EYEGAZE TRACE PROGRAM
USER'S GUIDE

SETTING UP THE TRACE PROGRAM

Start the Eyegaze "Trace" program –– "Trace" icon

From the computer desktop, select the "Trace" icon.

Set the desired state of "AutoSave" –– 'Active' or 'Inactive'

The Trace program has an "AutoSave" control parameter that tells the program to either a) continually overwrite the trace data file each time a new test is run, or b) save the results of each trace run to a separate disk file. If AutoSave is 'Inactive', Trace saves the results of each test to a file called Trace.dat. In the Inactive mode, Trace overwrites the prior Trace.dat file at the end of each new test run. When AutoSave is 'Active', Trace saves the results of each test in a new file called TraceDataXXXX.dat, where XXXX is a number that begins with 0001 and increases by 1 after each test.

The state of the AutoSave parameter is displayed on the Trace program's title bar. When the Trace program is opened, AutoSave defaults to InActive. If you want to save all the test results, switch AutoSave to Active before collecting data. To change the AutoSave parameter, click on the "File" tab and click "AutoSave." Each time you click AutoSave, it toggles between Active and Inactive. Look at the program title bar to verify that AutoSave is in the desired state.

Set the maximum data-collection time –– "File", "Set Collection Time"

To prevent excessive data collection in case the experimenter does not end a data-collection session, the Trace program automatically stops data-collection after a maximum Collection Time. The default Collection Time is 60 seconds. If you want to run longer experiments, click on the "File" tab, select "Set Collection Time," and type in the desired maximum Collection Time (up to 10 minutes, or 600 seconds). To make the collection time greater than 10 minutes, contact LC Technologies.

Select a specific image –– "File", "Select Bitmap" or "Select Text", select the file

To select an image file to display, click the "File" tab, click "Select Bitmap" or "Select Text", then use the dialog box to select the file you want displayed.

The name of the image-display file is shown in the Trace Program's Title Bar.

COLLECTING EYEGAZE TRACE DATA

Calibrate the subject –– press 'c'.

Prior to running a gaze-trace capture test, the test subject must perform the Eyegaze Calibration procedure (where he visually follows the dot around the screen). To begin the calibration process, click the "Calibrate" tab, or simply press the 'c' key.

Enter the user ID – fill in dialog box.

If "AutoSave" is 'Active', a dialog box appears to enter the subject ID. This ID (along with the date, time of the test run, and name of the image-display file) is saved in the TraceData*.dat file for future reference. The ID may be left blank by typing only the 'Enter' key.

Start/Stop Data Collection –– press 'b', 'e'.

After the calibration procedure is finished, the screen goes blank and waits for the operator to start the data-collection session. To begin the experiment, select the "Collect Data" tab and select "Begin." The Trace program then displays the image and begins to collect the subject's gaze trace.

To stop data collection, select the "Collect Data" tab and select "End."

Data collection can also be started and stopped simply by pressing the 'b' and 'e' keys on the keyboard. 'b' and 'e' stand for 'begin' and 'end.'

Toggle Eye Image display –– press 'F12'

If you are not using an external eye monitor to make sure the user's eye stays within the camera field of view, you can toggle the on-screen Eye Image display on and off by pressing the 'F12' key on the keyboard.

CONTROLING THE GAZE-TRACE REPLAY

After completing a data collection run, or after retrieving a prior experiment, the Trace program automatically redisplays the image and superimposes the trace over the image.

(Note: Before superimposing the gaze trace over the image, the Trace Program dims the original image to make sure the gaze-trace graphics stand out clearly on the original picture. For purposes of displaying the dimmed image, the Trace program creates a *.bmp.dim file from the original *.bmp file. If the dimmed-image file does not already exist on disk, the Trace program pauses for several seconds to create the dim file before displaying the superimposed trace.)

Control the gaze-trace display –– "Replay", then "Complete Raw Trace" or "Moving Trace".

To control the gaze-trace display, click the "Replay" tab. Gaze traces may be replayed in two basic modes. In the "Replay Complete Raw Trace" mode, the Trace program displays a static image of the subject's complete trace over the image. In the "Replay Moving Trace" mode, the Trace program dynamically replays the user's gazepoint in the time sequence that he originally scanned the image.

Note: If you are in the moving-trace mode, you must press the Escape key to terminate the moving-trace mode before switching to any other display mode.

Controlling the Static-Trace Display –– press 'r', 'f', 't', 'd', 'n':

The static-trace display may be controlled to display various combinations of trace information. In particular, the raw trace, the fixation trace, the time plots, and the original image may all be turned on and off.

Press 'r' to toggle the **r**aw gaze-trace plot on and off.
Press 'f' to toggle the **f**ixation gaze trace on and off.
Press 't' to toggle the fixation **t**ime plots on and off.
Press 'd' to toggle the original image data **d**isplay on and off.
Press 'n' to toggle the file-**n**ame display on and off.

