Rogue Research Inc.

Marmoset Smart Chair

USER MANUAL

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Chapter 1: The Marmoset Smart Chair

The Marmoset Smart Chair can work with different types of experimental software when behavioral control and data acquisition in non-human primate experiments is required. The experimental software that we have tested with the Marmoset Smart Chair is NIMH MonkeyLogic 2 (released on Oct 12, 2017, build 95). We have created custom functions in MATLAB that interface with the electronic components of the Marmoset Smart Chair (proximity sensors, RFID, weighing mechanism) and send the information to MonkeyLogic. We provide the installation files for MonkeyLogic 2 (build 95) which include the custom scripts and functions for the Marmoset Smart Chair for our researchers. We are in the process of testing the Marmoset Smart Chair MATLAB functions with the newest version of MonkeyLogic 2 software (Apr 8, 2019 build 185). If you have any questions, please contact us at info@rogue-research.com.

The setup of the Marmoset Smart Chair consists of the following steps. First, the researcher needs to set up the Marmoset Smart Chair in their facility and connect it to the MonkeyLogic computer. Second, the researcher needs to install both MATLAB R2017b (Mathworks Inc.) and MonkeyLogic 2 software on a Windows computer running Windows 7 or Windows 10 operating system. The installation files for MonkeyLogic 2 (Oct 12, 2017 build 95) will be provided on a USB device. Finally, the researcher will be required to calibrate the weighing plate inside the Marmoset Smart Chair with the help of MATLAB scripts and the precision calibration weights (see "Calibration of the Weighing Mechanism"). The procedure for setting up the MonkeyLogic software and the Marmoset Smart Chair is described.

To complete the setup, the researcher needs to use a standard HDMI cable connecting the touchscreen to the computer (see "Marmoset Smart Chair Installation").

Please, note that the description of the MonkeyLogic software setup includes the information taken directly from the NIMH website https://monkeylogic.nimh.nih.gov/index.html and additional information provided in this manual.

MARMOSET SMART CHAIR INSTALLATION

Below are the steps required to set up the Marmoset Smart Chair on an animal enclosure:

1- Mount the cage panel to the animal cage (see Fig. 1-1

and Fig. 1-2). Vertical sliding door should be in upper position in order to remove or install the Marmoset Smart Chair. Where necessary, we will provide drill guides and other instructions for mounting based on prior correspondence with the customer.

2- Mount the perch to inside of the cage panel.

3- Mount the Marmoset Smart Chair onto the cage panel (Fig. 1-3). Once the Marmoset Smart Chair is installed, the vertical sliding door can be lowered into position to allow animal entry/exit.

4- Connect the flat ribbon cable from the NHP Smart System Interface SC-1 (electronics enclosure) to the Marmoset Smart Chair (Fig. 1-4A).

5- Install the touchscreen and connect the following three cables to the touchscreen (Fig. 1-4B):

- a high-speed HDMI cable connecting the touchscreen to the MonkeyLogic computer. This cable needs to be purchased by the researcher (see Appendix for recommended cable)
- a microUSB cable connecting the touchscreen with the electronics enclosure, provided with the Marmoset Smart Chair
- a power cable connecting the touchscreen with the electronics enclosure, provided with the Marmoset Smart Chair

6- First, install the reward bottle onto the cage panel. Next, insert one end of the tubing into the reward bottle, pass the tubing through the pump (as shown in Fig. 1-5), and connect the other end of the tubing to the sipper tube.

REWARD SYSTEM

The NHP Smart System Interface SC-1 features:

- a button for manual reward delivery and priming the reward (middle red button)

Fig. 1-1

Hardware components

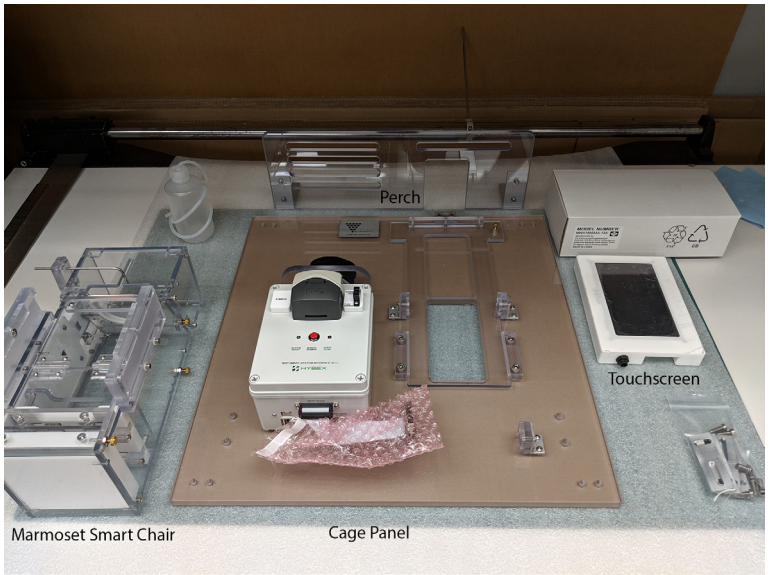


Fig. 1-2

Cage panel and mounting bracket

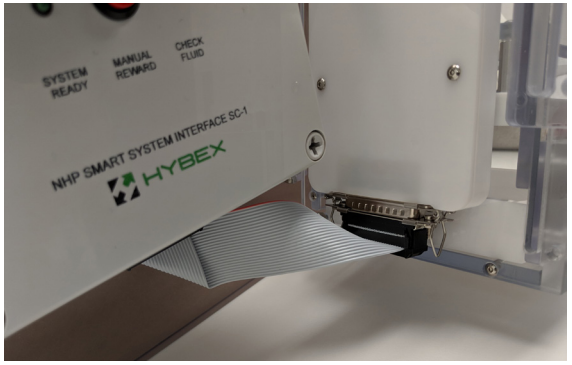
Fig. 1-3

Marmoset Smart Chair mounted to cage panel

Fig. 1-4

Connecting cables

A. Ribbon cable from NHP Smart System Interface SC-1 to the Marmoset Smart Chair.



- a green LED indicating the system is powered on and ready for reward delivery
- a red LED indicating the absence of fluid inside the tubing

In the behavioral experiments we have been using dilutions of two different types of syrups, Canadian Maple syrup and banana syrup.

