmoothingPos) + 1. No smoothing occurs when the *Smoothing* slider position is set to 0 creating a Kernel value of 1. Larger Kernel values produce more smoothing than smaller Kernel values.
- **Aspect Ratio Gain Slider:** Sets the gain for the pupil aspect ratio plot in the *Time Plot* window. The gain is a y-axis scale factor (multiplier) that allows the user to change the y-axis viewing resolution.
- **Torsion Gain Slider:** Sets the gain for the torsion plot in the *Time Plot* window. The gain is a y-axis scale factor (multiplier) that allows the user to change the y-axis viewing resolution. Torsion not implemented.

- Pupil Width Gain Slider

  The *Pupil Width Gain* slider sets the gain for the pupil width plot in the *Time Plot* window. The gain is a y-axis scale factor (multiplier) that allows the user to change the y-axis viewing resolution.

- **Smoothing Filer Drop List:** Sets the current Smoothing Filter for smoothing the data. The current, available filters the user can select from are Uniform and Gaussian. The user can change the amount of smoothing by adjusting the *Smoothing* slider.

- **Units Drop List:** Sets the current units for the Fixation/Saccade Algorithm. When the algorithm is Velocity Threshold, the units change for the *Saccade Threshold* slider. When the algorithm is Dispersion Centroid, the units change for the *Max Dispersion* edit box. The current, available units the user can select from are normalized, degrees, and radians. The degrees and radians options are only available for data files in which the screen width, height, and distance have been set using the geometry setup in *ViewPoint.* Please make sure the geometry setting are setup correctly if the degrees or radians units are used.
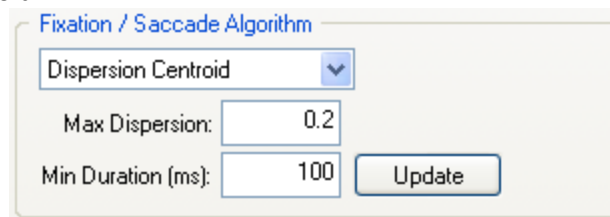
2.2.1   Fixation / Saccade Algorithms

There are two algorithms available to identify fixations and saccades.

1. Velocity Threshold
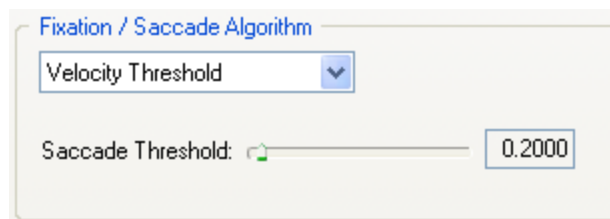
The Velocity Threshold algorithm finds fixations and saccades by identifying the saccades by finding total velocities that are greater than the saccade threshold. Anything not considered a saccade is considered a fixation. Changing the saccade threshold changes the number of fixations and saccades identified. The user can change the saccade threshold by adjusting the *Saccade Threshold* slider. The saccade threshold value is shown to the right of the slider in the *Saccade Threshold* edit box. The units of the saccade threshold are indicated by the selection made in the *Units* drop list.

2. Dispersion Centroid

The Dispersion Centroid algorithm finds fixations and saccades by identifying the fixations by using a weighted position that allows for the human eye to first land close to the object of interest and then for micro saccades

to adjust the eye to the object that we want to fixate. The fixations in this case would only consist of those data points that follow the adjustments made after the eyes landing position.

Falkmer, T., et al., *Fixation identification in Centroid versus Start-point modes eye tracking data.* Perceptual and Motor Skills., 2008(106): p. 710-724.