Note: In the raw-trace display, small red circles show the gazepoint for each $1/60^{th}$ second sample, and lines between the successive samples illustrate the sequence of gaze motion. In the fixation-trace display, groups of individual samples that comprise a single user fixation are combined and displayed as a single circle whose size (area) is indicative of the total duration of the fixation.

Controlling the Moving-Trace Display –– press space, ->, <-, Escape

Press the space bar to start and stop the moving trace.
Press the right and left arrow keys to switch between move-forward and move-backward modes.
Click on "File," "Set Replay Speed" to set the replay speed (1.0 = real time).
Press the Escape key to get out of the Moving-Trace mode.

Printing and Saving Trace Images –– "File", "Print Screen", "Print" or "Save Bitmap of Screen"

Click "File", "Print Screen", "Print" to generate a hardcopy print of the gaze trace presently displayed on the screen.
Click "File", "Print Screen", "Save Bitmap of Screen" to generate a disk file of the gaze trace presently displayed on the screen.

Clear any Replay Display –– press 'w'

To clear the screen of any replay display, click the "Display" tab, and select "Clear Screen". Alternatively, simply press the 'w' key.

RETRIEVING PREVIOUSLY COLLECTED TRACE FILES

Load a previously collected data file –– "Replay", "Load Data File"

To retrieve a previously collected data file, click the "Replay" tab, click "Load Data File" and use the dialog box to select the desired file. Note: When looking for trace files to retrieve, recall that the Trace program writes TraceDataXXXX.dat files into the directory from which the Trace program is being run.

Once a previously-collected Trace file has been reloaded, its name is displayed on the Trace program title bar.

MANAGING TRACE DATA FILES

Trace Data File Contents

When Trace saves a TraceData*.dat file (in the AutoSave Active mode), it saves:

1. the date and time of the data collection run,
2. the name and path of the selected image file,
3. the sequence of the subject's gazepoint coordinates, and
4. the sequence of the subject's fixations.

This information allows the Trace program to completely reconstruct and replay traces at any time. See the listing below for the format of a TraceData*.dat file.

Trace Data File Locations

When Trace saves TraceDataXXXX.dat files (in the AutoSave Active mode), it writes the files into the directory from which the Trace program is being run. Typically, Trace runs from the c:\Eyegaze directory, and in this case it writes the files into the c:\Eyegaze directory.

File Sequence Numbers

When determining the numerical value of XXXX for the next experiment data file, the Trace program searches for all the TraceDataXXXX.dat files in the Trace subdirectory, finds the highest existing value of XXXX, and adds 1 to form the number value for the next file name. If you delete a file whose number is less than the highest existing value, Trace does not re-use that "missing" number; it keeps adding onto the highest value. On the other hand, if you delete the file with the highest number, Trace does re-use that number when you run the next experiment. In any event, the files numbers always represent the sequence in which the tests were run, even if some file numbers are missing.

Resetting TraceDataXXXX.dat file numbers.

Before beginning a logical group of test runs that you wish to keep, it is advisable to either delete all the prior TraceData*.dat files from the Trace subdirectory or to move them to another directory. The Trace program will then begin numbering the new data files at 0001. After completing a group of test runs you wish to keep, move the TraceData*.dat files to another directory.

Image File Locations

You can put the image files (*.bmp or *.txt) in any directory that is useful to you. However, once you use an image in a Trace collection session, the image file must remain in its original directory so Trace can access it for future replays. (To keep track of which image a gaze trace goes with, the Trace program stores the full path name of the image file in the TraceData*.dat file. If you move an image file after collecting gaze-trace data, the Trace program will not display the image in subsequent replays.)

When the Trace program generates a dimmed image file (*.bmp.dim), it places the dimmed-image file in the same directory as the original *.bmp file.

TRACE DATA FILE FORMAT

The TraceData*.dat files that contain the gazepoint trace data are ascii files. The figure below shows the specific format. The first 8 lines (including blank lines) are header data, primarily for human reference. Then come the raw gazepoint data, with each line representing a raw gazepoint data sample. The end of the raw data is indicated by a blank line. The next 6 lines are header data for fixation list that follows. Then come the fixation data, with a line for each fixation.

The files are organized such that the numerical sections can be easily copied to purely numerical files that can be processed by spread-sheet and data-base programs.