Both syrups need to be diluted in water, with the dilution factor determined experimentally on-site (5-20% dilution).

IR SENSORS, RFID SYSTEM AND WEIGHING PLATE

The Marmoset Smart Chair is equipped with two sets of infrared (IR) proximity sensors, an RFID system and a weighing plate, shown in Fig. 1-6. The IR sensors are located above and below the neckplate. The weighing plate is positioned directly below the sitting plate. The

B: Power and microUSB cables for the touchsreen.

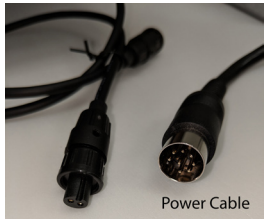
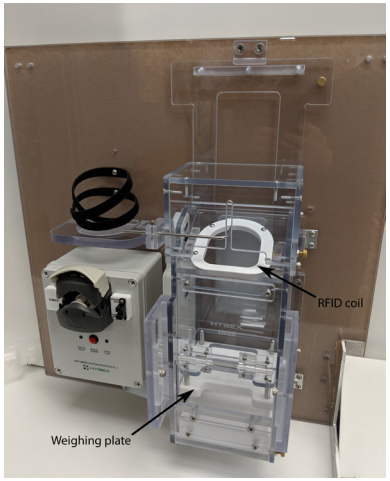


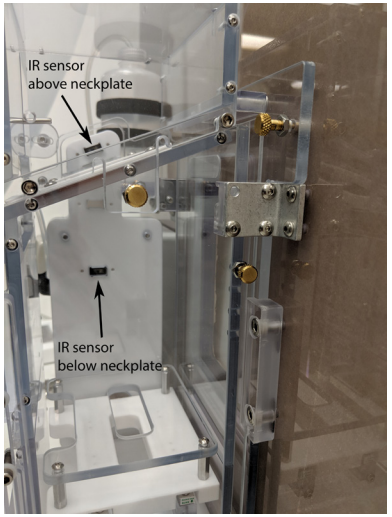
Fig. 1-5

Inserting the tubing through the reward system

Fig. 1-6

IR proximity sensors, RFID coil and weighing plate





RFID coil is incorporated into the neckplate. The RFID system records the identification number of each marmoset by detecting the RFID tag (transponder) located in their collar. Fig. 1-7 demonstrates how to assemble the RFID containers for the collars.

An assembled and installed Marmoset Smart Chair is seen in Fig. 1-8.

DISINFECTION AND MAINTENANCE

The plastic components of the Marmoset Smart Chair should be cleaned several times per month (e.g. between 1 and 4 times per month depending on the waste accumulated inside the chair) using a standard type of cleaning solution as is found in most research animal facilities (e.g. Prevail by Virox Technologies Inc). The cleaning solution should not be sprayed onto the exposed electrical components, such as the infrared sensors or any wires inside the Marmoset Smart Chair.

An easy way to clean the tubing of the reward system is to remove it from the reward system and run warm water through it. You can use a 20 ml syringe with an 18 ga needle to squirt/pass water through the tubing. We clean the tubing at least 1-2 times per week to ensure that there is no syrup accumulation inside the tubing that would also decrease the amount of reward being dispensed per trial.

GETTING STARTED WITH MONKEYLOGIC

Complete information about the NIMH MonkeyLogic software is provided on the following website:

https://monkeylogic.nimh.nih.gov/index.html

The website contains specific guidelines for organizing and programming experiments in MonkeyLogic, including sample experiments, a list of functions, and a user forum.

The version of MonkeyLogic 2 which we provide on a USB device incorporates custom functions for the Marmoset Smart Chair.

Fig. 1-7

Assembly of the RFID container

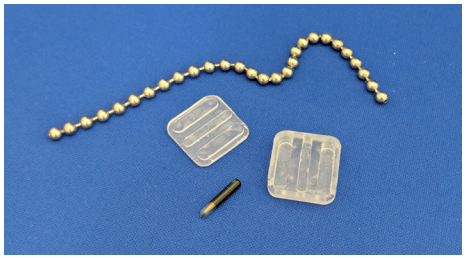


Fig. 1-8

The assembled and installed Marmoset Smart Chair hardware on an enclosure

The version of the MonkeyLogic software that we are sharing with our clients has not been proofread/checked by the MonkeyLogic NIMH team. We have tested MonkeyLogic 2 (Oct 12, 2017 build 95) software for over 12 months by running an actual behavioral marmoset experiment with the Marmoset Smart Chair.

MONKEYLOGIC 2 INSTALLATION

In order to replicate the NIMH MonkeyLogic software configuration that we have tested with the Marmoset Smart Chair, we recommend that you use:

1. MATLAB R2017b downloaded at https://www.mathworks.com/

2. NIMH MonkeyLogic 2 (Oct 12, 2017 build 95) provided by us on a USB device. We have incorporated custom scripts and functions into MonkeyLogic 2 (build 95), which permits communication with the Marmoset Smart Chair.