Anything not considered a fixation is considered a saccade. Changing the max dispersion and min duration changes the number of fixations and saccades identified. The user can change the max dispersion and min duration by directly editing their values in the edit boxes. The units of the max dispersion are indicated by the selection made in the *Units* drop list. In order for changes of max dispersion and min duration to take affect, the user must press the *Update* button. Because the post processing of the algorithm can take a while depending in the input values, a cancel/status dialog is show after pressing the *Update* button. The user can cancel the update at anytime without affecting the current fixations and saccades. Below is the *Cancel* Dialog.
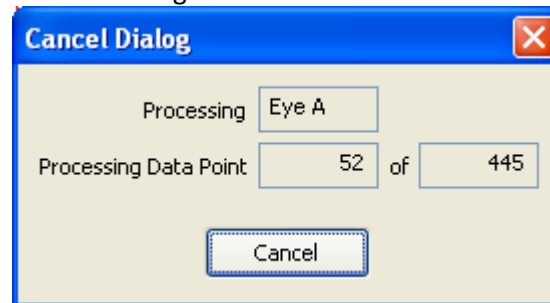
2.3 Controls Window > 2D Plot Tab

Figure 3.   Controls Window > Play Tab
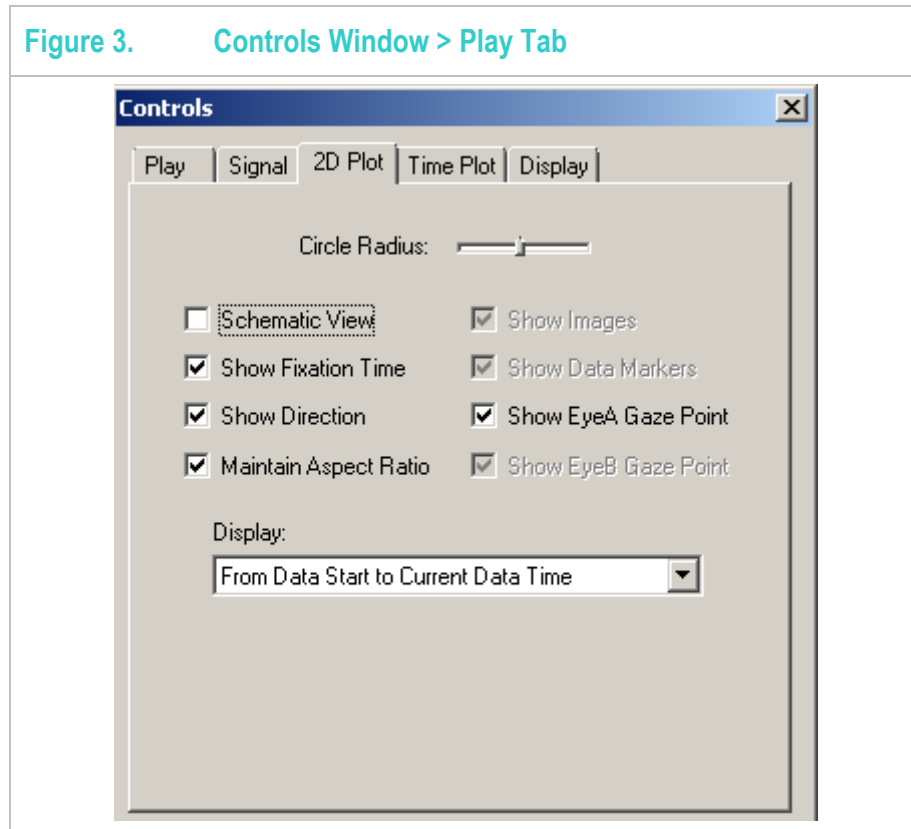
- **Schematic View Check Box:** Toggles the schematic view in the *2D Plot* window. In schematic view, the *2D Plot* window draws a circle around the mean data point for the current fixation event. The area of the circle is proportional to the fixation total time. Schematic view is only available for images, not movies.

- **Show Direction Check Box:** Toggles the show direction state in the *2D Plot* window. In show direction mode, arrows are used to indicate direction for both saccade and fixation lines. When the show direction mode is not used, the saccade and fixation lines are shown without direction being indicated. Show direction mode is only available for images, not movies.

- **Show Images Check Box:** Toggles the show images state when displaying images in the *2D Plot* window. In show images mode, the *2D Plot* window displays the image associated with the current data point. If there is no associated image the 2D Plot window displays either a blank window or an image that the user manually loaded. Show images mode is only available for images, not movies.

