CAMPDEN INSTRUMENTS LIMITED

INSTRUCTION MANUAL

FOR

MKII Mouse 5CSRT Software

V1.08 onwards

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CONTENTS

CCL CONTROL 5-CHOICE SERIAL REACTION TIME TASK FOR THE MOUSE

Campden Instruments would like to thank Dr Lawrence Wilkinson and Dr Trevor Humby (Babraham Institute, Cambridge, UK) for their help in preparing this task and manual.

Recommended Reading

This manual should be used in conjunction with the 'CCL Control' manual. For additional information on the tests see:

Humby, Laird, Davies and Wilkinson (1999), **Visuospatial attentional functioning in mice: interactions between cholinergic manipulations and genotype**, *European Journal of Neuroscience*, **Vol. 11**, pp. 2813-2823.

Introduction

These are the specifications for the mouse 5-choice serial reaction time task (5-CSRT) currently used at the Babraham Institute, Cambridge. Further details can be found in Humby et al (1999, EJN, 11, pp2831-2823). They contain general details about handling/water deprivation schedules, initial shaping, training to baseline and the basic task manipulations performed at baseline. Babraham have been running this task for over 3 years and in that time have obtained data in the following mouse strains; C57Bl/6, MF1, DBA2 x C57Bl/6 F1 and F2, CBA2 x C57Bl/6 F1 and F2. They have yet to find a strain that cannot be trained on the task (though they may exist) and both male and female mice can do the task. They have also shown that the task is appropriately sensitive to pharmacological manipulations of the cholinergic and monoaminergic systems. The task has also been successfully used to look for cognitive deficits in a number of genetically modified and knockout mice including, APP(V717I) overexpressor, APPxtau cross, PSD95 KO, nNOS KO, VMAT2 KO.

The basic training schedule is detailed in chapter 4. Briefly, mice should be thoroughly habituated to being picked up, handled and weighed prior to the onset of testing. Once the animals can be handled with ease then they need to be water deprived to provide an incentive to work in the task, this schedule should be implemented gradually and in accordance with Home Office procedures (if applicable). The final stage of pre-treatment is to give the mice experience of the food reward. Babraham use a simple preference test over 6 days. The first few days of testing in the 9-hole boxes involve habituating to the new environment, learning where the food is presented and learning to press open the panel covering the food magazine. After 8 days of pre-training the mice begin training of the 5CSRT task. Finally, once baseline performance has been reached various task and neural manipulations can be carried out.

You have been provided with 15 programs for running a Mouse 5CSRT task:

For cleaning and calculating the feeder:
FeederCal

For checking equipment
Mouse5CSRTSetup1, Mouse5CSRTSetup2, Mouse5CSRTSetup3,
Mouse5CSRTSetup4, Mouse9HBTotalSetup, Mouse9HBwithoutDim

For habituating the Mouse to the 5CSRT task:
MouseTraining1, MouseTraining2, MouseTraining3

Training for the task and the task itself:
Mouse5CSRTBasic

Variations on the task:
Mouse5CSRTVar1, Mouse5CSRTVar2, Mouse5CSRTVar3
Mouse5CSRTVar4

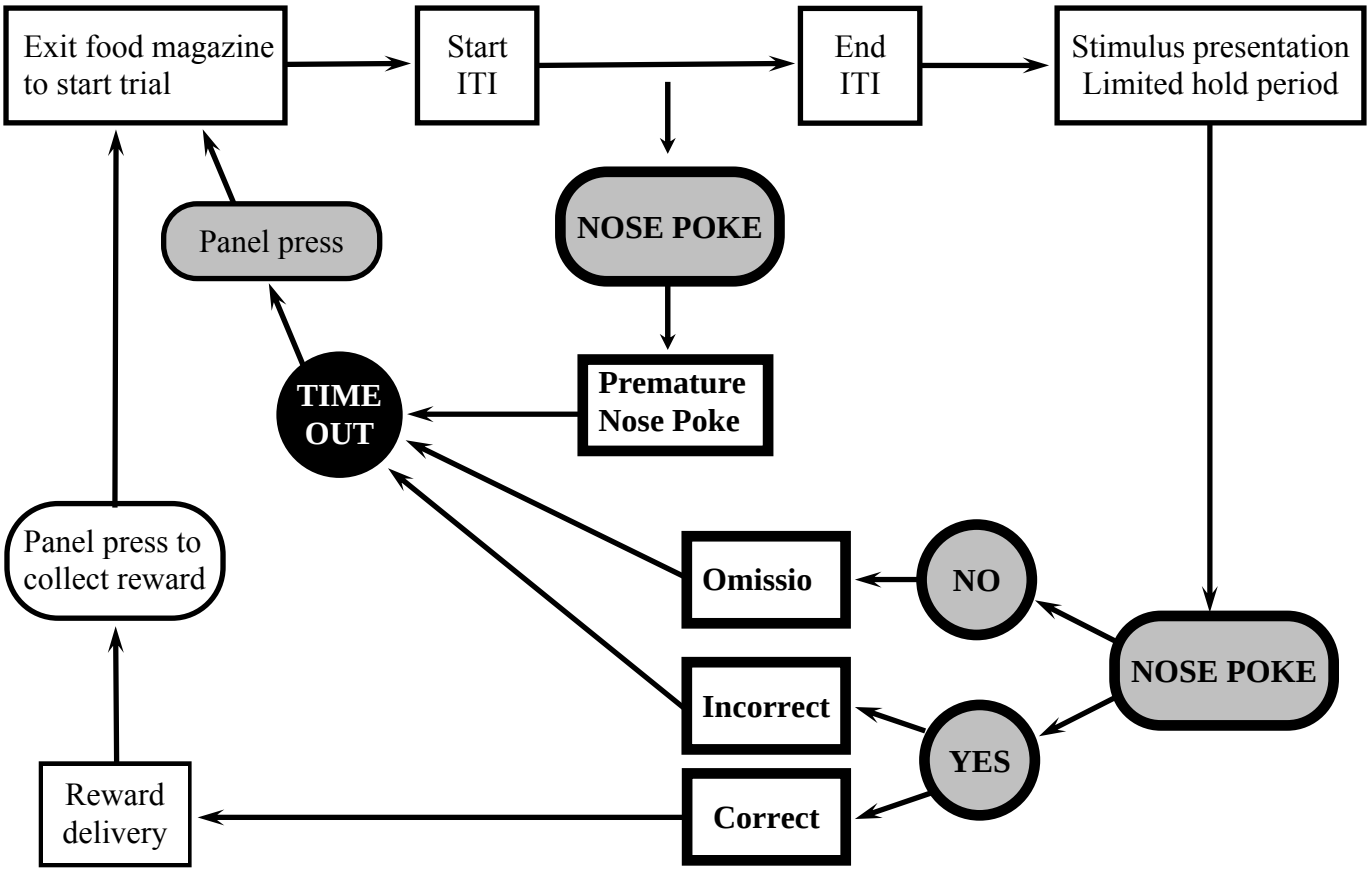
This manual will take you through:

1. The Task
2. Installing the software
3. Setting up the hardware for the task using Control Network Manager.
4. Checking the equipment by running one of the configuration programs. Which one you choose depends on which variation of the task you are likely to use in the future.
5. The habituation procedure that introduces the mice to the equipment.
6. The training procedure, where the 5-choice task is gradually introduced by a series of stages. This is done by using the Mouse5CSTBasic program and a range of set-ups that alter variables in the task.
7. How to create your own set-up files to run variations of the main testing schedule.
8. Further variations on the main task, namely Mouse5CSRTVar1-Mouse5CSRTVar4.
9. Analysing the results using the Control Results Manager, filtering the raw data and creating reports.
10. The last section describes the 'locking' of programs for security purposes, ensuring that the programs are not accidentally or otherwise changed.

1. The Task

The basic form of the task is illustrated below. In order to earn food reward, the mouse is required to detect brief flashes of light occurring in one of the five holes. To do this, it must respond in the appropriate aperture before a certain period (termed the **limited hold**) has elapsed. If it fails to respond, responds in the wrong hole, or at the inappropriate time, then a short period of punishment occurs (**time-out**) signalled by illumination of the house lights (a 5CSRT session is run in darkness). Each trial is discrete, being separated by an intertrial interval (**ITI**). There are typically 100 trials in a session, which might last for up to 30 min.

The 'basic task protocol' below outlines the structure and procedures of the 'Basic CCL Control 5-Choice Serial Reaction Task for the Mouse' (Mouse5CSRTBasic). The program allows discrete sets (blocks) of trials (each with different variables and options) to be run one after the other. Variables and options are determined from a 'set-up' file, easily created from the settings table.