The entire installation procedure for MonkeyLogic is provided in detail at https://monkeylogic.nimh.nih.gov/docs_GettingStarted.html

Below we are including the relevant steps taken from the NIMH website:

1. Software Installation, using either a MATLAB installer or a zip file.

- Using a MATLAB app installer:
  - Double-click the downloaded ***.mlappinstall** file. It will open MATLAB and pop up a question dialog. Click the **Install** button and NIMH MonkeyLogic will be added to the MATLAB menu. If this process fails for any reason, you can manually open MATLAB and install the package by clicking the

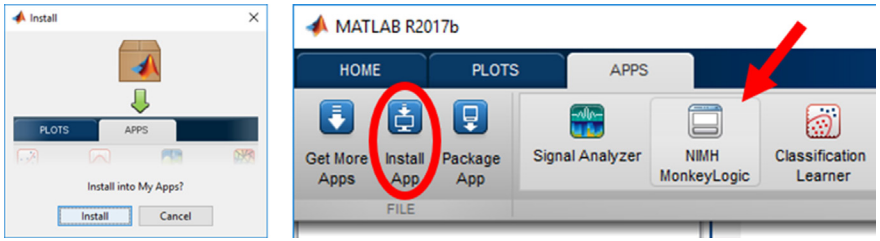


Fig. 1-9

MATLAB app installer

Install App icon.

- The installation directory for MonkeyLogic 2 with MATLAB 2017b is:

  C:\Users**username**\Documents\MATLAB\Add-Ons\Apps

  Username is your user directory.

- Using a zip file:
  - Decompress the zip file to a directory that you choose and add the directory to the MATLAB path. You can add the subdirectories as well but it is not necessary.

2. Once installation is complete, exit MATLAB.

3. Extract the **ML2_MarmChair.zip** file and copy the contents to "C:\Users**username**\Documents\MATLAB" . Overwrite all files when asked.

4. In the same path "C:\Users**username**\Documents\MATLAB", edit the **startup.m** file and edit the path line "path = 'C:\Users**username**\Documents\MATLAB';"

Insert the user directory name your computer uses where it says **username.**

At this point the installation and the initial setup of MonkeyLogic 2 should be complete.

Installing additional libraries

NIMH ML requires two libraries distributed freely by Microsoft: 1) Visual C++ Redistributable Packages for Visual Studio 2013 (https://www.microsoft.com/en-us/download/details.aspx?id=40784) and 2) DirectX End-User Runtimes (https://www.microsoft.com/en-us/download/details.aspx?id=8109). NIMH ML tries to detect these libraries during initialization and will ask you to install them if they are not found.

For the VS2013 Redistributable, you need to install **vcredist_x64.exe**, if you have a 64-bit MATLAB, and **vcredist_x86.exe**, if it is a 32-bit MATLAB. **vsredist_arm.exe** is not necessary.

If you have a parallel port, you will be asked to install Inpout32, an open source parallel port driver. To install it, run **inpout32_installer.exe** in the daqtoolbox directory of the NIMH ML installation path. The installation occurs instantly and there is no wizard window showing up. Both 32-bit and 64-bit drivers are installed together. The admin privilege is required.

Launching MonkeyLogic 2

In order to start NIMH MonkeyLogic, click the **NIMH MonkeyLogic** icon on the MATLAB APPS menu (MATLAB app installer) or type **monkeylogic** on the MATLAB command window (zip file installation), depending on your installation method.

The links below explain how to use the Main Menu of the MonkeyLogic:

https://monkeylogic.nimh.nih.gov/docs_MainMenu.html

https://monkeylogic.nimh.nih.gov/docs_GettingStarted.html

Reward Assignment in Main Menu

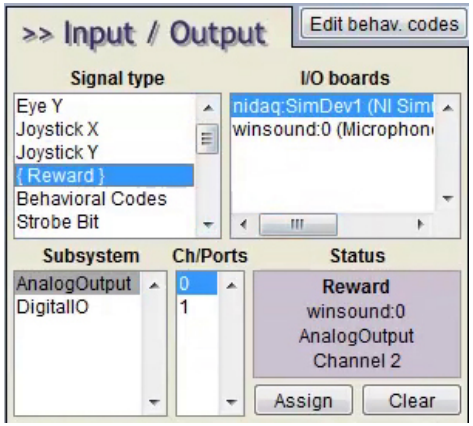
In order to use the reward system that comes with the Marmoset Smart Chair, the researcher needs to enter the following information in the MonkeyLogic Main Menu (top right corner):

First, Select **{Reward}** under Signal Type. Next, select **winsound:0** under Subsystem.

Fig. 1-10 is a snapshot of the configuration that we use in our setup. The researcher does not need the NIDAQ card installed in their system to use the Marmoset Smart Chair (the selection nidaq:SimDev1 will be absent from the researcher's computer in such case).

Fig. 1-10

Reward submenu



Video Information in Main Menu

The link below gives information about the use of Video section (middle top part) of the Main Menu:

https://monkeylogic.nimh.nih.gov/docs_MainMenu.html#Video

See Fig. 1-11 for an example configuration.

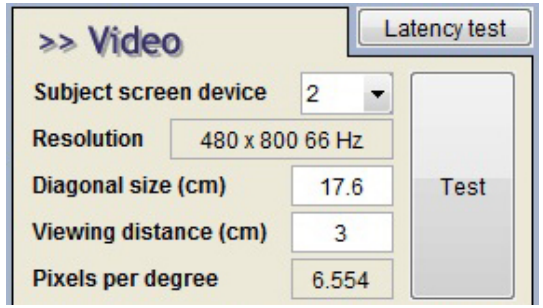
MonkeyLogic Control Screen: Running an Experiment

Fig. 1-12 shows the MonkeyLogic control screen on the left, a web camera view on the Marmoset Smart Chair during the experiment in the top right and the custom GUI created specifically for the Marmoset Smart Chair in the bottom right.

