Coding HPP videos using PsyCode
by Judit Gervain
(with scattered sentences added by L.L.B. here and there)

PsyCode is a Mac application written by Luca Filippin. It is the successor of CodeThis, written by Luca Bonatti. We used CodeThis for several years in our lab. Then fame hit us. Other labs wanted to use it, and so LB asked LF to take a look at the code before making it public. LF was so ashamed of how LB had written the code that he decided to rewrite it entirely, and so PsyCode was born.

The program allows the user to code behavioral videos, i.e. capture the beginnings and ends of events of interest, e.g. looks, in the video.

This introduction uses the Head-turn Preference Procedure (HPP) as an example to describe the use of PsyCode. Therefore, some familiarity with HPP is assumed (see Kemler Nelson et al. 1995. "The Headturn Preference Procedure for Testing Auditory Perception". *Infant Behavior and Development* 18:111-116, for a very good introduction), although the key concepts will be briefly defined below.

You can, of course, use PsyCode to code videos created using a large number of other experimental procedures, but HPP will be used as an example. No matter what procedure you use, it is very important to have a good operational definition of the event you are interested in *before* you start coding to ensure consistency across videos, coders and studies.

1. The Headturn Preference Procedure (HPP)

Basic events involved in HPP:

Looking: In HPP, we usually define a look as a headturn (and/or eye and gaze shift) of at least 30° (a different angle can, of course, be chosen) in the direction of the side light that is blinking and where the sound is coming from. It is important to realize that there are two important criteria: the infant has to be looking at the adequate light and the sound has to be playing. If the sound is not playing or the infant is not orienting to the correct side, the event does not count as a looking episode.

Trial: A trial is a single test event. It consists of playing a given auditory stimulus from one side while the attention-getter light is blinking. A trial ends when the whole sound file is played (maximal duration) or when the infant looks away for longer than a predefined lookaway criterion, typically 2 consecutive seconds. A trial might consist of several looking episodes (i.e., if the infant orients to the light, then looks away, then turns back, etc.; see below).

Looking Episode: Within one trial, the infant may produce several looking episodes. If that infant looks away for less than the predefined lookaway criterion, then the trial continues, allowing the infant to look away and back several times,

as long as (s)he looks away for less than the criterion. The purpose of off-line coding is to capture these looking episodes, as the looking time for any given trial needs to be calculated as the sum of the looking times of all the looking episodes within that trial.

Timeout: The word 'timeout' is used in two different ways in the HPP literature. First, it refers to the length of the time period while the baby is looking away. This results in a timeout of the baby looked away for more than 2 sec. This is the meaning used in PsyCode. Second, it refers to trials that end (because the planned max. duration of the trial is over) without the baby looking away. In PsyCode, this is referred to Max. Time looking. You can set both of these parameters in the Settings tab of PsyCode.

2. The PsyCode Application

PsyCode is a Mac application with a graphical user interface that allows you to code behavioral (typically, looking) data using a video file and a data file. It uses the data file to input any information about the events you are coding, as they appear in the datafile (see example below) and it adds to this event the onset and end times that you select in the movie file. Its final output is a text file (with the extension .cdf).

The PsyCode **GUI** window has four **tabs** (**Code, Setting, Info, Log**) shown and explained on the next pages (**Figures 1-4**). In addition, PsyCode has a **menu bar** at the top of the screen, which include the following items (some of which are regular menu items in many applications):

2.1 The PsyCode menu bar

PsyCode:

• **About**…: provides info about the application (developers, credits, license etc.)

• **Quit**: quits application

File:

• **Open**…:

  •**QT Movie:** opens QuickTime Player, then a browser window in QT to locate and open the movie to be coded

  •**Data File**: allows you to open the data file (see later for explanation)

  •**Unfinished**: allows you to open a previously saved output code file that you want to modify or continue working on

  •**Close**: closes data file

  •**Save**: saves coded output as a file (with a .cdf extension)

  •**Save as**…: allows you to save the coded output in a new location and without an extension

Edit: standard Edit features: undo, redo, copy, paste etc. – not specific to PsyCode; allows you to manually edit the coded output

Help: regular Mac help.