1.1. Basic Task Protocol

1) Session Start

a. Maximum session length is set from settings table and monitored every 30s. When session length has been exceeded and the **trial in progress has finished**, then step 9. ***(Note: because the experiment waits for the trial to end, the actual length of the trial could vary considerably, depending on how good the mouse is at panel pushing. If you feel this is a problem and would like to end promptly when the session length is reached contact Campden Instruments for an amended program).***
b. Free food is delivered by pulsing the liquid pump (usually 350ms) and the food-tray light is turned on.
c. Wait for tray-report / feed-tray panel to be activated.
d. Then step 2.

2) Setting Variables

a. A sequence of spatial stimuli (lamps) is generated from the settings table (e.g. 4 trials each of five holes). There is an option to stipulate the order of the stimuli or to have the computer generate a random order. If the order is randomised, there is an option to limit the number of consecutive times that a lamp is displayed.
b. Intertrial interval set from settings table.
c. Stimulus duration set from settings table.
d. Limited hold set from settings table.
e. Time-out set from settings table.
f. Amount of food to be delivered is set from the settings table.
g. Then step 3.

3) Intertrial Interval (ITI)

a. If last trial in the current block has been completed then step 8.
b. House light is turned off (if on).
c. Food-tray light is turned off (if on).
d. Wait for ITI (normally 5s) then (unless step e) step 4.
e. Response in any of the five holes during ITI (premature response) then step 6.

4) Trial - Limited Hold Period

a. Next stimulus (lamp) in sequence is turned on for the stimulus duration.
b. Wait for the limited hold period, if no hole responses made during that period (error of omission) then step 6.
c. If nose-poke in correct (illuminated) hole is detected (correct response) then step 5.
d. If nose-poke in incorrect hole is detected (error of commission) then step 6.

5) Reinforcement

a. Stimulus lamp is turned off if still on.
b. Liquid food is delivered (usually pump turned on to deliver 20µl) and (optionally) the tray light is turned on.
c. If a nose-poke response is detected in any of the incorrect holes (perseverative responses in incorrect hole) then step 6 (perseverative responses in the correct hole are just counted).
d. If feed-tray panel is pushed then, on release, step 3.

6) Time-out

a. Stimulus lamp is turned off if still on
b. House light is turned on.
c. Wait for the time-out duration (usually 5s).
d. (Optionally if the feed-tray panel is pushed then, on release, step 3.)
e. (Optionally if a nose-poke is detected the time-out period is re-started.)
f. Then step 7

7) Time-out end

a. Turn off house light and turn on tray light.
b. If a nose-poke is detected (unclassified response), option to restart the time-out period (step 6) – there is an additional option to limit the number of times that the time-out will be restarted by an unclassified response during each trial.
c. If feed-tray panel is pushed then, on release, step 3.

8) End of block

a. If there are further blocks of trials to run, then step 2.
b. If there are no further blocks of trials to run, then step 9.

9) Finish

a. All lights are turned out.
b. Data recording ceases.

1.2. Variable 1

The basic task, with the addition of having the option for variable ITIs and/or stimulus durations within a block of trials.

As for the Basic Task protocol except:

2) Setting Variables

b. A sequence of intertrial intervals (ITIs) is generated from the settings table. There is an option stipulate the order of the ITIs or to have the computer generate a random order.
c. A sequence of stimulus durations is generated from the settings table. There is an option to stipulate the order of the durations or to have the computer generate a random order.

1.3. Variable 2

Variable 1, with the addition of allowing a distraction just before or at the same time as the stimulus.

As for variable 1 except:

2) Setting Variables

g. A sequence of times to distraction is generated from the settings table. There is an option stipulate the order of the times to distractions or to have the computer generate a random order. Then step 3.

3) Intertrial Interval (ITI)

c. Food-tray light is turned off (if on). Wait for 'time to distraction' and then pulse the distraction (usually white noise) for the distraction duration.

1.4. Variable 3

Variable 1, with the addition of allowing the stimulus lights to have a variable brightness.

As for variable 1 except:

2) Setting Variables

a. A sequence of spatial stimuli (lamps) is generated from the settings table (e.g. 4 trials each of five holes). There is an option stipulate the order of the stimuli or to have the computer generate a random order. A sequence of the stimulus lamp brightness is generated from the settings table. There is an option to stipulate the order of the brightness or to have the computer generate a random order.

1.5. Variable 4

Variable 2, with the variable brightness shown for variable 3.

2. Installing the 5-choice software

To install the 5-choice programmes onto your data handling PC, simply copy all the folders on the 'Mouse 5-choice programmes' disc supplied into your Unverified files folder (the default file selected by the CCL Control installer is - C:\Control\Programs\Unverified)

2.1. Accessing the 5-choice software

Once installed:

- The 5-choice program design, simulation, filter files and settings files can be viewed from 'Designer'.
- 5-choice experiments can be run from 'Network Manager'
- Data generated from running the 5-choice experiments can be viewed from 'Results Manager'.

'Designer', Network Manager' and 'Results Manager' can all be accessed from the 'Start' menu.

3. Setting-up the hardware (on a MKII unit)

To help you configure and test the hardware we have 2 configuration programs- Mouse9HBwithoutDim (if you do not have the analogue dimming boxes) and Mouse9HBTotalSetup (which includes connecting the dimming boxes). This manual will take you through the steps needed to get the 9-hole boxes up and going with the 5CSRT task. It is advised, however, that you take the time to run through the tutorials provided with the main CCL Control Manual, to understand this process fully.

3.1. Connecting the hardware:

a. Wire-up the 'Controller' PC, power supply and I/O card rack as instructed in the hardware manual.
b. Connect the 9-hole boxes to the I/O rack. Be sure that the dimmer box cables (the 37-way D plug with four cables coming out of it) are connected to the designated I/O cards.
c. Connect your desktop PC to the 'Controller' unit via a network connection. (You will need a twisted cable if you are connection the PC directly to the 'Controller' or you can connect through your existing network or via a hub.)
d. Run the Network Manager by clicking 'Start' and then 'Network Manager'.
e. Power-up the power supply by switching the red switch on the left and then the PSU 1 switch (and the PSU2 switch if you have a double unit, i.e. two I/O racks). Then switch on the 'Controller' PC; the name of the controller unit should appear in the top right of the Network Manager Window. (If the controller name does not appear, try adding it manually by clicking the 'Controller' menu, selecting 'Add a controller' and typing in the IP address of the 'Controller Unit'. See the hardware manual for how to change the IP address).

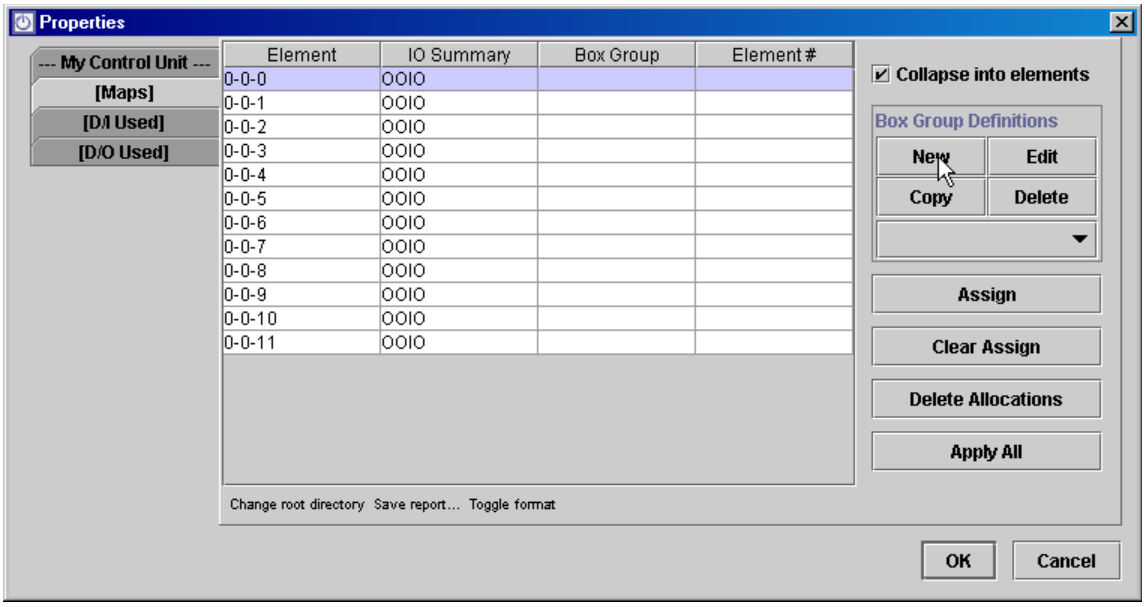
Note: If you wish, you can change the controller name shown by the Network manager to a name of your choice. To do this, select the appropriate controller from the drop-down list (if you have more than one controller connected, you can access other controllers by clicking on ▼ besides the controller name) and click on '(properties...)' (top right of the window) and overwrite the current name with a name of your choice in the 'Controller Name:' box. Click 'OK'

f. You now need to tell the Network Manager how the system has been wired. Click on the 'Controller' menu and select 'Add a box'. A window similar to figure 1 will appear. You can now double check that you have plugged the 9-hole boxes into the correct I/O cards. An element refers to the I/O card. – 0-0-0 is the first card on the left of the 19" rack of cards, 0-0-11 would be the 12th card on the right (assuming you have a full set of 12 cards). If you have another rack these will be numbered 0-1-0 to 0-1-11. You should have your main 9Hbox cables (37-way D plugs with one cable attached) plugged into cards with an IO summary of OOII (on the actual I/O cards the A and B ports will have a red LED light and the C and D ports will have a Green LED light) and your dimmer box cables (37-way D plugs with four cables attached) plugged into cards with an IO summary of OOOO (on the actual I/O cards all ports will have red LED lights). If you do need to change the

order in which the boxes are plugged, make sure you power down the system first.