- **Show Fixation Time Check Box:** Toggles the show fixation time state when displaying fixations in the *2D Plot* window. In show fixation time mode, the *2D Plot* window displays the fixation total time at the mean data point for each respective fixation event. Show fixation time mode is only available for images, not movies.

- **Show Data Markers Check Box:** Toggles the show data markers state in the *2D Plot* window. In show data markers mode, the *2D Plot* window displays data markers at their respective x/y positions. Show data markers mode only affects drawing in the *2D Plot* window and does not affect drawing in the *Events* window and the *Time Plot* window.
- **Show EyeA/B Gaze Point Check Box:** Toggles display of the gaze point as calculated by the DataAnalysis Program.
- **Maintain Aspect Ratio Check Box:** Toggles the maintain aspect ratio state. In maintain aspect ratio state, the *2D Plot* window is kept at the proper aspect ratio for both movies and images. Anytime the *2D Plot* window size changes, the software automatically adjusts the window size to maintain the aspect ratio of 4:3 (w:h).
- **Circle Radius Slider:** Sets the circle size when drawing circles in the *2D Plot* window. The circles that are directly affected by this slider are fixations in schematic view and gaze points in movie playback mode.
- **Display Drop List:** The *Display* drop list gives options for how the data points are drawn in the *2D Plot* window relative to time.

> **All Data –** This option forces the *2D Plot* window to display graphics for all the data points at once.

> **From Data Start to Current Data Time –** This option forces the *2D Plot* window to display graphics from the first data point to the current data point.

> **From Previous Image to Current Data Time –** This option forces the *2D Plot* window to display graphics from the previous image to the current data point.

2.4 Controls Window > Time Plot Tab

Figure 4.   Controls Window > TimePlot Tab
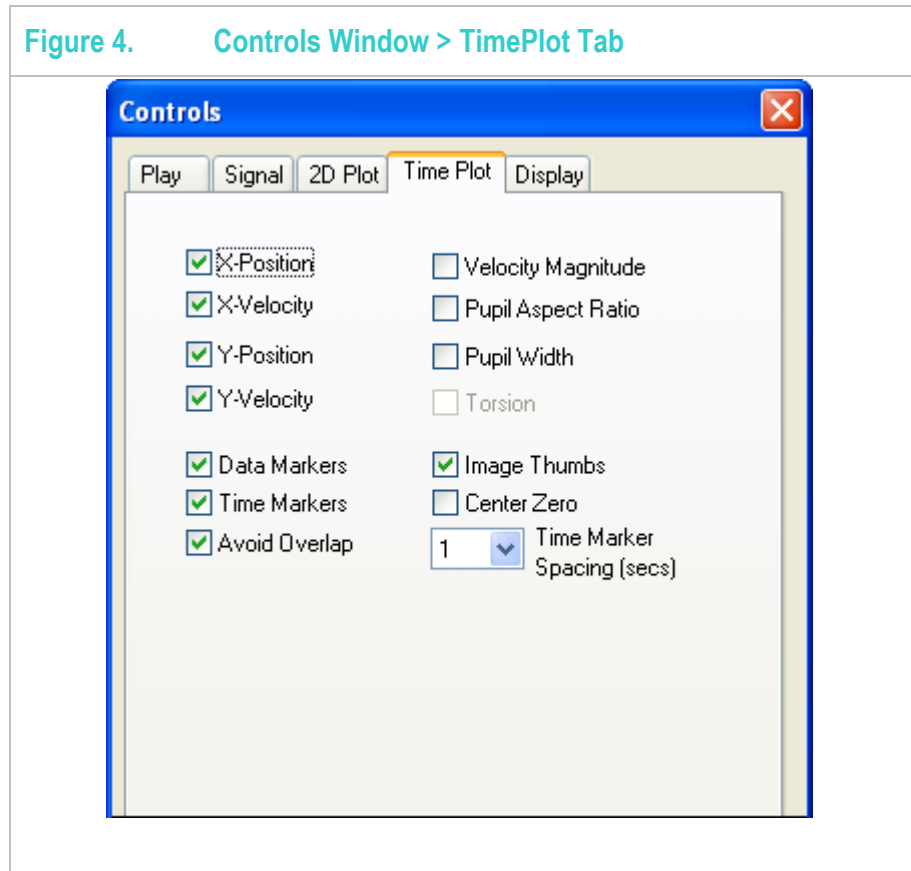
- **X-Position Check Box:** Displays the x position plot in the *Time Plot* window. The x position is the gaze x position from the data file.
- **X-Velocity Check Box:** Displays the x velocity plot in the *Time Plot* window. The x velocity is in units of normalized/ms calculated from (delta gaze x * frame rate). The frame rate is used rather than the delta time to create a smoother data set.
- **Y-Position Check Box:** Displays the y position plot in the *Time Plot* window. The y position is the gaze y position from the data file.
- **Y-Velocity Check Box:** Displays the y velocity plot in the *Time Plot* window. The y velocity is in units of normalized/ms calculated from (delta gaze y * frame rate). The frame rate is used rather than the delta time to create a smoother data set.
- **Velocity Magnitude Check Box:** Displays the velocity magnitude (total velocity) plot in the *Time Plot* window. The velocity magnitude is in units of normalized/ms calculated using the Pythagorean theorem on the x velocity and y velocity (sqrt((Velx * Velx) + (Vely *Vely))).