2.2. The graphical interface

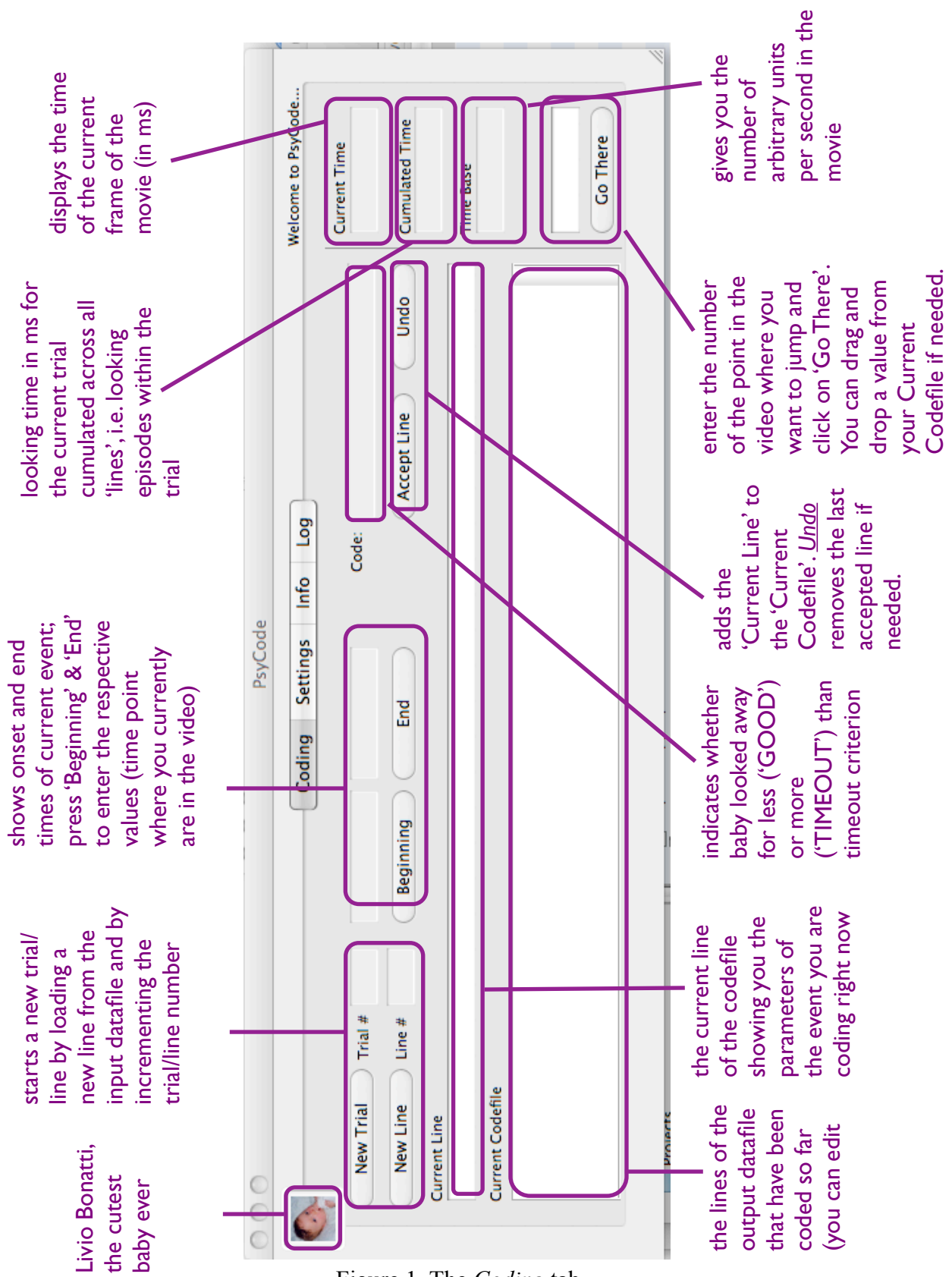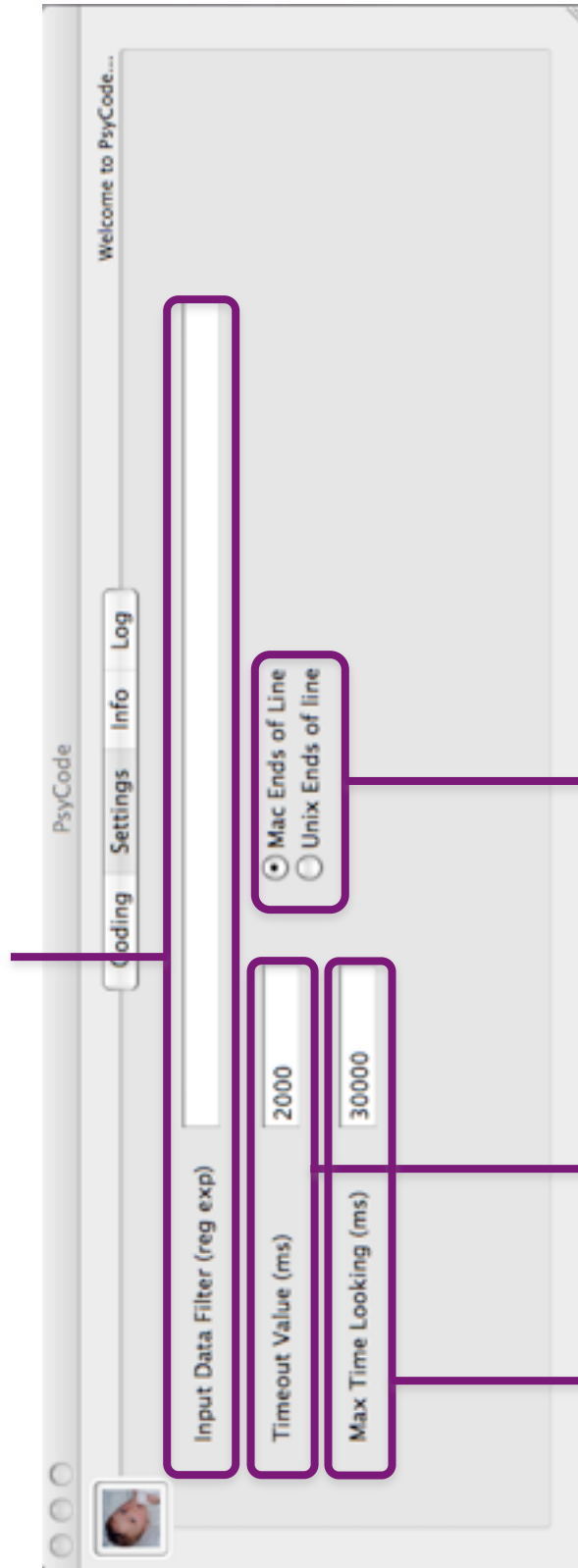Figures 1, 2 and 3 explain the meaning of the various parts of the graphical interface.