Note: **To power down the system** click on the 'Controller' menu and select 'Restart/Shutdown'. Select the controller to be powered down and click 'Shutdown'. Once the computer has confirmed that the 'controller PC' has shut down you can then turn off both the 'controller PC' and the power supply switches.

Figure 1



3.2. Adding boxes with no dimmer box control

a. From the properties window pictured in figure 1, select the first element line and click on 'New'
b. Overtype 'New Box Name' with a name of your choice (e.g. Mouse 9-Hole Box)
c. Select all the lines from A-0 to D-7, by clicking and dragging.
d. Click on 'use program…' and select 'Mouse9HBwithoutDim' from the drop down list.

Note: **If you cannot find the program**, it may be that the network manager is looking in the wrong place. To change where the Network Manager accesses the programs go back to the main Control Network Manager Window and click on 'Tools/Options' and brows to find the file where the Unverified and Verified (assuming you have already created Verified programs) programs are stored.

e. Rearrange the line identifiers to the order shown in table 1, *making sure that there are no spaces in the identifier names*. You can use the drop-down arrow (which becomes visible when you click in any of the cells in the identifier column) to find any name written in the program, or you can 'mark' and then use the 'move/copy/swap' features, or you can simply overtype the name required. Make sure that the 'Box #' column reads 1 throughout (use 'set box #' to change this if necessary).

Table 1

			Inputs		
Line	**Identifier**	**Comment**	**Line**	**Identifier**	**Comment**
A-0	Lamp1A		C-0	Hole1	
A-1	Lamp2A		C-1	Hole2	
A-2	Lamp3A		C-2	Hole3	
A-3	Lamp4A		C-3	Hole4	
A-4	Lamp5A		C-4	Hole5	
A-5	Lamp6A		C-5	Hole6	
A-6	Lamp7A		C-6	Hole7	
A-7	Lamp8A		C-7	Hole8	
B-0	Lamp9A		D-0	Hole9	
B-1	HouseLight		D-1	FIRBeam	For future use
B-2	TrayLight		D-2	BIRBeam	"
B-3	Feeder		D-3	IRTrayReport	If included *
B-4	Distracter		D-4	Spare2	For future use
B-5	Spare3	For future possible use with other equipment	D-5		Not in use
B-6	Spare4	"	D-6		Not in use
B-7	Lamp5B	For use if dimmer attached	D-7	TrayReport	

Note: If you are using the **IR detection** in the tray report, in place of the tray report door to detect entry to the food tray in the 5CSRT tasks, then name this 'TrayReport' and rename line D-7 to 'TrayReportDoor'.

f. Click OK to return to the properties window.
g. Select all the element lines, which have a Mouse 9 Hole Box attached, and click 'Assign', making sure that the correct box group definition file has been selected.
h. Click 'Apply All' and then 'OK'
i. The boxes have been assigned and you are now ready to load the protocols (schedules). You can rename the boxes at this point and also add further attributes. To see how to do this see the relevant pages in the Control Manual. It is also wise at this stage to save the configuration by clicking 'File/Store config as…'

3.3. Adding boxes with dimmer box control

In 3.2 above we were able to use one box group definition file for each element, because each box was attached to its own I/O card (element). When we have a dimmer box attached, up to four boxes can share an element, in addition to there own elements. We will therefore have to create a box definition file, which includes all the boxes sharing the same element. If you have more than four boxes, making the hardware set-up symmetrical will simplify the procedure (e.g. if you have 6 boxes and two dimmer boxes, then divide into 3 boxes sharing one dimmer / I/O card and 3 boxes sharing another).

a. From the properties window pictured in figure 1, select the OOII elements connected to boxes which will be sharing a dimmer box and the OOOO element connected to the relevant dimmer box and then click on 'New'
b. Overtype 'New Box Name' with a name of your choice (e.g. Mouse 9-Hole Box)
c. Select all the lines (A-0 to D-7) in the first element with the OOII configuration, by clicking and dragging. Then use the Ctrl key to select lines A-0 to A-7 in the OOOO element (the number of the element is defined in the 'Element #' column).
d. Click on 'use program…' and select 'Mouse9HBTotalSetup' from the drop down list.

Note: **If you cannot find the program**, it may be that the network manager is looking in the wrong place. To change where the Network Manager accesses the programs go back to the main Control Network Manager Window and click on 'Tools/Options' and brows to find the file where the Unverified and Verified (assuming you have already created Verified programs) programs are stored.

e. Rearrange the line identifiers in the first OOII element to the order shown in table 1 above, *making sure that there are no spaces in the identifier names*. You can use the drop-down arrow (which becomes visible when you click in any of the cells in the identifier column) to find any name written in the program, or you can 'mark' and then use the 'move/copy/swap' features, or you can simply overtype the name required. Make sure that the 'Box #' column reads 1 throughout (use 'set box #' to change this if necessary).
f. Name the A-0 to A-7 lines in the OOOO element as shown in Table 2

Table 2

Line	Identifier	Box #
A-0	Lamp1B	1
A-1	Lamp2B	1
A-2	Lamp3B	1
A-3	Lamp4B	1
A-4	Lamp6B	1
A-5	Lamp7B	1
A-6	Lamp8B	1
A-7	Lamp9B	1

g. Now ‘mark’ and ‘copy’ the lines defined as shown in table 1 to the other OOII elements and define each set of lines as boxes 2, (3 and 4, if present) respectively.
h. ‘Mark’ and copy the lines defined as shown in table 2 to the B-0 to B-7 in the OOOO element and define each of these lines as box 2. Repeat the procedure for the C lines if you have a 3rd box attached and for the D lines if you have a 4th box attached.
i. Click OK to return to the properties window.
j. Again, select all the element lines first selected in step 1 above and click ‘Assign’, making sure that the correct box group definition file has been selected.
k. Repeat for any other set of elements connected in the same way. (If you do not have a symmetrical arrangement of the boxes to dimmer circuits, you will need to create another box group definition file by repeating steps a-j above.)
l. When all the elements have been assigned, click ‘Apply All’ and then ‘OK’
m. The boxes have been assigned and you are now ready to load the protocols (schedules). You can rename the boxes at this point and also add further attributes. To see how to do this, refer to the relevant pages in the Control Manual. It is also wise at this stage to save the configuration by clicking ‘File/Store config as…’

3.4. Testing the hardware:

It is recommended that this quick test of the hardware be done prior to every days training or testing:

You can also test lines by clicking on ‘properties…’ and clicking on ‘test lines by h/w…’ (see control manual for more details). However, a set of programs has been provided for you to speed up this process:

Mouse9HBwithoutDim and Mouse9HBTotalSetup will allow you to test all the lines connected. Mouse5CSRTSetup1-4 will allow you to just test the lines needed for the 5CSRT programs. Table 3 shows the programs that can be run using the lines tested in these set-up programs.

Note: For all the5CSRT programs, holes 2, 4, 6 and 8 should be blanked off with the metal blanking plates.

Table 3

Configuration program	No. of inputs tested	No. of outputs tested	5CSRT that can be run with this configuration
Mouse5CSRTSetup1	6	8	Mouse5CSRTBasic, Mouse5CSRTVar1
Mouse5CSRTSetup2	6	9	Mouse5CSRTBasic, Mouse5CSRTVar1, Mouse5CSRTVar2
Mouse5CSRTSetup3	6	13	Mouse5CSRTBasic, Mouse5CSRTVar1, Mouse5CSRTVar3
Mouse5CSRTSetup4	6	14	Mouse5CSRTBasic, Mouse5CSRTVar1, Mouse5CSRTVar2, Mouse5CSRTVar3, Mouse5CSRTVar4

a. From the main Network Manager Window, select the appropriate configuration program, for each of the 9-hole boxes, by clicking the down arrow in the 'Protocol' column. To register your chosen protocol, click 'OK' or click outside the protocol window. (You can do this individually for each box, or for all selected boxes, by clicking the 'Protocol' cell in the top row.)