- **Pupil Aspect Ratio Check Box:** Displays the pupil aspect ratio plot in the *Time Plot* window. The pupil aspect ratio is the pupil aspect ratio from the data file.
- **Pupil Width Check Box:** Displays the pupil width plot in the *Time Plot* window. The pupil aspect ratio is the pupil width from the data file.
- **Torsion Check Box:** Torsion not implemented.
- **Data Markers Check Box:** Displays the data markers in the Time Plot window. A data marker is a data marker from the data file.

- **Time Markers Check Box:** Displays the time markers at the bottom of the *Time Plot* window showing each time interval specified by the *Time Marker Spacing* drop list.
- **Avoid Overlap Check Box:** Prevents individual plots from overlapping inside the *Time Plot* window.
- **Image Thumbs Check Box:** Displays the thumbnails for each image associated with the current data file in the *Time Plot* window.
- **Center Zero Check Box:** Adjusts the plot y-scale from (0) – (1.0) to (-0.5) – (0.5). Only the x position and y position plots are affected.
- **Time Marker Spacing Drop List:** Specifies the time spacing ((0.1) sec - (10) sec) between the time markers in the *Time Plot* window.
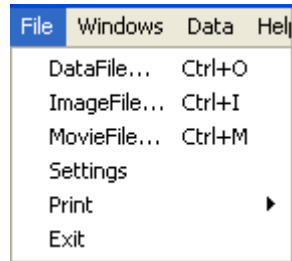
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2.5 Controls Window > Display Tab