displays the time of the current frame of the movie (in ms)

looking time in ms for the current trial cumulated across all 'lines'; i.e. looking episodes within the trial

shows onset and end times of current event; press 'Beginning' & 'End' to enter the respective values (time point where you currently are in the video)

starts a new trial/ line by loading a new line from the input datafile and by incrementing the trial/line number

Livio Bonatti, the cutest baby ever

the lines of the output datafile that have been coded so far (you can edit

the current line of the codefile showing you the parameters of the event you are coding right now

indicates whether baby looked away for less ('GOOD') or more ('TIMEOUT') than timeout criterion

adds the 'Current Line' to the 'Current Codefile'. *Undo* removes the last accepted line if needed.

enter the number of the point in the video where you want to jump and click on 'GoThere'. You can drag and drop a value from your Current Codefile if needed.

gives you the number of arbitrary units per second in the movie

Welcome to PsyCode...

Current Time

Cumulated Time

Time Base

Go There

Undo

Accept Line

Code:

Coding Settings Info Log

PsyCode

End

Beginning

New Trial

Trial #

New Line

Line #

Current Line

Current Codefile

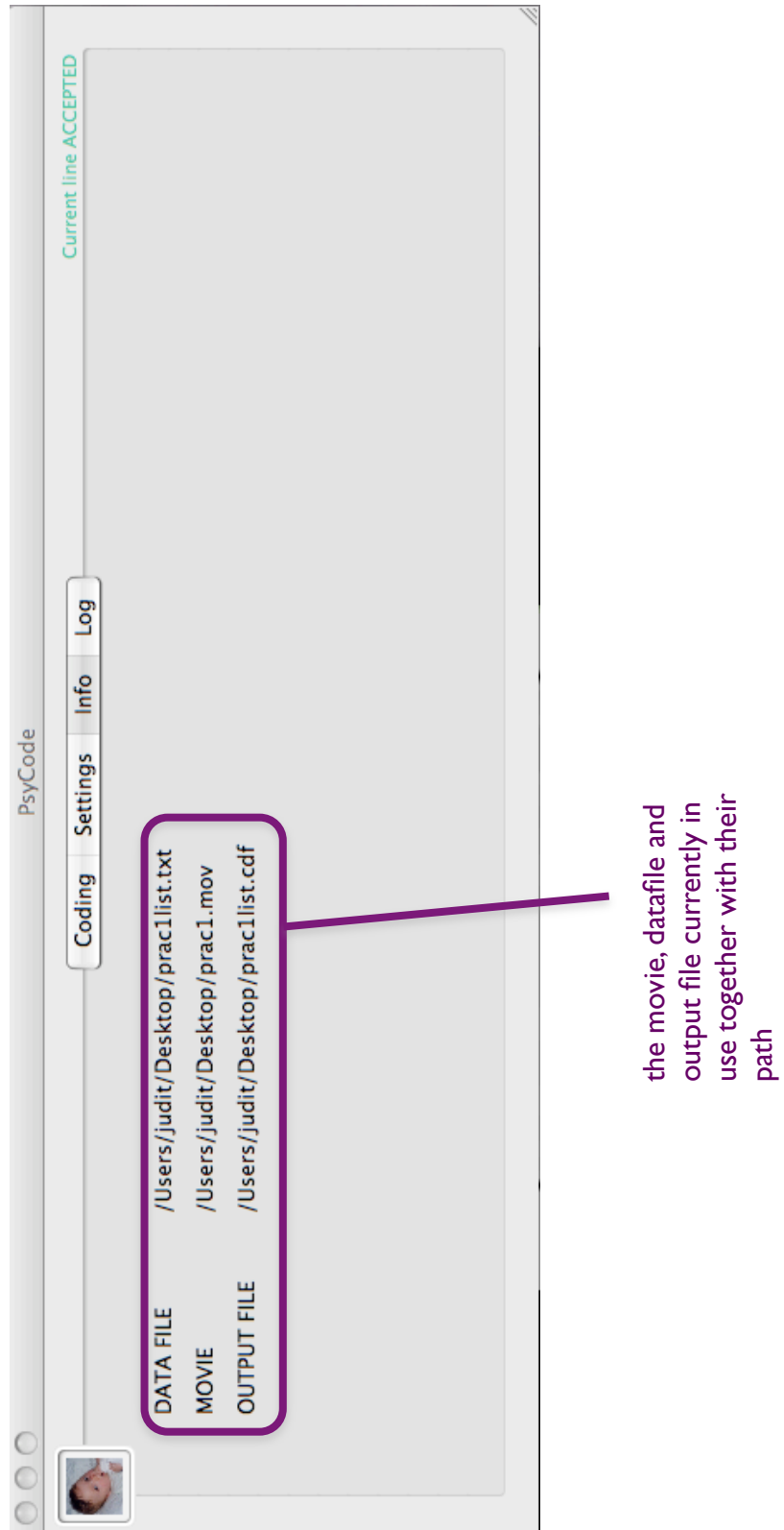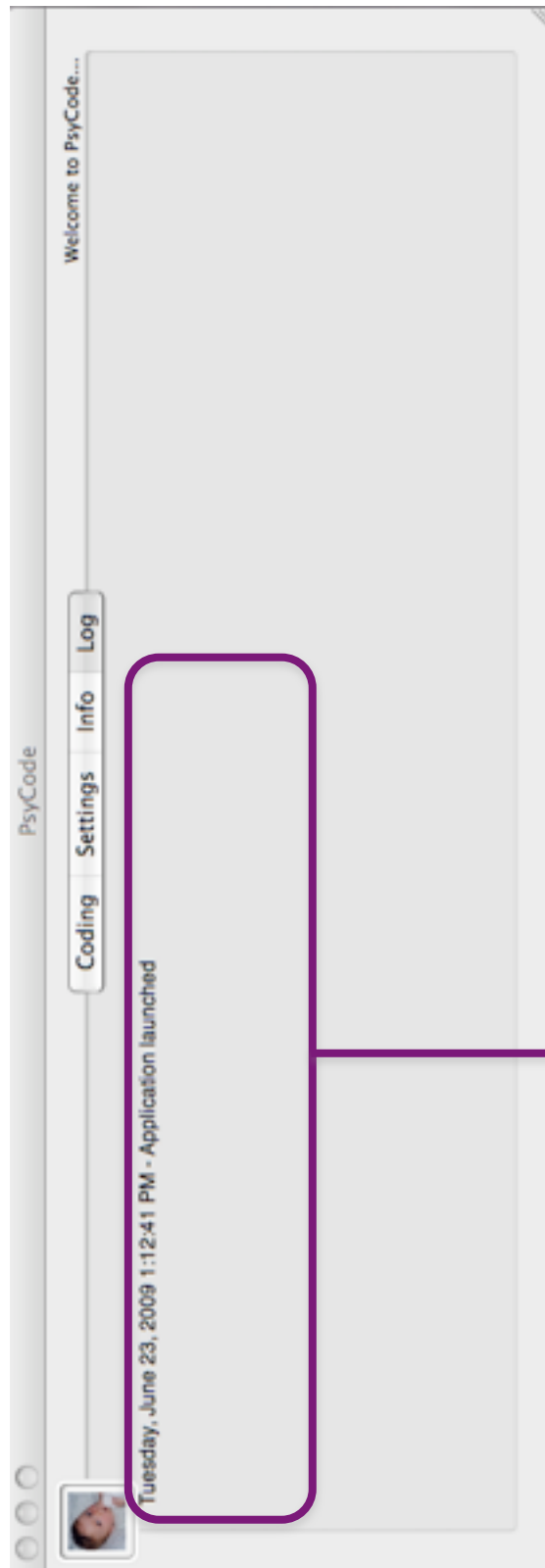Figure 1. The *Coding* tab