Note: On the first time of loading a test, a window will appear to ask whether you want to create a default monitor; click yes to create one. (At this point you might like to practise changing the information that appears in the monitor window by moving, hiding and changing the width of the columns available.)

b. Power-up the boxes by clicking the ⏻ button in the 'Control' column. Run the selected configuration program in each box by clicking the ▶ button and test the I/O lines as follows (activating the input described should activate the corresponding outputs):

Configuration program	Inputs to activate	Output response
Mouse5CSRTSetup1	i. Simulate hole nose-poke in each of the unblanked holes. ii. Push the feed-tray report.	i. All 5 stimulus lamps illuminate. ii. House-light and tray-light illuminate and feeder pulses 0.5s.
Mouse5CSRTSetup2	i. Simulate hole nose-poke in each of the unblanked holes ii. Push the feed-tray report	i. All 5 stimulus lamps illuminate and distracter pulses for 0.5s. ii. House-light and tray-light illuminate and feeder pulses 0.5s.

Mouse5CSRTSetup3	i. Simulate hole nose-poke in hole-1 ii. Simulate hole nose-poke in hole-3 iii. Simulate hole nose-poke in hole-5 iv. Simulate hole nose-poke in hole-7 or hole 9 v. Push the feed-tray report	i. All 5 stimulus lamps illuminate at full brightness ii. All 5 stimulus lamps illuminate at DIAL A brightness (normally set at an intermediate brightness) iii. All 5 stimulus lamps illuminate at DIAL B brightness (normally set as the lower brightness) iv. Lamps 1 and 9 illuminate at full brightness, lamps 3 and 7 illuminate at DIAL A brightness, lamp 5 illuminates at DIAL B brightness. (Useful to adjust the relative brightness'' as required) v. House-light and tray-light illuminate and feeder pulses 0.5s.
Mouse5CSRTSetup4	i. Simulate hole nose-poke in hole-1 ii. Simulate hole nose-poke in hole-3 iii. Simulate hole nose-poke in hole-5 iv. Simulate hole nose-poke in hole-7 or hole-9 v. Push the feed-tray report	i. All 5 stimulus lamps illuminate at full brightness and distracter pulses for 0.5s. ii. All 5 stimulus lamps illuminate at DIAL A brightness (normally set at an intermediate brightness) iii. All 5 stimulus lamps illuminate at DIAL B brightness (normally set as the lower brightness) iv. Lamps 1 and 9 illuminate at full brightness, lamps 3 and 7 illuminate at DIAL A brightness, lamp 5 illuminates at DIAL B brightness. (Useful to adjust the relative brightness'' as required) v. House-light and tray-light illuminate and feeder pulses 0.5s.
Mouse9HBwithoutDim	i. Simulate hole nose-poke in each of the odd holes. ii. Simulate hole nose-poke in each of the even holes. iii. Push the feed-tray report.	i. All odd stimulus lamps illuminate and distracter pulses for 0.5s. ii. All even stimulus lamps illuminate. iii. House-light and tray-light illuminate and feeder pulses 0.5s.
Mouse9HBTotalSetup	i. Simulate hole nose-poke in hole-1 ii. Simulate hole nose-poke in hole-2 iii. Simulate hole nose-poke in hole-3 iv. Simulate hole nose-poke in hole-4 v. Simulate hole nose-poke in hole-5 vi. Simulate hole nose-poke in hole- 6 or 8 vii. Simulate hole nose-poke in hole-7 or hole-9	i. All odd stimulus lamps illuminate at full brightness and distracter pulses for 0.5s. ii. All even stimulus lamps illuminate at full iii. All odd stimulus lamps illuminate at DIAL A brightness (normally set at an intermediate brightness) iv. All even stimulus lamps illuminate at DIAL A brightness (normally set at an intermediate brightness) v. All odd stimulus lamps illuminate at DIAL B brightness (normally set as the lower brightness) vi. All even stimulus lamps illuminate at DIAL B brightness (normally set as the lower brightness) vii. Lamps 1, and 9 illuminate at full brightness, lamps 3 and 7 illuminate at DIAL A brightness, lamp 5

	viii. Push the feed-tray report	illuminates at DIAL B brightness. (Useful to adjust the relative brightness'' as required) viii. House-light and tray-light illuminate and feeder 0.5s.
All the above	i. Blocking the front or back IR beam	i. The house light turns on.

When the test is complete click ■ to stop the program and ⏻ to power down the boxes.

3.5. Cleaning, priming and calculating the feeder

The condensed milk solution used to reward the mice is sticky and the feeding tubes should be cleaned after each operant session. A program has been provided to make this easier.

Cleaning Procedure:

a For each box to be cleaned place distilled water in the pump reservoir. Disconnect the feed-tube from the reward tray and place the end in a collecting vessel.
b From the 'Network Manager' set the 9-hole box(es) to be cleaned to run the protocol 'FeederCal' with 'set-up' 'Clean'.
c Power up the box(es) (⏻) and start (▸) the program. The program will pump water through the tubes for 12s.

Prior to the start of an experiment, the feeder will have to be primed to ensure that there is food delivered on the first feed.

Priming Procedure:

a For each box to be primed place 10% condensed milk (CM) solution in the pump reservoir. Disconnect the feed-tube from the reward tray and place the end in a collecting vessel.
b From the 'Network Manager' set the 9-hole box(es) to be primed to run the protocol 'FeederCal' with 'set-up' 'Prime'.
c Power up the box(es) (⏻) and start (▸) the program. The program will pump CM through the tubes for 3s.
d Reconnect to the reward tray.

Each liquid feed system will vary a little. This small difference is not usually of concern for the 5CSRT task, but if it is vital that the same amount of liquid is dispensed to each box, a calculating program has been set-up for you.

Feeder Calculating Procedure:

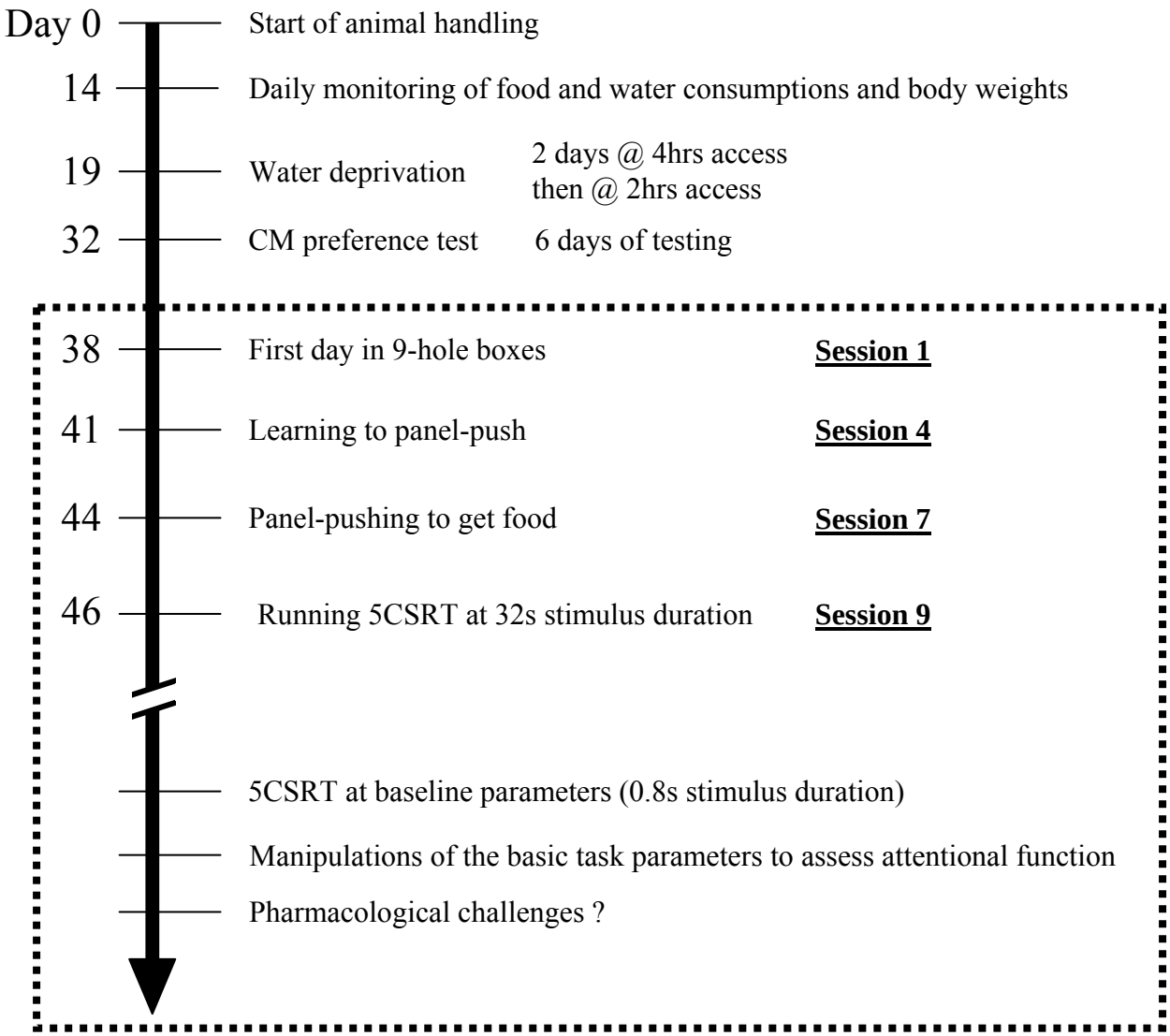
a Prime each system as described above (a-c).
b Set the end of the feed-tube to deliver food into a weighed container.
c From the 'Network Manager' set the 9-hole box(es) to be primed to run the protocol 'FeederCal' with 'set-up' 'StartCal'.
d Power up the box(es) (⏻) and start (▸) the program. The program will pump CM through the tubes for 5 x 350ms bursts.
e Weigh the liquid (should weigh (5 x 20µl) = 0.1g).
f If necessary adjust the 'Feed Pulse Time' in the 'FeederCal' setup (see chapter 5). Repeat procedure until 0.1g is delivered.
g You will need to enter this new 'Feed Pulse Time' into the appropriate experimental set-up for this box. (see chapter 5).

