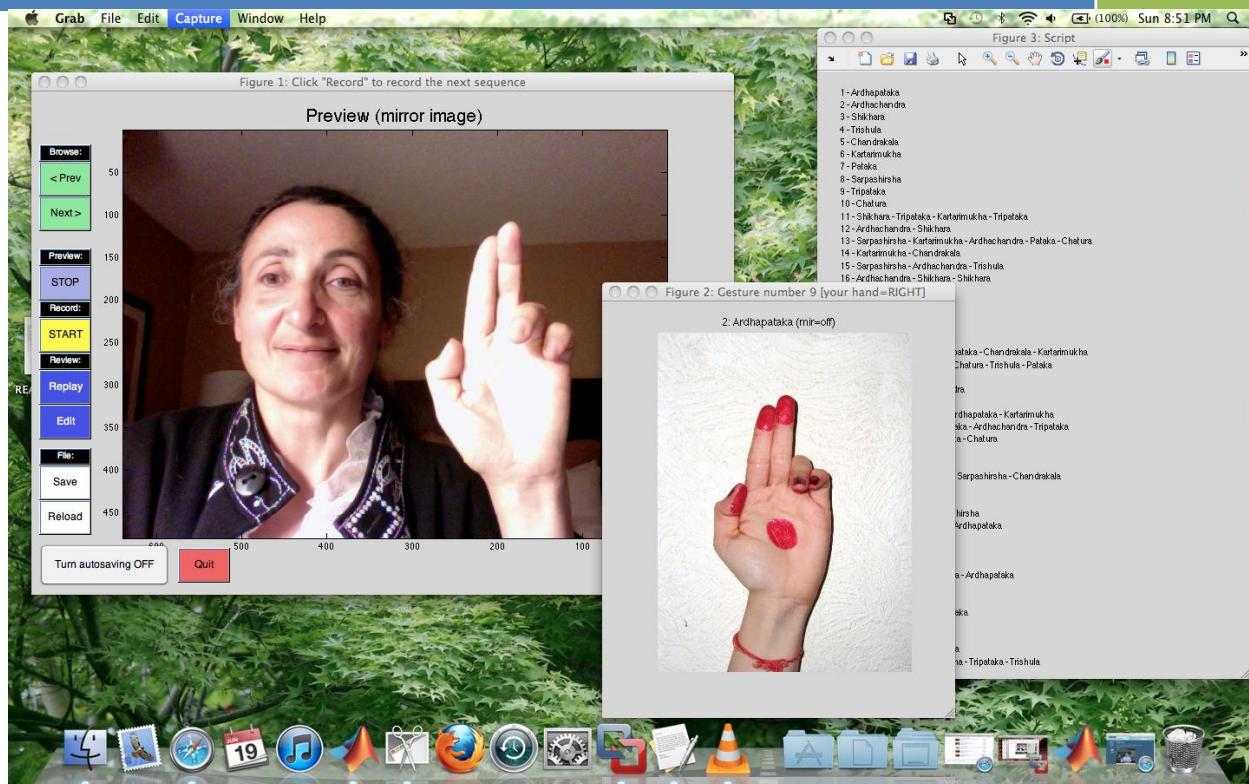


# 2011



## Gesture Data Collection Software



Isabelle Guyon

Clopinet

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# Gesture data collection

Isabelle Guyon – [guyon@clopinet.com](mailto:guyon@clopinet.com) – June 2011

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## Introduction:

This document describes a data collection program written in Matlab®. The software records videos of sets of gestures pertaining to a given “lexicon”. The user may choose among a variety of lexica, for instance *diving signals*, *traffic regulation signals*, *Italian gesture*, etc. The user can then practice the gestures before recording. For that purpose, the software presents the user with images representing the gestures and short descriptions. When ready, the user needs to record short sequences of one to five gestures, following a given “script”. Every script consists of a total of 100 gestures from the chosen lexicon. A set of recorded gestures following such a predefined script will be called an “experiment”. The recorded videos are saved in Matlab format. To view a movie, load it in Matlab and use function “movie”, e.g. load G1.mat; movie(M, [], fps);<sup>1</sup>