TraceDataXXXX.dat Format:

```
Gazepoint Trace Data File,  16:30:32  10/04/2002  Alan Buxton
Scene Type: bitmap 1024 768 L:\msvc\trace\k100rs-3.bmp
Raw Gazepoint Data (60 Hz Sampling Rate):

samp  Eye     Gazepoint  Pupil   Eyeball-Position  Focus   Fix
indx Found    X      Y    Diam     X     Y     Z   Range  Indx
     (t/f)  (pix)  (pix)  (mm)   (mm)  (mm)  (mm)  (mm)

  0     1    822     22   3.10    7.7   7.9 -10.8   710.4    0
  1     1    822     26   3.09    7.8   7.9 -11.4   710.4    0
  2     1    819     23   3.12    7.9   7.9 -11.2   710.4    0
  3     1    820     23   3.11    8.0   7.9 -11.2   710.4    0
  4     1    817     25   3.13    8.0   7.8 -11.2   710.4    0
  5     1    821     22   3.14    8.0   7.8 -10.2   710.4    0
  6     1    820     26   3.12    8.0   7.8 -11.3   710.4    0
  7     1    823     25   3.14    7.9   7.8 -11.2   710.4    0
  8     1    817     28   3.13    7.9   7.8 -11.7   710.4    0
  9     1    808     61   3.03    7.8   7.9 -10.7   710.4   -1  (Fix index = -1
 10     0      0      0   0.00    0.0   0.0   0.0   710.4   -1   indicates eye in
 11     0      0      0   0.00    0.0   0.0   0.0   710.4   -1   motion between
 12     1    597    233   3.04    5.1   5.4  -8.1   710.4   -1   fixations or eye
 13     1    535    258   3.25    5.6   6.2  -7.7   710.4   -1   not found)
 14     1    498    280   3.22    6.0   6.7  -9.4   710.4   -1
 15     1    506    286   3.22    6.2   7.1 -11.4   710.4   -1
 16     1    503    298   3.20    6.3   7.4 -14.2   710.4    1
 17     1    502    306   3.21    6.4   7.6 -17.1   710.4    1
 18     1    501    303   3.24    6.5   7.8 -18.1   710.4    1
 19     1    499    297   3.26    6.6   8.0 -17.8   710.4    1
 20     1    501    297   3.27    6.7   8.2 -17.5   710.4    1
 21     1    500    306   3.23    6.7   8.3 -20.0   710.4    1
 22     1    501    302   3.31    6.7   8.4 -18.6   710.4    1
 23     1    500    307   3.23    6.7   8.4 -20.6   710.4    1
 24     1    501    306   3.30    6.7   8.5 -19.1   710.4    1
 25     1    501    310   3.23    6.7   8.5 -21.5   710.4    1
 26     1    505    313   3.30    6.7   8.6 -19.8   710.4    1
 27     1    492    351   3.26    6.6   8.6 -18.9   710.4   -1
 28     1    479    384   3.23    6.5   8.5 -19.4   710.4    2
 29     1    486    378   3.28    6.5   8.6 -17.1   710.4    2
 30     1    484    383   3.20    6.4   8.5 -19.2   710.4    2
   .
   .  (additional raw gazepoint data samples)
   .
 91     1    396    290   3.22    7.7   9.3 -18.6   710.4    5
 92     1    394    289   3.19    7.7   9.3 -18.7   710.4    5
 93     1    394    292   3.18    7.7   9.3 -18.6   710.4    5
 94     1    423    289   3.21    7.7   9.3 -17.0   710.4   -1
 95     1    482    279   3.17    7.7   9.3 -17.5   710.4   -1
 96     1    505    272   3.14    7.7   9.3 -18.8   710.4    6
 97     1    500    279   3.12    7.7   9.3 -20.6   710.4    6
 98     1    505    275   3.18    7.7   9.3 -19.3   710.4    6
 99     1    499    281   3.08    7.7   9.2 -21.9   710.4    6
100     1    501    280   3.14    7.8   9.2 -20.4   710.4    6
101     1    501    287   3.07    7.8   9.2 -22.5   710.4    6
102     1    505    284   3.14    7.8   9.2 -21.2   710.4    6
103     1    510    283   3.10    7.8   9.2 -21.5   710.4    6
104     1    505    293   3.07    7.7   9.2 -23.6   710.4    6
105     1    503    289   3.13    7.7   9.2 -22.5   710.4    6
106     1    500    294   3.07    7.7   9.2 -24.5   710.4    6
107     1    502    290   3.11    7.7   9.3 -23.5   710.4    6
108     1    502    293   3.07    7.7   9.3 -24.8   710.4    6
109     1    520    284   3.16    7.8   9.3 -20.8   710.4    6

Fixation Data: (60 Hz Sampling Rate)

 fix    Fixation     Sac   Fix   Fix
indx    X      Y     Dur   Dur  Start
      (pix)  (pix)  (cnt) (cnt)  Samp

  0    820     24     0      9      0
  1    501    304     7     11     16
  2    486    378     1     24     28
  3    173   1571     6     12     58
  4    125   1552     1      8     71
  5    396    294     5     10     84
  6    503    285     2     14     96
```