4. Training Procedures

Prior to the habituation and training procedures, make sure that the 9-hole box has been wired-up to run the 'Mouse5CSRTBasic' program (see section 3). Holes 2, 4, 6 and 8 should all be blanked–off.

Note: Results from experiments are automatically saved to the default results archive, however, this can be changed to another archive destination – from the 'Network Manager', before running the experiments, select 'Tools / Options' and then insert your chosen results archive destination in the 'Results Archive' window..

The basic training schedule is illustrated below:



4.1. Handling and water deprivation

Animals should be handled daily for 2 weeks prior to the start of the experiment. Then the mice are moved onto the water deprivation schedule. We have found that motivation is a critical determinant of performance in the task and water deprivation allows greater control of this variable. Although only access to water is limited, food consumption will also decrease because of the tendency of animals to eat only when they can drink. Therefore, the daily water and food consumption for each animal (or litter of animals) should be assessed for 5 days prior to and during the initial 10 period of water deprivation. Also, during this period and throughout the schedule of water deprivation animals should be weighed daily. If an animal's weight falls more that 10% from an average of the previous two days then the animal should be put onto free water until the body weight increases. Likewise, if at any time water consumption decreases then more water should be made available to that litter.

The water deprivation schedule begins by removal of the water bottles on the evening of the first day. For the next two days, animals are given 4hrs access to water (20hrs of deprivation). If water consumption is stable and bodyweights have not fallen precipitously then access to water is reduced to 2hrs per day. Water consumption and bodyweights are monitored daily from this point onwards.

4.2. Condensed milk preference testing - habituation to reinforcement:

The reinforcer used in the task is 10% condensed milk (CM, Nestle). In order to habituate the mice to the reinforcer and to detect any pre-existing differences in preference, a water vs. CM preference test is conducted. This test is performed after 10days of stable home cage water consumption. The preference test takes place over 6 days. Animals are placed into cages (300x135x110mm), in which two small bowls (10mm high, 20mm diameter and maximum volume of 3ml) are located 50mm from the rear wall. On the first and second days, both bowls are filled with normal tap water. On days 3 to 6 one bowl is filled with water and the other filled with 10% CM, sides are alternated daily. Bowls are weighed before and after each session and the volumes of each solution consumed calculated.

4.3. Shaping

All operant box work is conducted with the house-light extinguished at all times (apart from the time out phase, see later). Throughout this training period clear plastic windows block the NP response holes at the rear of the box. Initial shaping is carried out over 8 sessions. The aim of these sessions is to generally habituate the animals to the test environment, the sequence of events that occur and to teach them the location in which food is presented.

In sessions 1 to 3, the magazine panel is held open and an excess of CM is present in the magazine and the magazine (tray) light is illuminated throughout the 30min session. The amount of CM consumed is estimated and the number of beam breaks made recorded. In sessions 4-6, the magazine panel is released, and the mice must

now push the panel to gain access to the CM reward. Following an initial priming food delivery of 700ms in session 4, 350ms pulses of CM are delivered every 60s. The amount of reward is gradually reduced through these sessions such that by the sixth session, the priming delivery is of 350ms duration and the pulsed food is delivered for 350ms. The number of panel pushes and beam breaks are recorded to index the behaviour of the mice. Any animals not panel pushing are given extra training sessions until they learn this operant action.

Finally in sessions 7 and 8, the procedure is adjusted so that it becomes similar to the full task. Thus, the animals are given control of the rate of reinforcement and stimuli lights were illuminated preceding the delivery of food. 350ms of CM reward is presented for both priming and trial rewards and a session runs for 30min. Following a panel push, one of the stimuli lights is illuminated for 10s, and food delivered during the final second of this period. The tray light is illuminated concurrently with reward delivery and remains on until the animal panel pushes to collect the CM. Stimuli are presented in a random manner, such that an equal number of presentations at each stimulus location are made over the session.

Session 1: The Mouse is left in the 9-hole box for a 30 min session, with the tray-light turned on. The food-tray/magazine is primed with CM delivery for 2800ms (160µl). CM is then delivered for 700ms (40µl) every 40s. The food-tray panel should be tapped back for this initial session. The nose-poke holes are blocked off with clear plastic windows.

Session 2: The Mouse is left in the 9-hole box for a 30 min session, with the tray-light turned on. The food-tray/magazine is primed with CM delivery for 1400ms (80µl). CM is then delivered for 700ms (40µl) every 40s. The food-tray panel should be tapped back for this initial session. The nose-poke holes are blocked off with clear plastic windows.

Session 3: The Mouse is left in the 9-hole box for a 30 min session, with the tray-light turned on. The food-tray/magazine is primed with CM delivery for 700ms (40µl). CM is then delivered for 350ms (20µl) every 40s. The food-tray panel should be tapped back for this initial session. The nose-poke holes are blocked off with clear plastic windows.

Procedure for sessions 1-3:

a Prime the feeder with the 10% condensed milk solution (see 3.3 above).
b Tape back the food-tray panel. The nose-poke holes should be blocked off with clear plastic windows.
c From the 'Network Manager' set the same 9-hole box(es) to run the protocol 'MouseTraining1' with 'set-up' 'Session1, 2 or 3' appropriately. Rearrange the monitor window columns as required.
d You will probably find it useful to add further attribute columns at this stage. These are used to add relevant information about the experiment, such as the name of the Mouse. To see how to add attributes please refer to the relevant

sections in the CCL Control manual – Chapter 'Running Programs on Control Units'

e Power up the box(es) (⏻), introduce the subject Mouse(Mice) and start (⏵) the program. The program will deliver food as described above and monitor IR beam breaks.

f At the end of 30 mins the Control column reads 'Done'. The Mouse(Mice) should now be removed from the test chamber.

Note: To change the session length or delivery of the food, create a new 'set-up' file for 'MouseTraining1' using the 'Settings Editor'. Using the 'Settings Editor' is described in more detail below (section 5.1).

Tip: Save the 'Network Manager' configuration for the Session 1 training by clicking 'File/Store Config As'. This way the Network configuration for future Session 1 trainings can be easily loaded using 'File/Load Config' This configuration can also be used as a basis for subsequent training and test configurations, which can also be saved individually following modification.

Note: Each chamber can be run independently from each other, therefore each Mouse can be progressed through the training at it's own speed.

Session 4: The Mouse is left in the 9-hole box for a 30 min session. The food-tray/magazine is primed with CM delivery for 700ms (40µl). CM is then delivered for 350ms (20µl) every 60s. The food-tray panel is now released; the mouse must now push the panel to gain access to the CM reward. With each food delivery the tray-light is turned on. The tray-light is turned off when the food-tray panel is pushed.