## Prerequisites

- Matlab R2011a
- Image processing toolbox
- Image acquisition toolbox
- A webcam. Test it from within Matlab by typing:

```
➤ a = imaqhwinfo;
➤ camera_name = char(a.InstalledAdaptors(end));
➤ camera_info = imaqhwinfo(camera_name);
➤ camera_id = camera_info.DeviceInfo.DeviceID(end);
➤ resolution = char(camera_info.DeviceInfo.SupportedFormats(end));
➤ preview(vid);
```

When you are done, close the preview window and delete the video object:

```
➤ delete(vid);
```

---

<sup>1</sup> Matlab may run out of memory; to run large movies rather use our script play\_movie(M, fps), which chops the movie in smaller chunks.

If this does not work, check that your webcam is functioning properly using another application like Skype.

- Increase your Java heap space by going to Matlab “Preferences”, then “Java Heap Memory” under “General” and increase it to the maximum.

## Contents of the package

When the software is unpacked, the main directory includes the Gesture Data Collection (GDC) program **gdc.m** and the following sub-directories:

- Matlab: the objects and functions that main.m depend upon
- Lexicon: the various lexicons
- Collected\_data: where the recorded data ends up.

Change the Matlab directory to the main directory and type:

```
➤ gdc;
```

at the prompt to start the GUI (Graphical User Interface). This is all you should need to do.

If you have to interrupt your work or if Matlab quits unexpectedly, the working session can be resumed by starting gdc again. To quit cleanly, either click on “Quit” or type at the prompt:

```
➤ cleanup;
```

This will close all the windows and delete the video object used for recording.

Although all the functions are accessible from the GUI, you may want to start (or restart) some of them at the prompt, after the initializations. If you do not run gdc first, you must set your path properly. From the root directory of the package:

```
➤ set_path;
```

Then, you can run the initialization program called by gdc manually

```
➤ initialize;
```

Here is a list of the principal scripts or functions you may want to run after initialization:

Name of the script or function	Task performed
browse(lexicon);	Displays the flashcards of the selected lexicon (image and description of gestures).
show(lexicon);	Displays all the images of the selected lexicon.
show(V{k});	Shows the lexicon V{k}.
show(S);	Displays the script in a window.
practice;	Starts the practice GUI. Previews the gestures, no recording.
preview_and_go;	Starts the GUI, which allows you to record gesture sequences following a given script.
continue_working;	Re-starts without asking again the name of the person, his dominant hand, etc.
cleanup;	Closes cleanly all the objects and windows (also called by clicking on the “Quit” button).
movieeditor;	Starts the movie editor that lets you clip the beginning and end of a movie. Lets you save in Matlab and AVI formats.
save_movie(filename, M, fps);	Lets you save the current movie in Matlab format (use load(filename) to reload)
play_movie(M, fps);	Plays a movie.

## Getting started with the GUI

When you type **gdc** at the Matlab prompt, you first get prompted for your name (enter your first and last name) and you are asked whether you want to continue an old experiment (reply n, for NO). Then you are asked for your dominant hand (r for right and l for left). Finally, you get to choose your lexicon. Reply YES (y) if you want to visualize them. An example of lexicon visualization is shown in Figure 1. Then, choose the number of the lexicon you want to work on. In this example, we chose “SurgeonSignals”.