Figure 2. The *Settings* tab.

Figure 3. The *Info* tab.

Figure 4. The *Log* tab.

a log of what has happened since you opened PsyCode; useful to understand bugs

3. Getting Started

What you need:

• the PsyCode application.

• QuickTime 7 installed on your computer. **Note: you need QuickTime 7 *even* if you have Snow Leopard. The Snow Leopard installation disk allows you to add QuickTime 7 as an optional install.**

• the movie you want to code (better if it's not yet compressed; you can use pretty much any format that QT can open)

• the input datafile that contains a single line entry for each event (e.g. looking episode) that you want to code, e.g.:

```
1          test          pefufu     left     ABB
2          test          fepun@     left     ABC
```

where the fields are for example:

```
trial #    identifier     item      side      condition
```

You can use any field and add any information that will be useful for you when you analyze the data. PsyCode loads each line as is, so it's up to you what information you put in there. However, each line corresponding to a relevant event has to contain a constant string (an identifier or a 'search pattern', see below) to mark it for PsyCode. PsyCode will only load the lines that contain this identifier/search pattern. (This allows you to have a datafile that contain headers and other information not directly relevant for coding.)

Note that each relevant line of the datafile, i.e. the ones identified by the search pattern, has to be numbered using consecutive numbering for PsyCode to be able to read the lines of the datafile. If this is not the case, you get an error message saying "The datafile is in a bad format". The input data file might come from the trial randomization lists of your experimental software or the log files created while running the experiment. You might need to make a few modifications to these files before you can use them as the input datafile.

In the worse case -- the case in which you have no datafile -- you can always prepare a very simple custom-made data file. It will be sufficient that the file contains one number per line, progressively, corresponding to the number of trials in your experiment. Thus a file as essential as:

1
2
3
4

will be read by PsyCode as meaning that the experiment contained four trials. PsyCode will then fill in the information it is designed to add, outputting a data file with as many lines as needed for trials 1, 2, 3 and 4.

3.1. Coding

Starting up:

- **Launch PsyCode**.

- **Opening the Movie:** Click on the Open… item in the menu bar, then select QT Movie from the drop-down menu to launch QuickTime and open the movie you need to code

- Make sure the correct number appears in the 'Movie Time Base' window. For some movie formats, PsyCode might not be able to determine the time base correctly, which will give you erroneous looking times. Should this be the case, you have to figure the time base out yourself and enter the correct number into PsyCode. Note, however, that the time base only becomes important when you do you stats and want to convert the beginning and end times into seconds.

- **Opening the Input Datafile:** Click on "Open…" from the menu bar and then select the "Data File" item from the menu. Before letting you choose the datafile, PsyCode will display a window asking you to specify a 'Search Pattern'. You have to enter the identifier (constant string) that marks each relevant line of the datafile (see above). PsyCode will only load the lines that contain this string. After you entered this string, PsyCode will allow you to open the datafile you want to use.

- If the datafile is correctly opened, you will see 'Data File LOADED' appearing in green in the upper right corner of the main PsyCode window.

3.2 Really Coding

You are now ready to code the first event you are interested in. I will use looking behavior as an example, but you could code other behaviors or events, too.

- **Starting a New Trial:** When the datafile is opened, it automatically loads the first line, i.e. the first trial (and the trial and line counters are set to 1). If you want to skip a trial, click on the 'New Trial' button to load the next line from the input datafile (remember, the input datafile contains one line for each trial, not for each looking episode).

- **Starting a New Line:** Each looking episode corresponds to a line in the output codefile. PsyCode forces the lines to have consecutive numbering (1, 2, 3 etc.), so you cannot skip a line in the same way as you can skip a trial. If you try to create a new line before saving the current one, you will get an error message and you will be forced to save the current line. If you really to have the lines

numbered differently, i.e. other than consecutive integers, you can edit the line manually in the "Current Codefile" window once it has been accepted.

- **Locating the Beginning of a Look:** Locate the very first frame of the movie where the event of interest starts. The exact frame where this happens might be hard to identify, so you will have to go through a portion of the movie frame-by-frame.

- **Moving Back and Forth in a Movie:** There are several different ways in which you can move forward or backward in a movie.

    - you can play and pause the movie by pressing the space bar (or the regular QT menu options) – this is a fast, but not precise way of finding a time point of interest

    - you can drag the cursor on the time line under the movie to a desired point

    - you can use the arrow keys on the keyboard to move frame-by-frame (in this case, no sound is played) – most of the times, this is the precision necessary to find the onset or end of a looking episode

    - you can enter a time into the window above "Go There" and click on 'Go There'

    - to know where you are in the movie, check 'Current Time' window (it is updated every time you switch back from QT to PsyCode)

3.3. Really Really Coding

Once you identified the frame where the current looking episode starts, click on the 'Beginning' button to enter the time (in ms) into the Beginning/End window. You will also see that PsyCode appended the 'Current Line' with something like '1 1 0 GOOD 39601 ****', where the first number is the trial number, the second number is the line (i.e. looking episode) number, 'GOOD' mean that the trial hasn't timed out, 39601 is the time of the beginning of the look, and the asterisks stand for the end time, which you will define as the next step.