Sessions 5&6: The Mouse is left in the 9-hole box for a 30 min session. The food-tray/magazine is primed with CM delivery for 350ms (20µl). CM is then delivered for 350ms (20µl) every 60s. The food-tray panel is now released; the mouse must now push the panel to gain access to the CM reward. With each food delivery the tray-light is turned on. The tray-light is turned off when the food-tray panel is pushed.

Procedure for sessions 4-6:

a Prime the feeder with the 10% condensed milk solution (see 3.3 above). The nose-poke holes should be blocked off with clear plastic windows.

b From the 'Network Manager' set the appropriate 9-hole box(es) to run the protocol 'MouseTraining2' with 'set-up' 'Session4 or 5&6' appropriately. Rearrange the monitor window columns as required.

c Power up the box(es) (⏻), introduce the subject Mouse(Mice) and start (⏵) the program. The program will deliver food as described above and monitor IR beam breaks, food tray panel breaks, the latency to collect the food and the time spent eating..

d At the end of 30 mins the Control column reads 'Done'. The Mouse(Mice) should now be removed from the test chamber.

Sessions 7&8: The Mouse is left in the 9-hole box for a 30 min session or until all the trials are complete, which ever is the sooner. The food-tray/magazine is primed with CM delivery for 350ms (20µl) and the tray-light is turned on. On release of the food-tray panel, one of the stimulus lamps is illuminated for 10s and food is delivered for 350ms (20µl) during the final second. (Each lamp is illuminated for a maximum of 20 times; the order of the lamps is randomised by the computer.) The tray-light is turned on again when food is delivered. The process is repeated until the trial end.

Procedure for sessions 7&8:

a Prime the feeder with the 10% condensed milk solution (see 3.3 above). The nose-poke holes should be blocked off with clear plastic windows.
b From the 'Network Manager' set the same 9-hole box(es) to run the protocol 'MouseTraining3' with 'set-up' 'Sess7and8' appropriately. Rearrange the monitor window columns as required.
c Power up the box(es) (), introduce the subject Mouse(Mice) and start ( ) the program. The program will deliver food as described above and monitor IR beam breaks, food tray panel breaks, the latency to collect the food and the time spent eating..
d At the end of 30 mins or when all 100 trials are complete the Control column reads 'Done'. The Mouse(Mice) should now be removed from the test chamber.

4.4. 5-CSRT Training – training to baseline

In the next session (session 9), the windows blocking the stimuli holes are removed and the task proper begins. The sessions are still run in darkness, although a time out period following an incorrect response or an omission would be signalled by illumination of the house light for 5s. The session begins with a priming delivery of reinforcer [350ms (20µl)] and on exiting the food magazine (thus releasing the panel) the first trial begins. Following this panel-push, an inter-trial interval (ITI) of 5s begins at the end of which one of the 5 stimuli lights at the rear of the chamber is illuminated. The sequence of presentations of the stimuli light is a pseudo-random schedule such that there are 4 presentations at each spatial location within a block of 20 trials. The subject must respond within a time period defined as the stimuli duration and a 5s limited hold period (in which the stimulus has been extinguished). A correct response, nose poking at the location in which the stimulus was presented, will trigger the presentation of 350ms (20µl) of reinforcer into the food magazine. The subject collects the food by making a panel-push at the food magazine. On releasing the panel the next trial will begin.

An incorrect response, nose poking a location other than where the stimulus was presented, or making no response at all (an omission) causes a 5s time out (TO)

identified by the illumination of the house light. After the TO, the trial moves to a "wait" phase in which the subject must make a panel-push to start the next trial. A premature response is recorded when a nose poke is made in one of the response holes during the ITI and results in a TO. Making a panel-push during the TO will initiate the next trial except if the error was a premature response in which case the same trial is re-started. A session is set to finish should the subject complete 100 trials or the run time exceed 40 minutes.

At Babraham, throughout training, video camera footage is scrutinised to ensure the subjects adopt appropriate scanning strategies in response to the increasing attentional demands occasioned by the progressively reducing stimulus durations.

A typical training schedule for the five choice task is shown in the table below. Each training session should be applied in the order shown. Each session should be repeated until the Mouse achieves the following on two consecutive sessions:

> 80% accuracy [no. of correct trials / Total no. trials responded to (correct and incorrect)]
< 20% omissions [no. trials missed / No. of trials presented]

The Mouse should be given one training session per day.

Tip: % accuracy and % omissions are calculated automatically in 'Summary Report Template' – see section 6.5.

The final training 'set-up' parameters (BaseLine) are also the standard baseline parameters for all subsequent testing.

These tests have been included as individual 'set-up' files of the 'Mouse5CSRTBasic' program. To run the tests:

a Prime the feeder with the 10% condensed milk solution (see 3.3 above). The 5 nose-poke holes should now be uncovered.
b From the 'Network Manager' set the appropriate 9-hole box(es) to run the 'Mouse5CSRTBasic' program with the appropriate 'set-up' file from the table below (by clicking the 'Protocol' ▼).
c Add additional attributes if required. To see how to add attributes please refer to the relevant sections in the CCL Control manual – Chapter 'Running Programs on Control Units'
d Select the data you wish to monitor in the monitor window. This is most easily achieved selecting each column in the table and then clicking the hide icon (the hide and unhide icons are situated at the top-right of the table) to hide all the columns. On clicking the unhide icon a list of the hidden columns appears. You can then select the columns that you want to monitor during the experiment. Suggested columns to monitor: 'Box', 'Block', 'CorrectResponse', 'ErrCommision', 'ErrOmission', Hole Events (1,3,5,7 &9), 'PrematureResponse'. You can also monitor which trial the Mouse is

on by clicking ‘new column’ and typing ‘WhichTrial’ into the box pop-up window. Typing ‘WhichLamp’ will show which lamp was last lit.

Note: The monitor column widths can be changed by placing the cursor over the left side of the column title until the ↔cursor appears; drag to required width.

e Power up the box(es) (⏻), introduce the subject mouse(s) and start (▸) the program.

f Program will end after 30 mins. or when all 100 trials have been completed, which ever is the sooner. At the experiment end all lights will turn off and the Control column reads ‘Done’. The mouse(mice) should now be removed from the test chamber(s).

Program – Mouse5CSRTBasic							
‘set-up’	**Session 09**	**Session 10**	**Session 11**	**Session 12**	**Session 13**	**Session 14**	**Session 15**
Session Length	30 mins	30 mins	30 mins	30 mins	30 mins	30 mins	30 mins
ITI	5 s	5 s	5 s	5 s	5 s	5 s	5 s
Time Out	5 s	5 s	5 s	5 s	5 s	5 s	5 s
Stimulus Duration	32 s	16 s	8 s	4 s	2 s	1.8 s	1.6 s
Limited Hold	37 s	21 s	13 s	9 s	7 s	6.8 s	6.6 s
Lamps are presented randomly (4 of each lamp in each block of 20 trials; maximum no. trials = 100); presentation of consecutive lamps is limited to 3; feed-tray panel pushes during the time-out period will end the time-out; all nose-poke responses either during or following time-out (but before a new ITI period is started) restart the time-out period; the tray-light is lit to signify the delivery of reward; liquid reward is delivered in 350ms pulses.							

Program – Mouse5CSRTBasic						
‘set-up’	**Session 16**	**Session 17**	**Session 18**			**BaseLine**
Session Length	30 mins	30 mins	30 mins			30 mins
ITI	5 s	5 s	5 s			5 s
Time Out	5 s	5 s	5 s			5 s
Stimulus Duration	1.4 s	01.2 s	1.0 s			0.8 s
Limited Hold	6.4 s	6.2 s	6 s			5.8 s
Lamps are presented randomly (4 of each lamp in each block of 20 trials; maximum no. trials = 100); presentation of consecutive lamps is limited to 3; feed-tray panel pushes during the time-out period will end the time-out; all nose-poke responses either during or following time-out (but before a new ITI period is started) restart the time-out period; the tray-light is lit to signify the delivery of reward; liquid reward is delivered in 350ms pulses.						

Typical baseline performance:

Table 1 shows the typical performance at baseline for mice trained according to these methods. In general, mice show very high levels of accuracy, whilst omitting few trials. There are very few extraneous nose pokes, with mice making, on average, only the single nose poke required for each trial. There are very few premature nose pokes with in a trial. Mice respond with latencies consistent with the stimulus duration, demonstrating good stimulus control.