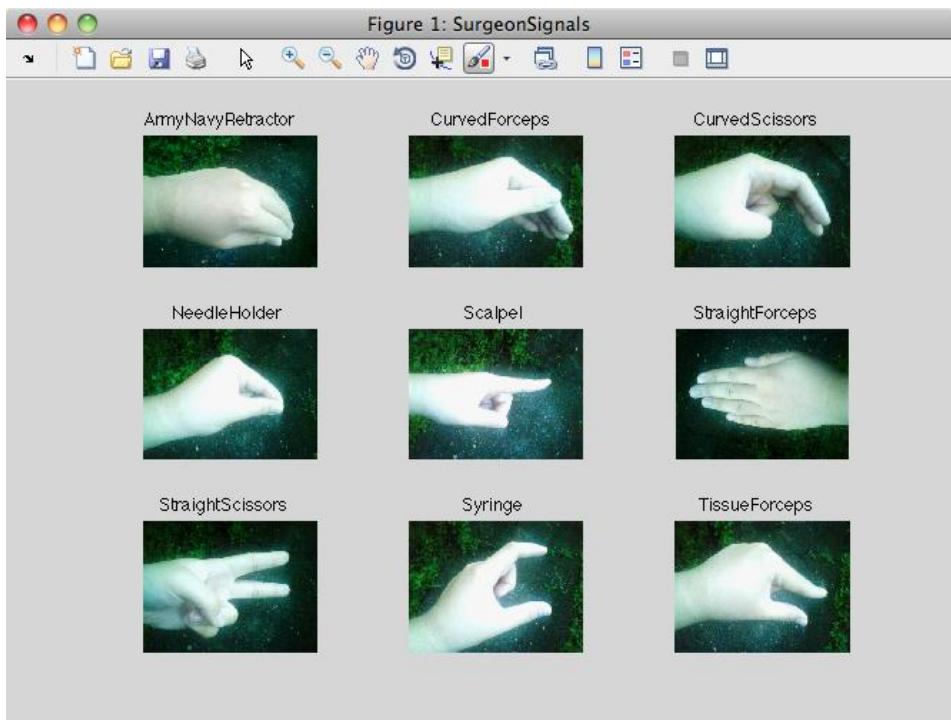


Figure 1: Example of lexicon.

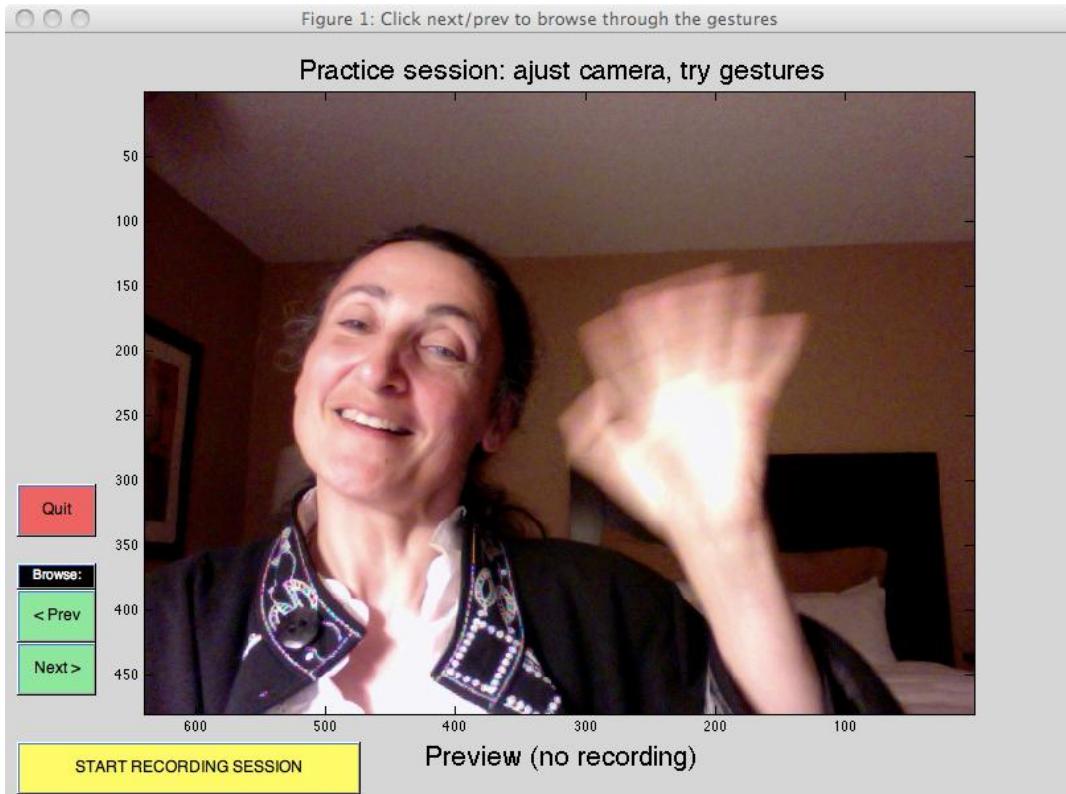


Figure 2: The preview GUI to practice gestures.