Figure 5.   Controls Window > Display Tab
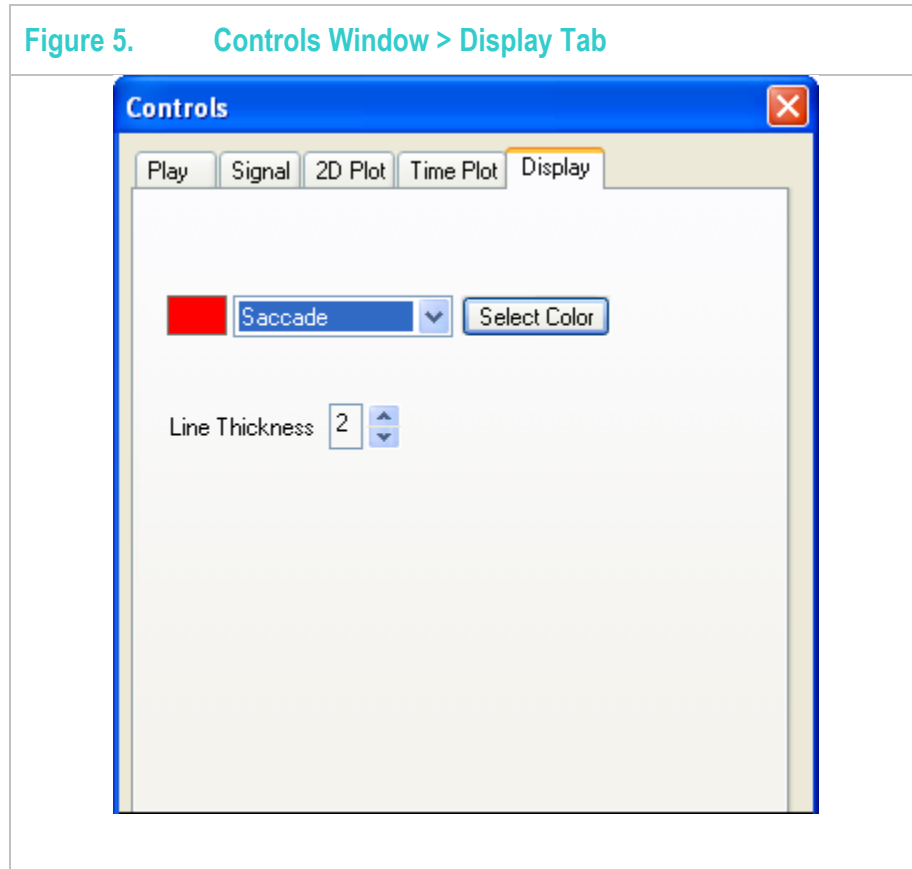
Display Tab: The display tab allows a user to customize the display by selecting different colors and line thicknesses for backgrounds, fixations, and saccades.

2.6 File Menu Items

Figure 6.   File Menu

- **File_DataFile:** Loads a data file. Selecting this menu option prompts the user with a file selection dialog box. Once the user selects the data file, the application loads the data file. The data file format is discussed in the *ViewPoint* manual under the Data Collection chapter. The data file indicates whether or not the application should load a movie file or an image file. After loading the data file, the data is processed according to the settings, then the data is displayed in the *Events* window, *Time Plot* window, and either the movie or images are displayed in the *2D Plot* window. The user can now analyze the data.

- **File_ImageFile:** Loads an image file. Selecting this menu option prompts the user with a file selection dialog box. Once the user selects the image file, the application loads the image file and displays it in the *2D Plot* window.. Loading a new image file while a movie file is loaded causes DA to close the current movie file. If the current data file contains images, loading a new image file does not overwrite any of the images but will become the current image anytime DA cannot associate the current data point with an image from the data file.

- **File_MoveFile:** Loads a movie file. Selecting this menu option prompts the user with a file selection dialog box. Once the user selects the movie file, the application opens the movie file and displays the first frame in the *2D Plot* window.. Loading a movie file causes the application to close any movie file or image file previously loaded even if those files were specified in the data file.

- **File_Settings:** Loads the AOI's from the *ViewPoint* settings file. Selecting the menu option prompts the user with a file selection dialog box. Once the user selects the settings file, the application loads all the AOI's from the settings file and overlays them on the *2D Plot* window. "Not implemented".

- **File_Print:** "Not implemented".