Typical performance at baseline for male CBA/C57Bl6 mice (N=44)

	Mean	S.E.
Trials	77.92	1.07
Accuracy	92.01	1.06
Omissions	15.02	1.00
Correct reaction time (csec)	85.74	2.41
Incorrect reaction time (csec)	265.07	29.23
Latency to collect reward (csec)	110.80	3.20
Duration of eating (csec)	460.79	21.15
Premature responses	1.24	0.20
Nose Pokes/trial	1.03	0.04
Panel Pushes/trial	2.39	0.12
Beam breaks/trial	34.32	4.32

Table 1: 5CSRTT performance of 44 male F2 CBAxC57/Bl6 mice at baseline parameters of 0.8s stimulus duration and 5s ITI.

5. Testing Schedules / Task Manipulations

Once performance has stabilised at criteria with the baseline parameters, attentional functioning can be further assessed by manipulating the basic task parameters. Each manipulation session is presented after three consecutive days of baseline performance. The order of presentation of the manipulations is as follows:

(1). Altering the duration of the ITI, which increases attentional load by disrupting the temporal predictability of the stimulus onset: short ITI - 2s, 3s, 4s or 5s; long ITI - 5s, 6s, 7s or 8s.
(2). Reducing the stimulus duration - 0.8s, 0.6s, 0.4s or 0.2s,
(3). Reducing the stimulus brightness (52%, 30%, 21% and 12% of full)
(4). Imposition of a 100dB 0.5s burst of distracting white noise at 0s, 2.5s or 5s, following the beginning of the ITI (hence, the 5s presentation was concurrent with the onset of the stimulus).

For each manipulation the baseline value for the parameter under test is included for a direct within session comparison, thus ITI manipulations included a 5s level, stimuli tests included 0.8s and maximum intensity and in the white noise distracter session there were trials in which no sound was presented. Similarly, parameters other than that under test are maintained at baseline levels, although obviously, combinations of manipulations could be used if desired. Within each session, each level of manipulation is presented equally and the order of presentation is distributed randomly throughout the session. Finally, to assess motivational effects on task performance animals are given access to home cage water for 24hrs prior to testing. This session is also conducted only after three days of stable performance at the standard 22hrs of home cage water deprivation.

5.1. Creating ‘set-up’ files

The ‘set-up’ files allow you to easily create your own testing schedules. This can be done as follows:

a. Open ‘Designer’.
b. Select the appropriate program (see chapter 1 above for test details)
c. Click ‘Run/Settings Editor…’
d. Select Setup ‘[New]’ using ▼ and overtype ‘NewName’ with the name of your choice. (Providing the settings file as not been verified, you can select an existing one and go to step f, but note that the original settings will be lost if changed.)
e. You can opt to edit an existing ‘set-up’ file by clicking ‘Base on...’ and selecting the appropriate ‘set-up’ file. If you do not click ‘Base on...’, a blank ‘set-up’ file will be presented.
f. Click ‘Edit/View Setup’.
g. Fill-in or change each column as appropriate.
h. Click ‘Save’

Tips:

- Information on how to fill each cell can be obtained by selecting the appropriate cell and clicking the ? icon. Instructions will also appear at the bottom of the table.
- Every column must be filled in, even the 'No.Consec.Punished' column, even though this will only apply if the 'LimitUnclassRespPunished' column is ticked.
- Cells which require a list of variables, such as 'Lamps' can be more easily filled using the properties table – select row and click the end '*Show full properties for currently selected rows*' icon. (The variables will be presented in the order entered, unless the 'Randomise' tick box for this function is ticked. If the randomisation function is being utilised, the quickest way to enter the data is to enter a row for each different value required, along with the number of times each variable should be presented across the block. If you wish to stipulate your own order you will need a new row for each time the variable changes e.g. if you require the order:

  Trial 1: variable value a; Trail 2: variable value b; Trial 3: variable value b; Trial 4: variable value c; Trail 5: variable value a,
  you will need to fill in the properties table as follows:

a	1
b	2
c	1
a	1

  The copy and paste functions can to used to enter repeated orders of variables.

  If this variable should remain constant throughout the block (e.g. the stimulus duration when using Mouse5CSRTVar1 to vary ITI length), then simply fill in one row with the value required, along with the number of trials in that block.

- Each row constitutes a block of trials. Additional blocks can be added by clicking the '*Create new, blank row*' icon. Blocks can be filled in identically by using the '*copy*' and '*paste*' functions.

Note: The session length refers to the time from the beginning of the first block. This can be re-set for each block. E.g. if you set:

Block 1: Session length = 1,800,000 ms
Block 2: Session length = 3,600,000 ms
Block 3: Session length = 5,400,000 ms

The experiment would end firstly if Block 1 was not completed within 30 mins, secondly if Block 1 and Block 2 combined were not finished within 60 mins, or thirdly if the whole experiment was not finished within 90 mins.

5.2. Standard Tests

'Set-up' files for some standard tests as described above, have been included. For a description on how to run these and other tests see section 4.4.

5.2.1. Variable ITI – short

Program: Mouse5CSRTVar1, 'set-up': ITIshort1

The standard baseline parameters, except the ITI is set unpredictably within the session –ITIs of 2, 3, 4 and 5 s (5 of each in each block of 20 trials) are presented randomly.

5.2.2. Variable ITI – long

Program: Mouse5CSRTVar1, 'set-up': ITIlong1

The standard baseline parameters, except the ITI is set unpredictably within the session –ITIs of 5, 6, 7 and 8 s (5 of each in each block of 20 trials) are presented randomly.

5.2.3. Reduced Stimulus Duration

Program: Mouse5CSRTVar1, 'set-up': RedStimDur

The standard baseline parameters, except the stimulus duration is set unpredictably within the session –stimulus durations of 0.8, 0.6, 0,4 and 0.2 s (5 of each in each block of 20 trials) are presented randomly.

5.2.4. Variable Brightness

Program: Mouse5CSRTVar3, 'set-up': RedStimIntens

The standard baseline parameters, except the brightness of the stimulus lamps are changed unpredictably within a single session. The lamp brightness is set by DIAL B for 7 trials (suggest 1/3 full brightness), by DIAL A for 7 trials (suggest 2/3 full brightness) and at full brightness for 6 trials within each block of 20 trials, each trial being presented randomly.

5.2.5. Distraction

Program: Mouse5CSRTVar2, 'set-up': VarNoise

The standard baseline parameters, except a 0.5 s burst of noise (usually 105 dB of white noise) is sounded at various points within the normal 5 s ITI. A burst of noise (or what ever distraction you have connected to the box) is sounded at 1ms (equating to the start of the ITI), 2.5, 5.0 (end of the ITI) after the beginning of the ITI (5 of each in each block of 20 trials, the remaining 5 trials in the block of 20 contain no distraction), in a random order.

6. Analysing Results

Results from the experiments can be analysed by using the 'Results Manager'.

6.1. Raw Data

To view the data:

a. Open the 'Results Manager'.
b. If the results you are interested in have been saved to other than the default archive, open the relevant archive by clicking on 'change archive….'.
c. Select the file(s) you are interested in by using the selection tables in the left-hand window.
d. To see the raw data click on 'Show logs'.
e. To save the log file as a CSV file, click on 'save as…'.

6.2. Filtering Data

A filter is provided to allow you to extract relevant information from the raw data.

a. Select the relevant data files as described in 6.1 above.
b. Click on 'Start filtering'.

6.3. Reports

Reports can be generated from the filtered data:

a. From the filtered data archive (see 6.2 above) select the file(s) from which you wish to make a report.
b. Click on 'Make report'.
c. The filter provided allows you to create reports from the following data:

The number of values, the individual time values (in milliseconds, unless multiplier column is used) and the mean, max, min and standard deviation of those values for:

MouseTraining1

i) Back Beam Break
ii) The Time at which the food was delivered (FoodDeliveryTime)
iii) Front Beam Break

MouseTraining2

i) Back Beam Break
ii) The time between delivery of the food and food collection (CollectFood)
iii) The time taken to eat the food (FeedingTime)
iv) The Time at which the food was delivered (FoodDeliveryTime)
v) Front Beam Break
vi) The total number of feed-tray panel pushes (TPushTotal)

MouseTraining3

i) Back Beam Break
ii) The time between delivery of the food and food collection (CollectFood)
iii) The time taken to eat the food (FeedingTime)
iv) Front Beam Break
v) The total number of feed-tray panel pushes (TPushTotal)