## Practice GUI

Once you have entered this information, a first GUI starts to let you practice gestures (Figure 2). Click the buttons “Next” and “Prev” to explore the lexicon and practice the gestures, which are described by “flashcards” (Figure 3).

We found that it is usually easier to reproduce gestures if we see in the preview window our *mirror image* and if the flashcards of the gestures also show the mirror image of the gesture to be performed. By default, we generally show the mirror image of a gesture performed (adjusting the choice of dominant hand for right or left handed people). There are a few exceptions to that rule depending on the position of the camera, which took the picture: it is sometimes more confusing to see the mirror image if the picture was taken by the person performing the gesture rather than a person place in front. However, you may feel more comfortable by a different view. We let you toggle in the “Gestures to be performed” window between “direct view” and “mirror view”. Your final choice is recorded and will be used to present you images for recording.

Click “START RECORDING SESSION” when you are ready to start or “Quit” to terminate.

## Data collection GUI

When you click “START RECORDING SESSION”, you open a new GUI (Figure 4). You are initially in preview mode. This lets you practice gestures. You can turn the *preview mode* on and off using the button in the “Preview” section. **Known bug: when you let “preview” run for a long time Matlab crashes.**

When you are ready, you can record the gesture sequence shown in the “Gestures to be performed” window (Figure 5). This is a random subset of one to five gestures from the lexicon. The gestures should be performed in sequence, reading the figure from left to right and from top to bottom. The script (show in Figure 6) contains a number of such sequences, for a total of 100 gestures to be recorded. This bundle of gesture sequences, once recorded, is called an “experiment”. Every experiment starts with the recording of isolated gestures for all the gestures of the lexicon.

To record a gesture sequence:

- Click “START” in the “Record” section, wait for the camera to be ready, perform the gesture sequence, then click “STOP”
- If you are in “autosaving” mode (this is the default option), your recording is automatically saved. Wait for the file to be saved, then click “Preview” to check your recording. If not satisfied, record again. Otherwise, click “Next” to advance in the script.
- If you are not in “autosaving” mode (this can be changed by clicking on the lower left button), your recording is not saved automatically. Instead, you get redirected to an editor

(Figure 7), which lets you clip away the beginning and the end of the recording, if you want. When satisfied you can manually save (or record again).

- Before moving on you may want to preview your work. You can re-record if you are not satisfied. You can also move backwards and forward with the “Next” and “Prev” buttons and re-record any sequence you want.
- The autosaving mode is convenient to record simple hand gestures, which require framing only the upper body, in a way that you can sit at your computer and easily control the recording without moving in and out. The manual saving mode allows you to record signals made with the entire arm, which require standing and being out of reach of the computer mouse. You can then edit out the beginning and end of the video clip before saving.
- The editor can be used even when you are in autosaving mode. However, if you edit, your changes take effect only if you manually save. You can check your progress in the script by looking at the script window. All sequences recorded are marked [done]. If you accidentally did not record one, you can go back several steps in the script (with the “Prev” button), record it, then move forward several step to where you were (with the “Next” button). Movies can also be re-loaded, previewed, and overwritten with a new recording.
- **The script wraps around and starts again from the beginning. So check your progress not to do the work twice.**
- Just click the “Quit” button when you are done. You will be asked at the Matlab prompt whether you want to continue working on another lexicon. You can then record a new “experiment”.
- **If Matlab quits unexpectedly or if you have to interrupt your work, don’t panic, you can just start Matlab again and run gcd. It will let you resume an old experiment of your choice were you left it.**

Have fun!