The GUI gives the researcher access to the following information:

Fig. 1-11

Video information submenu



- Date and Time when the experimental session started

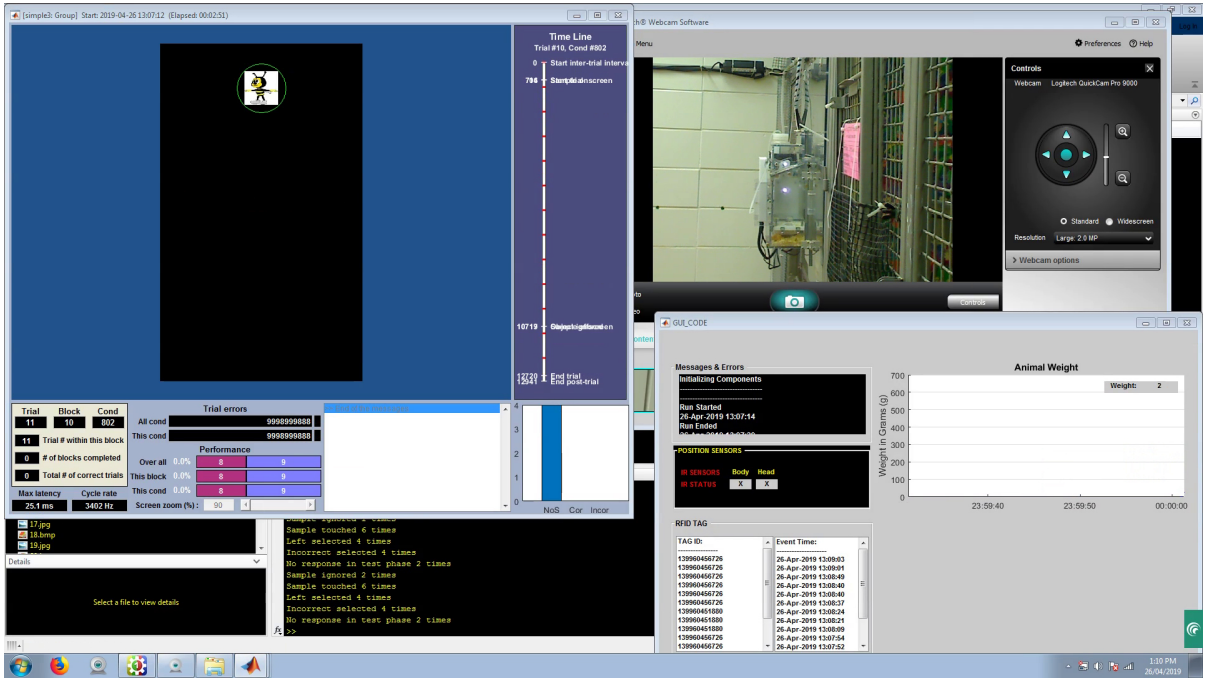
- Animals' weight in grams

- Whether an animal is inside the chair (Body = 1) or not (Body = X), and whether the animal's head is above the neckplate (Head = 1) or below (Head = X)

- The radio-frequency identification tag number (TAG ID) of the animal and the time it was detected (Event Time)

Fig. 1-12

MonkeyLogic session GUI



MonkeyLogic 2: Sample Experiments and User's Forum

The link provided below explains how to create and organize the tasks using MonkeyLogic:

https://monkeylogic.nimh.nih.gov/docs_CreatingTask.html

We are including a sample delayed non-match to sample experiment on the provided USB device.

Any questions concerning programming in MonkeyLogic can be posted on the NIMH MonkeyLogic User's forum at https://monkeylogic.nimh.nih.gov/board/

Initialization Script

We are providing the initialization script **RFID_PhidgetBridge_Timer.m** which verifies that all components of the Marmoset Smart Chair, specifically the IR sensors, RFID and weighing mechanism work properly. The initialization script can be executed both before and after launching MonkeyLogic. The researcher is recommended to run the script before starting an experiment.

Timing Files: Initialization and Termination Codes

Tasks in MonkeyLogic are programmed using condition files and timing files (see https://monkeylogic.nimh.nih. gov/docs_CreatingTask.html). In order to establish communication between MonkeyLogic and the Marmoset Smart Chair, it is required that each timing file contain the correct initialization and termination codes (see the provided appendix_scripts.m file).

Timing Files: Online Sensor, Weight and RFID Data

In the appendix_scripts.m file, example codes for retrieving IR proximity sensor, weight, and RFID data online are provided.

In the GUI, the weight displayed should be zero when no animals are present. Should the number deviate, you may use the following procedure to zero the scale:

- Add the following line of code in the beginning of each timing file (after the initialization code):

---

hotkey('z', 'Zero();');

- While the task is running and no animals are present in the Marmoset Smart Chair, press **z** on the keyboard. This will zero the scale and the display in the GUI will return to "zero".