Mouse5CSRTBasic, Mouse5CSRTVar1-4

i) Back beam breaks
ii) The latency between delivering and collecting reward (ColRewardLatency).*
iii) The latency between stimuli responded to by a correct response and those correct responses (CorrectResponse).*
iv) The latency between stimuli responded to by an incorrect response and those incorrect responses / errors of commission (ErrCommission).*
v) Missed responses / errors of omission (ErrOmission)
vi) Front beam breaks
vii) Nose poke activity in hole 1 / poke1 (Hole1Activity)
viii) Nose poke activity in hole 3 / poke2 (Hole3Activity)
ix) Nose poke activity in hole 5 / poke3 (Hole5Activity)
x) Nose poke activity in hole 7 / poke4 (Hole7Activity)
xi) Nose poke activity in hole 9 / poke5 (Hole9Activity)
xii) Total nose pokes in all holes (NosePokeTotal)
xiii) Perseverative responses (following correct responses) in the correct hole (PersRespCorr)
xiv) Perseverative responses (following correct responses) in incorrect holes (PersRespIncorr)
xv) Premature responses (nose poke response during the ITI) (PrematureRes)
xvi) Response Times ending the 'Limited Hold' period (incorrect, correct and missed)
xvii) The initial feed-tray panel push (TPush1st)
xviii) Feed-tray panel pushes during the ITI period (TPushITI)
xix) The feed-tray panel pushes that initiate a trial either during (if this option has been selected) or after 'time-out' (TPushInitiateTrialFollowingIncorrect)

xx) Feed-tray panel pushes during the 'limited hold' period (TPushLimitedHold)
xxi) Feed-tray panel pushes to collect reward (TPushReward)
xxii) Feed-tray panel pushes during the 'time-out' period (TPushTimeOut)
xxiii) The total feed-tray panel pushes (TPushTotal)
xxiv) Nose-poke responses during the 'time-out' period (TimeOutResponse)
vii) The time taken to eat the reward (TimeToFeed)*
viii) Total beam breaks
xxv) Unclassified nose-poke responses following 'time-out', but before the next ITI period, which are punished by restarting the 'time-out' period (UnclassResPunished)
xxvi) Unclassified nose-poke responses following 'time-out', but before the next ITI period, which are unpunished (UnclassRespUnpunished)

Note: All the above filtered data values are all records of single events (except for those marked * , which are latencies between events) and therefore have calculated latencies = 0. Selecting an unopened tree in the top window will give you the latency value; to record the individual times at which the events occurred – open the tree for that event by clicking on ◎- in the top window , select 'Latency Start' and then select the required stats. by clicking 'add' in the lower window. Clicking 'OK' will then add these stats. to the report.

6.4. Report Templates

Some summary reports have been provided for you (see details below). These reports can be accessed as follows:

a. Select results and go to 'Make Report' as described in 6.3 above.
b. Click on 'Open template'.
c. Select and open the required report.
d. Click ' Insert attributes' to add any custom attribute data which you added in the 'Network Manager'.

Note: You may wish to save these attribute columns into the template, to save you adding them every time you create a report: Click 'Save as template' and save as either the original or a new file name. Additional data columns can also be added (see 6.1 above) and saved to the report. If you click 'Save as default', then this report will be available as a default every time you enter the report making window with results from this program selected. Lines from the original report can be deleted or added, as you require.

e. If the results you are viewing were created using an experiment with more than one block of trials, the individual data for each block can be viewed by ticking the 'per block' square.
f. Click 'create'.
g. To save the report as a CSV file, click on 'save as…' and save to a folder of your choice.

SUMMARY REPORTS

Latencies in the following reports are all report in seconds.

MouseTraining1 – Beam Break Report

This report will display the following data:

i) No. of back beam breaks
ii) No. of front beam breaks
iii) Total number of beam breaks

MouseTraining 2 and 3 – Summary Reports

This report will display the following data:

i) No. of back beam breaks
ii) No. of front beam breaks
iii) Total number of beam breaks
iv) Total no. of panel pushes
v) Mean latency to collect food (in seconds)
vi) Mean duration of eating (in seconds)

Mouse5CSRTBasic, Mouse5CSRTVar1-4 – Summary Report

The 'Summary Report' summarises the overall data from all trials within an experiment, or each block of trials. This report will display the following data:

i) Reward Collection Latency (Mean, Max and Min)
ii) Mean Duration of Eating
iii) Correct Response Latency (Mean, Max and Min)
iv) Incorrect Response (errors of commission) Latency (Mean, Max and Min)
v) No. of Correct Responses
vi) No. of Errors of Commission
vii) No. of Errors of Omission
viii) No. of Premature Responses
ix) No. of Perseverative Responses at the Correct Hole (Perseverative Responses in Correct Hole)
x) Incorrect Perseverative Responses Following a Correct Response (Perseverative Responses in Incorrect Hole)
xi) No. of Time-Out (nose-poke) Responses
xii) No. of Unclassified Responses Punished (see xxiii above)
xiii) No. of Unclassified Responses Unpunished (xxiv above)
xiv) No. (Feed-tray) Panel Pushes during ITI
xv) Total number of Nose Pokes
xvi) Total number of Panel Pushes

xvii) Total number of Beam Breaks
xviii) Total Number of Trials Completed
xix) Total Correct and Incorrect Responses
xx) % Correct (i.e. No Correct Responses/Total Correct + Incorrect Responses as %)
xxi) % Missed (i.e. Total No. of Omissions/Total trials completed as a %)
xxii) Nose Pokes per Trial
xxiii) Panel Pushes per Trail
xxiv) Beam Breaks per Trial

6.5. Detailed Reports/Measure Lists

More detailed (trial by trial) reports can be obtained from the 'measure lists'. Details of all the measures outlined in 6.3 above can be seen in the measure tables. To access these:

a. From the filtered data archive (see 6.2 above) select the file from which you wish to make a detailed report.
b. Click on 'show measure list.

In addition to the latency and times of each recorded measure, the filters provided also give the following data:

Mouse5CSRTBasic

i) Correct Response – 'Which Lamp' was lit and on 'Which Trial' the correct response took place.
ii) Error of Commission - 'Which Lamp' was lit, the 'Hole Chosen' and on 'Which Trial' the incorrect response took place.
iii) Error of Omission - 'Which Lamp' was lit and on 'Which Trial' the response was missed
iv) Premature Response – The 'Trial No.' in which the premature response took place, the 'Hole Chosen' and the 'Last Lamp' to be lit before this response.
v) Collect Reward Latency – Which trial it occurred

Mouse5CSRTVar1

As for Mouse5CSRTBasic above plus:

i) Which ITI and Which Lamp Duration
ii) Which ITI and Which Lamp Duration
iii) Which ITI and Which Lamp Duration
iv) Which ITI

Mouse5CSRTVar2

As for Mouse5CSRTVar1 above plus:

i) Which Time to Distraction (from Start of ITI in milliseconds; 0 means no distraction)
ii) Which Time to Distraction
iii) Which Time to Distraction
iv) Which Time to Distraction

Mouse5CSRTVar3

As for Mouse5CSRTVar1 above plus:

i) Which Brightness the stimulus lamp was lit at
ii) Which Brightness the stimulus lamp was lit at
iii) Which Brightness the stimulus lamp was lit at

Mouse5CSRTVar4

Combination of Mouse5CSRTVar2 and 3 above:

Note – The trial number will start from one for each new block

All tables can be saved as csv files for further manipulation in other packages (e.g. Excel), but the recommended way to effectively handle this data is to use a database such as Access.

7. Verifying / Locking Programs

CCL control contains a security system, which enables you to lock versions of a program (including the results filter and 'set-up' files) so that they cannot be changed. This not only prevents accidental change to the programmes, but also permanently locks any results generated with the program to that program, that way you will always have a record of which program was used to generate the results. The raw results are also encrypted so they cannot be tampered with at a later time.

All the 5-choice programs are provided in a non-protected / unverified form, so that you can change them to your individual needs. You will be able to modify the program itself (through the Designer), the 'Results Filter', the 'set-up' table (through the 'Settings Designer') and the 'set-up' files (through the 'Settings Editor'). However, before changing and/or verifying these programs it is recommended that you create a new version of the programs as follows:

a. Open 'Designer'.
b. Choose the program you wish to amend.
c. Click the version ▼ and select '[New].
d. Click 'Base on…' and choose version 1.
e. Click 'Edit/View'.
f. Choose the program files to be included and click 'OK'.
g. Amend and add to as required.

This way the original programs remain in tack as version 1. If they ever become accidentally changed, you can simply reinstall from the installation disk.

It is recommended that before embarking on any actual experimental work, that you protect your final chosen program set by verifying it. To do this:

a. Open 'Designer'.
b. Choose the program you wish to verify (clicking on the version ▼ will give you information on which versions are already locked).
c. Click 'Edit/View'.
d. Click 'File/Verify this version'.
e. Fill-in table as required (see 'Control manual' for more details).
f. Delete from the list any 'Setup files', which you do not want included and click 'Verify'.
g. You should then select this verified version of the program for you experimental work.

Note: Verifying a program does not prevent you from altering or adding to that program in the future. To do this you will simply have to create a new version of this program, as described above.