Figure 3: Gesture to be performed

CurvedScissors



**TYPE** = signal

**NAME** = CurvedScissors

**BODYPART** = one hand

**DESCRIPTION** = Make a curve with index and middle finger, palm down,  
thumb folded.

**ENGLISH** = Give me the cuved scissors or Metzenbaum.

**SOURCE** = Nursing the Nurse

**URL** = <http://nursing-the-nurse.blogspot.com/2010/03/hand-signals-in-operating-room.html>

**MIRROR** = off

Original view

Mirror view

Figure 3: An example of gesture description card.



Figure 4: Data collection GUI.

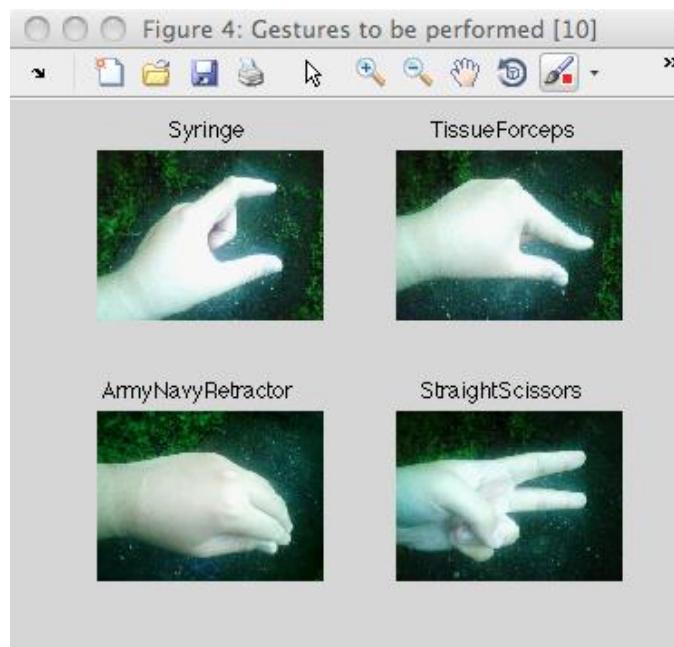


Figure 5: A random subset of gestures to be performed. The script contains a number of such sequences of gestures, for a total of 100 gestures per “experiment”.

Figure 3: Script

```
1-CurvedScissors [done]
2-Syringe
3-CurvedForceps
4-StraightScissors
5-Scalpel
6-NeedleHolder
7-ArmyNavyRetractor
8-StraightForceps
9-TissueForceps
10-Syringe - TissueForceps - ArmyNavyRetractor - StraightScissors
11-Scalpel - TissueForceps
12-CurvedScissors - TissueForceps - Scalpel - ArmyNavyRetractor - ArmyNavyRetractor
13-NeedleHolder - NeedleHolder - CurvedForceps
14-NeedleHolder
15-NeedleHolder
16-Syringe - CurvedForceps
17-CurvedScissors - CurvedScissors
18-StraightScissors - CurvedScissors - Scalpel
19-CurvedForceps
20-StraightForceps - Scalpel - TissueForceps
21-Syringe - StraightScissors - TissueForceps - Syringe - CurvedScissors
22-CurvedScissors
23-CurvedScissors - StraightScissors - NeedleHolder - Syringe
24-TissueForceps - Scalpel - CurvedForceps - ArmyNavyRetractor
25-Syringe
26-StraightForceps
27-TissueForceps - ArmyNavyRetractor
28-ArmyNavyRetractor - StraightForceps - StraightScissors
29-Scalpel
30-ArmyNavyRetractor - Syringe - Syringe - StraightForceps - StraightForceps
31-NeedleHolder - StraightScissors
32-CurvedScissors - ArmyNavyRetractor - NeedleHolder
33-StraightForceps
34-CurvedForceps - ArmyNavyRetractor - TissueForceps - Scalpel
35-ArmyNavyRetractor
36-CurvedForceps - StraightForceps
37-StraightForceps - CurvedForceps - NeedleHolder - Scalpel - TissueForceps
38-TissueForceps
39-StraightScissors
40-NeedleHolder - CurvedForceps - StraightScissors - CurvedForceps
41-CurvedForceps - Syringe
42-Scalpel
43-Scalpel - CurvedForceps - Syringe
44-StraightScissors - Scalpel
45-ArmyNavyRetractor - NeedleHolder
46-StraightForceps - StraightForceps
47-TissueForceps
```

Figure 6: An example of script for the SurgeonSignals lexicon. Recorded sequences are marked [done].