Helpful MonkeyLogic Functions in Timing Files

We have found the following functions to be useful in our timing files:

- bhv_variable() is a timing file command "that can be used to add custom variables to the behavior file. The syntax for this command is 'bhv_variable('var_name',var_value);'. The variable name should be a string of 32 letters or fewer, and the variable value should be a scalar or a vector of length 128 or less. The data type must be char or numeric, and all numeric data types will be cast to doubles. This command should be called once on each trial for each new variable" (see https://www.brown.edu/Research/monkeylogic/recentchanges.html#february10)

e.g. bhv_variable('correct','left');

In addition, a variable can be stored inside the BHV file using the following code:

e.g. TrialRecord.User.SubjectName = 'Apple';

- In MonkeyLogic 2 (build 95) eventmarkers from the preceding trials within a session cannot be accessed or retrieved by default. In order to make them available online, the following code can be used in the beginning of a timing file (it needs to follow the initialization sequence for the sensors; see the provided **appendix_scripts.m** file):

```
if TrialRecord.CurrentTrialNumber > 1
    TrialRecord.User.TrialCodes(...
    TrialRecord.CurrentTrialNumber-1) = ...
    TrialRecord.LastTrialCodes;
end
```

Structure of a Data.mat File

The IR proximity sensor data, weight and RFID data are saved automatically in the MonkeyLogic experiment folder in the end of each trial using the following format: year-month-date HH:MM:SS.mat. For instance, 2019-January-01 13_12_31.mat. The structure of a data file is explained below (see Fig. 1-13, Fig. 1-14 and Fig. 1-15).

- **startTime** is the start time of the entire experimental session (the start of the first trial in the session)
- **stopTime** is the end time of the entire experimental session (the stop time of the last trial in the session)
- **Weight** consists of two rows. The top row gives the weight in grams and the bottom row is the time

in seconds from the beginning of the current trial. The time is given as a serial date number. In order to convert the time from a serial date number to datetime, the researcher can use the following code:

---

t = datetime(InsertSerialDateNumberHere,...

'ConvertFrom','datenum')

For instance:

t = datetime(1.843402777777778e04,...

'ConvertFrom','datenum')

gives

t= 31-Dec--0001 00:00:15

At present, the user needs to ignore the date and only take note of the time in HH:MM:SS. We are working on the code to replace 31-Dec—0001 with the date of the experiment.

- **IR** gives information about the animal position inside the chair.
  - **Data.IR.Count** gives information about the number of times (count) the information from the IR proximity sensors was received.
  - **Data.IR.Data** gives the value of the IR Proximity sensors when a state change is detected by the Marmoset Smart Chair:

    Value = 0 is recorded when there is no animal inside the Marmoset Smart Chair.

    Value = 4 is recorded when the monkey is inside the chair but the head is below the neckplate.

    Value = 6 is recorded when the monkey is inside the chair and the head is above the neckplate.

Fig. 1-13

Structure of a Data.mat file

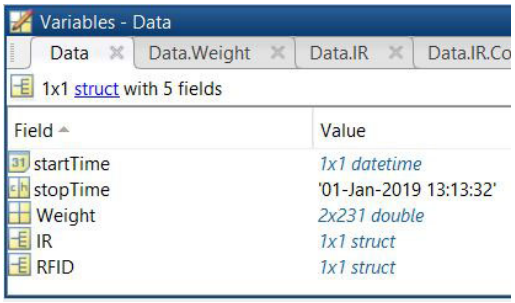
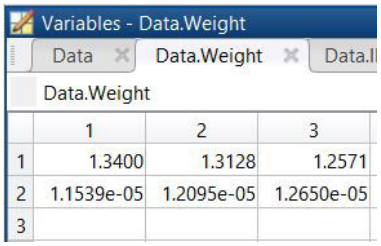


Fig. 1-14

Weight field sample data



Use of Images in MonkeyLogic

Based on our experience with the MonkeyLogic program, we recommend using RGB color images with .bmp, .jpg, or .jpeg extensions. Indexed color images do not seem to be displayed properly in MonkeyLogic. It is preferred to keep the size of individual image files under 1 kB.

Reward Amount

The amount of reward delivered by the reward system remains fairly constant for each pulse. By pressing the manual reward button on the electronics box or by calling goodmonkey(1000, 'NumReward', 1) function in the timing file, the reward system delivers between 0.03-0.04ml. The exact amount needs to be calculated by the researcher on-site.

It is important to note that in the current version of MonkeyLogic, the user cannot change the duration of reward delivery (i.e. the amount of time in seconds) using the **goodmonkey** function in the timing file. For instance, goodmonkey(5000, 'NumReward', 1) will always remain equivalent to goodmonkey(1000, 'NumReward', 1). In order to change the number of rewards (reward pulses) given, the researcher can i) either change the number of pulses using the goodmonkey function. For instance, goodmonkey(1000, 'NumReward', 5) will give 5 reward pulses, or ii) use a For loop in MATLAB. For example:

---

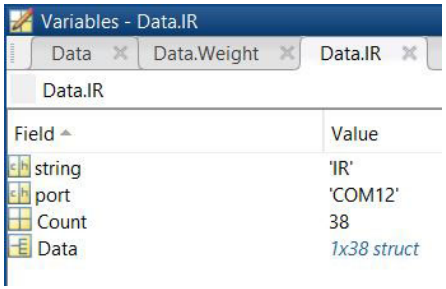
for i=1:3

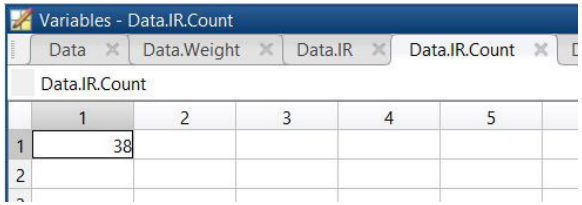
Fig. 1-15

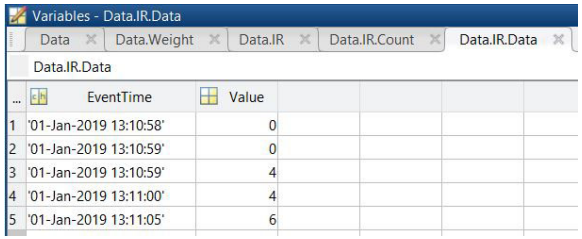
A: Example Data.IR structure

B: Example Data.IR.Count

C: Example Data.IR.Data








```
    goodmonkey(1000, 'NumReward', 1);
    pause(0.3);
end
```