- **Locating the End of a Look:** Go ahead in the movie to identify the frame where the current looking episode ends and click on 'End' to enter the time into the Beginning/End window. Notice that the asterisks in the 'Current Line' are now replaced by the end time you entered.

- **Correcting erroneous times:** If you think you have made a mistake in determining the beginning or the end of a look, you can select another frame of the video and by clicking on 'Beginning'/'End', you can overwrite the previous value.

- PsyCode automatically computes the looking time for this looking episode and if it is not the first one within the trial, it adds it to the 'Cumulated Time', which is shown in milliseconds.

- **Adding a Coded Looking Episode to the Codefile**: After you finish coding a looking episode and you are convinced that the beginning and end times are

correct, you have to click on 'Accept Line' to add the current line to the codefile. PsyCode won't allow you to create a new line without saving the current one.

- You have now finished coding your first looking episode and can go on to code the next one. To do this, you will have to repeat steps 8-15 above.

- **Ending a Trial** Steps 8-15 need to be repeated as many times as there are looking episodes within the trial. When the trial ends in the video, you have to start a new trial, as described in step 7. However, it might be the case that the trial in the movie goes on, but you need to end the trial anyway in your coding. This typically happens when the baby looks away for just a little bit more than 2 sec and due to the experimenter's reaction latency, the experimental software fails to capture this and does not stop the trial. If this is the case, PsyCode will display a 'TIMEOUT' warning in the 'Timeout?' window when you start the looking episode that follows the longer-than-2 sec look away, i.e the timeout. If you get a timeout warning, you can end the trial by not accepting the current line, i.e. the looking episode after the timeout, and start a new trial by going to step 7.

3.4 Finishing up

Now you have to save the coded file. You can save the codefile at any point during coding. You can save the code file even if you haven't finished coding the whole movie, because 'Unfinished' will allow you to open the codefile again and continue coding. To save the file, select 'Save' or 'Save as…' from the menu bar.

In the coded file, you will find only and all the saved lines, which contain the information of the lines you loaded, plus nine new columns, which may look like this:

1	10	1	GOOD	N/A	128840	129360	322100	323400
1	10	2	TIMEOUT	131360	131960	131960	329900	329900

- The first column contains the new trial number, starting from 1.

- The second column contains the old trial number, taken from the PsyScope X data file. This column is there mostly for you to understand the relation between Trial numbers in your PsyScope script and "real" coded trial numbers. In general, if your script contains for example instructions or a beginning template, your FIRST "Real" trial number will not be 1, but the n+1st trial number after the n initial trials that your script used for instructions, preparation, or whatever you may have done.

- The third column contains the line number of the lines you saved *within* the current coded trial.

- The fourth column contains a code signaling if the current difference between beginning the end value of the PREVIOUS line and the beginning value of the CURRENT line a re below or above the specified timeout value. If you find "GOOD", this means that you have not encountered a timeout yet. You may instead find TIMEOUT. If so,

- The fifth column contains the millisecond in which the timeout value triggered. In this case, you find for example 131360, that is, that although you may now be at time 180000 of the movie (i.e., the child starts back looking at the movie at ms 180000), because your timeout criterion was 2000, and the end value of the previous line was 129360, at ms 131360 there was a timeout. It's up to you to decide what to do with your coding -- whether to continue coding or to skip to the next trial. Obviously for lines in which the code is GOOD, this column contains no value (N/A).

- The sixth column contains the value of the Beginning time in each line, in milliseconds.

- The seventh column contains the value of the End time in each line, in millisecond. Again, in cases the line is a TIMEOUT line, Beginning and End values are kind of arbitrary, and they are really there to maintain the matrix structure of the file.

- The eight column contains the value of the Beginning time in each line, with the values expressed in the movie internal timebase (generally, but not always, a multiple of 600. For your convenience, the timebase of your movie is reported in the main window).

- • Finally, the last column contains the End values in the movie internal timebase.

We hope that the program can be useful. Enjoy your coding if you can!