## Movie Editor

The movie editor lets you clip the beginning and end of a sequence:

- Move the slider to the position where you want to start the movie (and eliminate the frames before), then click “Cut>from>Current”.
- Move the slider to the position where you want to end the movie (and eliminate the frames after), then click “Cut>to>Current”.
- Execute the cut by clicking Cut>Cut
- Verify your movie by clicking Playback>Current movie.
- Save your work by clicking Save>Current movie (it saves it with the “correct” name in the data collection directory).

Other function include:

- Opening a movie stored elsewhere with Open movie>Open new
- Saving a movie under another name or as AVI with Save>Save as...

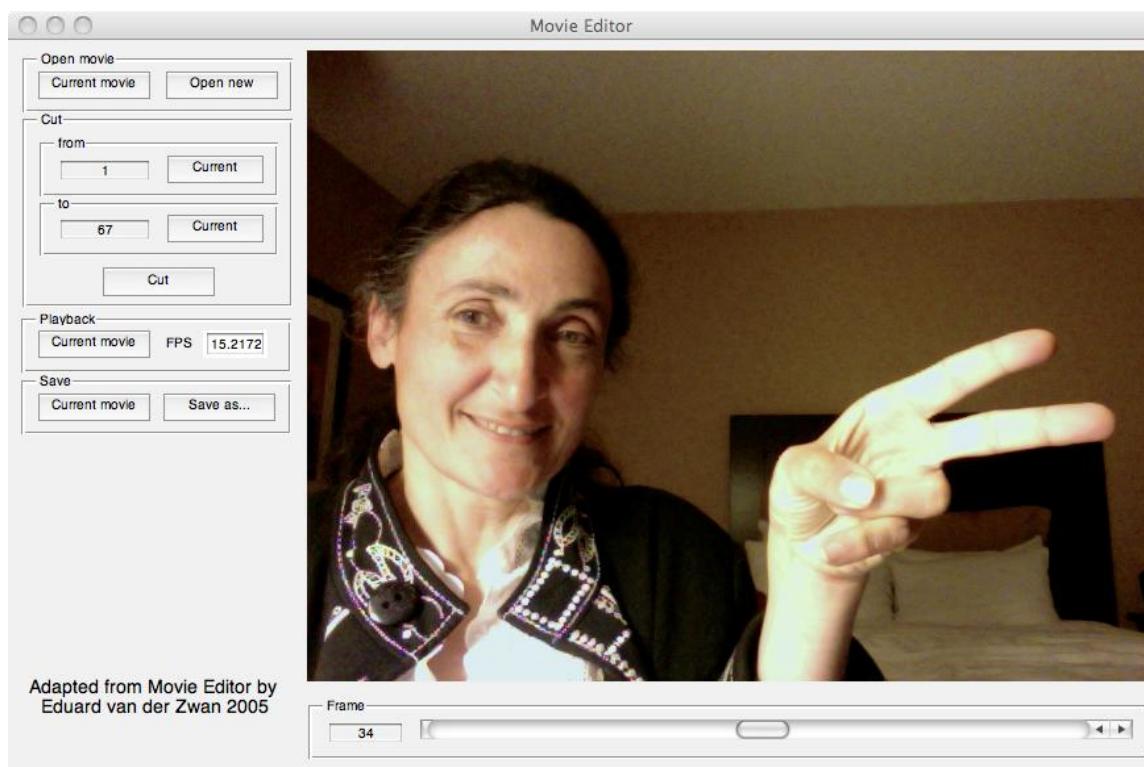


Figure 7: Movie editor.