User Plot Function in MonkeyLogic

User plot function can be used to display graphically the values/results of interest during an ongoing experiment. It is described the following way on the NIMH Monkey-Logic website:

"User plot: This figure can be used to show the result of online behavior analysis. Users can register their own functions in the main menu. If no function is registered, a default reaction time graph will be drawn here" (found at https://www.nimh.nih.gov/research/research-conducted-at-nimh/research-areas/clinics-and-labs/ln/shn/monkeylogic/running-a-task.shtml). An example of user plot function is provided in **appendix_scripts.m** file (Fig. 1-16).

Naming of Condition Files in MonkeyLogic

Depending on the version of MonkeyLogic, you are advised to avoid using special symbols/characters in the naming of a condition file, including dashes, underscores or slash lines. For instance, you should not name the condition file as cond_first.txt. Instead, it is advised to use condfirst.txt or cond1.txt.

CALIBRATION OF THE WEIGHING MECHANISM

We are providing MATLAB scripts required to calibrate the weight inside the Marmoset Smart Chair. The researcher will need to use the calibration weight sets of known value. We are providing two precision weight sets with the Marmoset Smart Chair. Additional weight sets can be purchased, see Appendix for suggested calibration weights. It is advised to perform the calibration when there is no animal activity in and around the Marmoset Smart Chair and attached perch.

MATLAB Calibration Procedure

- Download the folder called **Calibration** and paste it into "C:\Users**username**\Documents\MATLAB\Libraries".
- In MATLAB command window type **LoadCalibration**. A Calibration GUI Window will appear (Fig. 1-17).
- Put a checkmark next to **Detect Bridge**.
- Choose Bridge **0**.
- Put a checkmark next to **Enable**.

At the start of calibration, there should be no weight inside the chair (zero weight). We use two values for carrying out the calibration, V1 and V2. Value of V1 must be equal to zero. Value of V2 is the customer-set value and it needs to be within the weight range of an animal.

- Click **Start Calibration**. At this point, there should be no weight inside the chair.
- Put V1 equal to zero (V1 = **0**). Click **Set**.

- Place the weights of equal value on each corner of the weight plate (one weight per corner for a total of four weights on four corners). The combined value of all weights needs to be within the weight range of an animal, preferably slightly greater than the weight of the heaviest monkey using the chair. For instance, it can be four 125-gram weights placed on the four corners of the weight plate at the same time; the combined weight becomes 500 grams. The value of V2 equals the combined weight of all individual weights inside the chair.
- Enter the value of V2 (e.g. V2 = **500**). Click **Set**.
- Record the values of variables **m** and **b** from the formula in the Calibration GUI by copy-pasting them into a text document or equivalent.
- In MATLAB, open/double-click on **LoadCellsCalibData.mat** found in the MATLAB\ML2 folder. Replace the value of variable **a** in **LoadCellsCalibData.mat** with the value of **m** recorded in the Calibration GUI in the previous step. Similarly, replace the value of variable **b** in **LoadCellsCalibData.mat** with the value of **b** from the Calibration GUI. Save **LoadCellsCalibData.mat** containing the new values of **a** and **b**.

TOUCHSCREEN

Touchscreen Software Setup

In order to adjust the touchscreen backlight brightness and touch sensitivity, the researcher needs to download **GT-1 Pass application** (gt-1_pass_v1017_2.zip) on a USB device or by going to https://www.noritake-elec.com/support/design-resources/tools/gt-1-pass

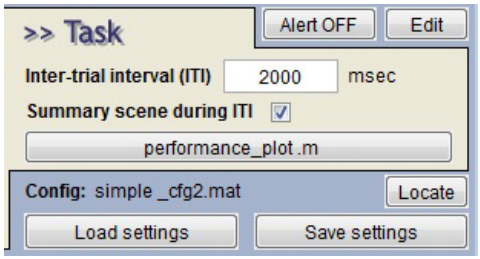
Follow the instructions below, provided by the screen manufacturer, for setting up the Noritake touchscreen. Our configuration is shown in Fig. 1-18.

Touchscreen Application Setup from the Manufacturer

1. Unzip the downloaded file into a folder that you wish to keep your GT-1 Pass. It is recommended to keep it in a new folder to avoid confusion with your existing files. You should now have the GT-1 Pass execution file, WinUSB installer for Windows 7 and GT-1 Pass Quick Start Guide.
2. The USB communication driver needs to be installed next. If you are using Windows 8.1/10, please skip forward to step 3. If you are using Windows 7, please follow the steps below:
   - Unzip **WinUSBdriverForWin7.zip**.

Fig. 1-16

In this example, the user plot function called performance_plot.m is uploaded to the Task submenu of the Main Menu in MonkeyLogic



- Connect your GT-1P module to your PC via USB.
- If you have not installed WinUSB or a Noritake virtual COM port driver before, the driver installation will fail. When it does, go to your PC's Device Manager.
- Right click on **GT800X480A-1303P** and choose **Update Driver Software**.
- Click on **Browse my computer for driver software**.
- Click **Browse** and navigate to **WinUSBdriverForWin7/winusbcompat**.
- Click on **Next**.
- The driver should install and finish by saying that the **WinUSB Device** driver has been installed.