2.7 Dump Summary Data

Figure 7.   Data Menu > Dump Summary
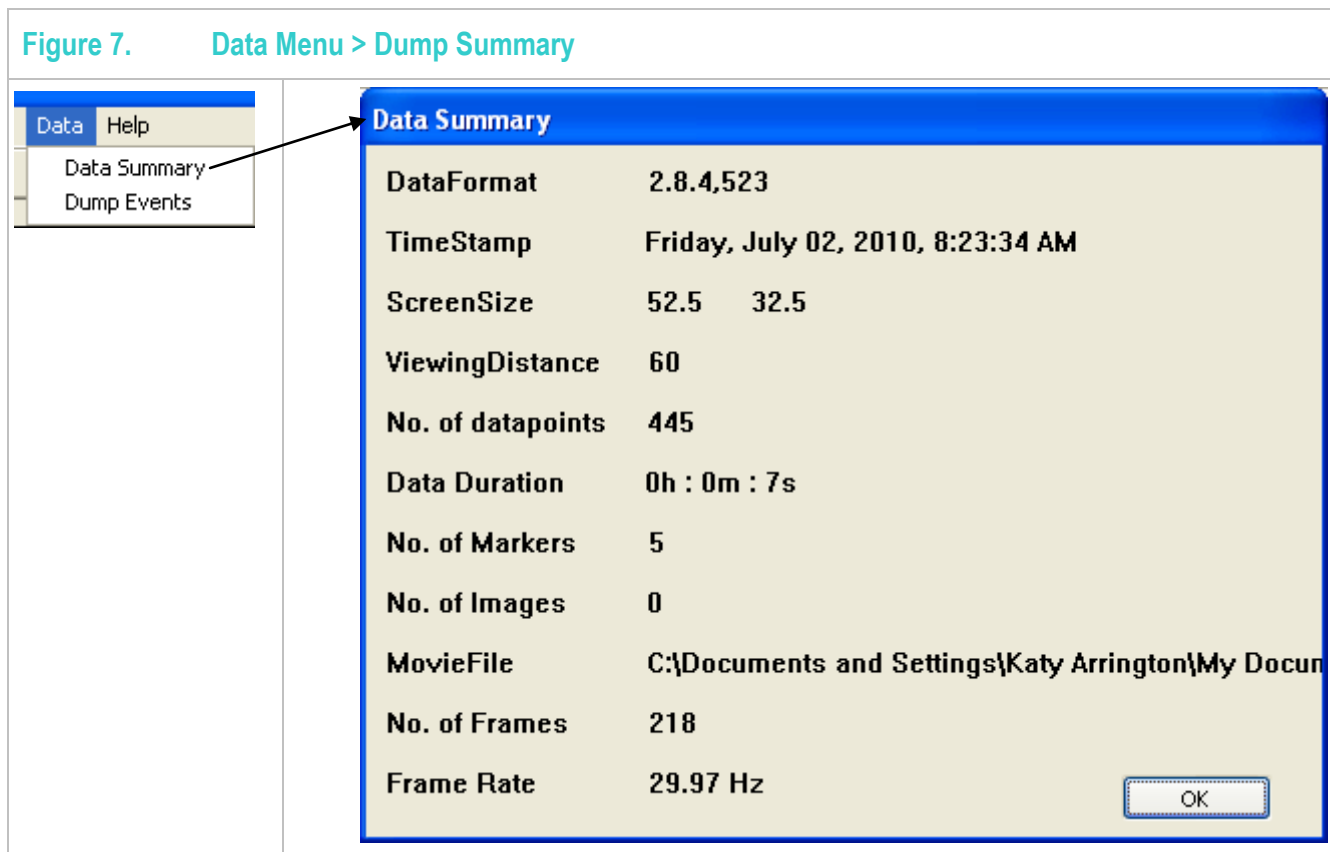
- **Data_DataSummary:** Displays a window that contains information about the current data file.

2.8 Dump Events Data

- **Data_DumpEvent:** Writes all the Events to a user selected file.
    The Events window displays 4 different events, Markers, Images, Fixations, and Saccades. Below is a description of each.

Figure 8.   **Data Menu > Dump Events**

1)   Marker - 1st column is the Event number. 2nd column is the Total Time in seconds. 3rd column is the Marker string. The last column is the data point the marker occurs at.

2)   Image - 1st column is the Event number. 2nd column is the Total Time in seconds. 3rd column is the Image File Name. The last column is the data point the image occurs at.

3)   Fixation - 1st column is the Event number. 2nd column is the Total Time in seconds. 3rd column is the duration time for the fixation in seconds. 4th column is the average gaze x and y points for all the points in the fixation in normalized coordinates. The last column is the data point range for all the points in the fixation.

4)   Saccade - 1st column is the Event number. 2nd column is the Total Time in seconds. 3rd column is the duration time for the saccade in seconds. 4th column is the start gaze x and y point and the end gaze x and y point for the saccade in normalized coordinates. The last column is the data point range for all the points in the saccade.

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