* WinUSB is already packaged with Windows 8.1/10 so only install it on Windows 7.

3. Connect your GT-1P module to your PC via USB.
4. Launch the **GT1-PassXXXX.exe** file. The main GT-1 Pass window should appear.
5. You can now use this tool to evaluate your Noritake GT-1P display module.

Touchscreen Calibration and Parameters

The touchscreen can be calibrated by going to **Tablet PC Settings** and selecting the **Calibrate** option (in Windows 7 operating system). Additional parameters, such as the screen resolution, orientation and the layout for multiple displays (namely the monitor for the MonkeyLogic

Fig. 1-17

Weight calibration GUI

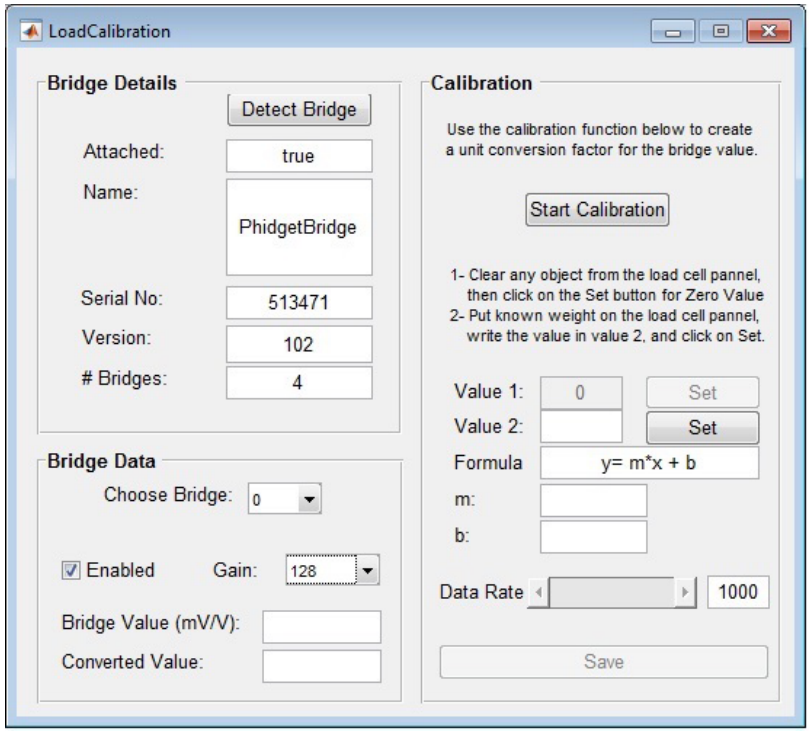


Fig. 1-18

Our touchscreen configuration

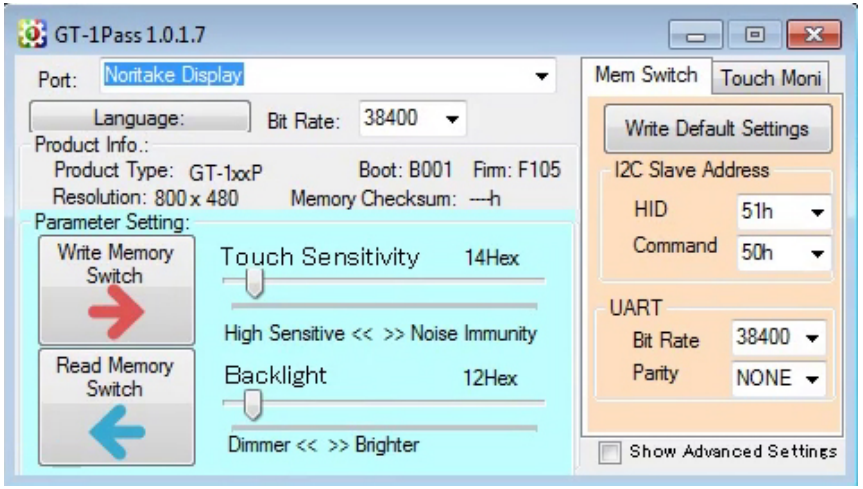


Fig. 1-19

Tablet PC and Screen Resolution settings used in our setup

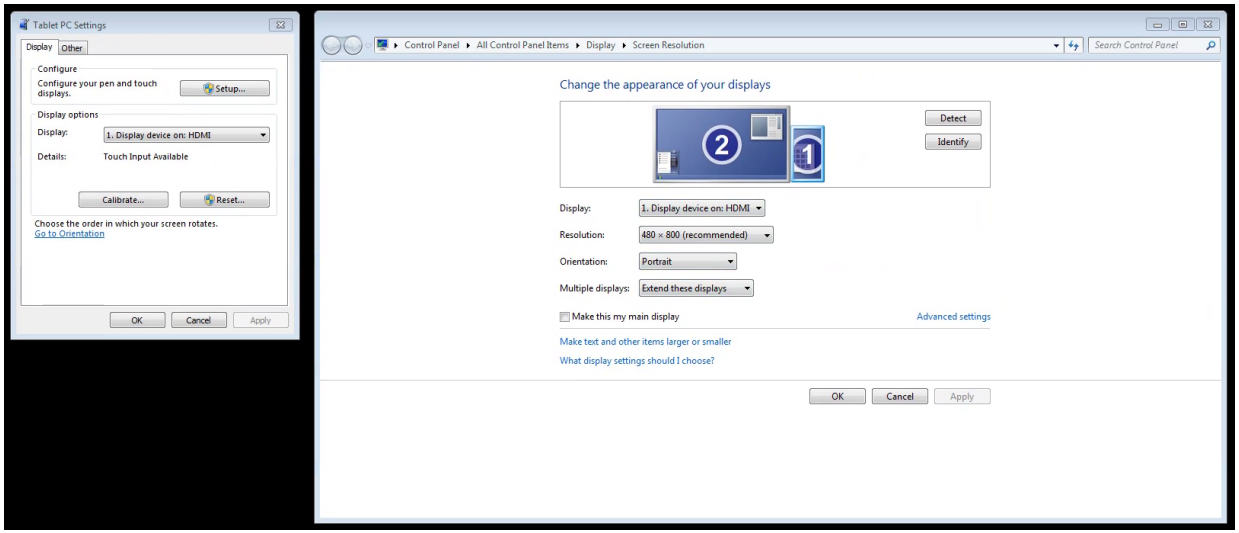
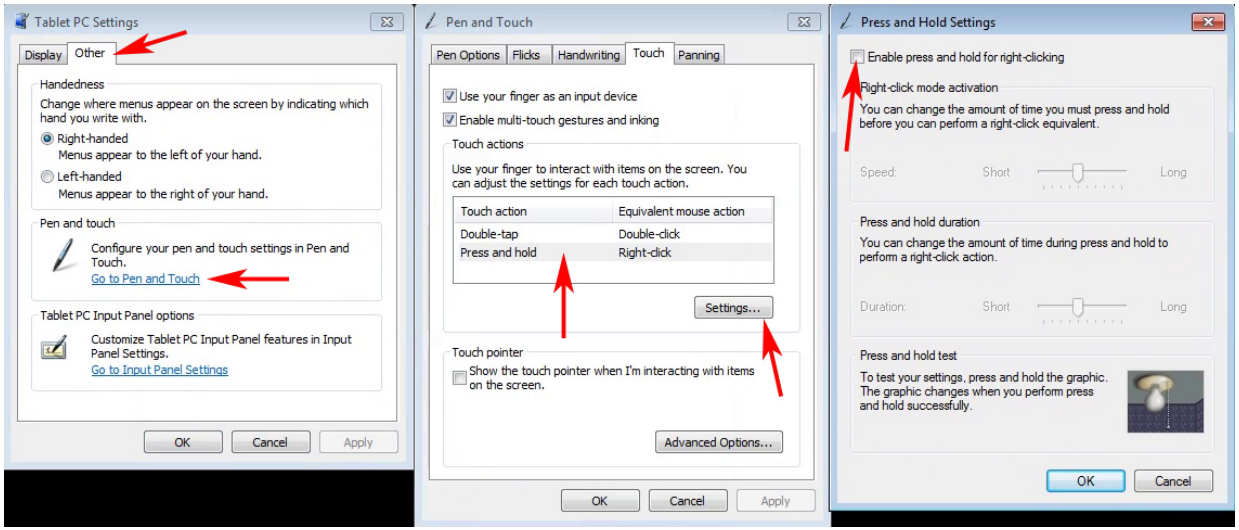


Fig. 1-20

Single tapping setup instructions



computer and the touchscreen) can be selected by going to **Control Panel -> Display -> Screen Resolution** (in the Windows 7 operating system).

In Fig. 1-18, you can see the screenshot of the Tablet PC Settings and Screen Resolution with our current parameters.

The parameters we use are:

- Touchscreen resolution 480 x 800

- Orientation: Portrait

- Multiple displays: Extend these displays

Single Tapping

In some instances, single tapping on a touchscreen is not registered as a touch in MonkeyLogic. To resolve this issue, the researcher needs to disable the '**press and hold**' option for right-clicking in **Pen and Touch**.

Here is the description of the procedure for Windows 7 operating system, shown in Fig. 1-19.

First, open **Tablet PC Settings** and select tab **Other**. Next, click on **Go to Pen and Touch**. Then, in tab **Touch**, highlight/choose **Press and hold** option. Click on **Settings...** directly below. In **Press and Hold Settings**, disable/uncheck the option for **Enable press and hold for right-clicking**.

At the end of each day we set the **Backlight** option in the touchscreen interface (the GT-1 Pass application) to the lowest value (on the Dimmer – Brighter spectrum), which removes all light coming from the screen at night.

REMOTE ACCESS TO MONKEYLOGIC COMPUTER

The computer running MonkeyLogic can be accessed remotely using a variety of programs. We have successfully used RemotePC (https://www.remotepc.com/) and TeamViewer (https://www.teamviewer.com/). Other remote access software can also be used.

APPENDIX

The following is a list of parts and consumable components used in our setup.

- **HDMI cable**

  AmazonBasics High-Speed HDMI Cable, 25 Feet, 1-Pack

  https://www.amazon.com/AmazonBasics-High-Speed-HDMI-Cable-1-Pack/dp/B014I8TC4E/ref=sr_1_3?keywords=AmazonBasics+High-Speed+HDMI+Cable%2C+25+Feet%2C+1-Pack&qid=1556033205&s=gateway&sr=8-3

- **Tubing for reward system**

  3/32"ID (1,6mm bore), 1/16" Wall (1,6mm)

- **RFID transponders**

  RFID Tag Read Only 134.2kHz ISO 11784, ISO 11785 Glass Encapsulated

  Size / Dimension: 2.12mm Dia x 12.00mm

- **Precision weight set**

  Brass Hooked Weight Set with Hanger, Metric (American Educational Products)

  https://www.amazon.com/American-Educational-Hooked-Weight-Hanger/dp/B00657P2XM/ref=sr_1_fkmrnull_1?keywords=Brass+Hooked+Weight+Set+with+Hanger%2C+Metric+%28made+by+American+Educational%29&qid=1555198816&s=gateway&sr=8-1-fkmrnull