CyberRat V3.x
User's Guide
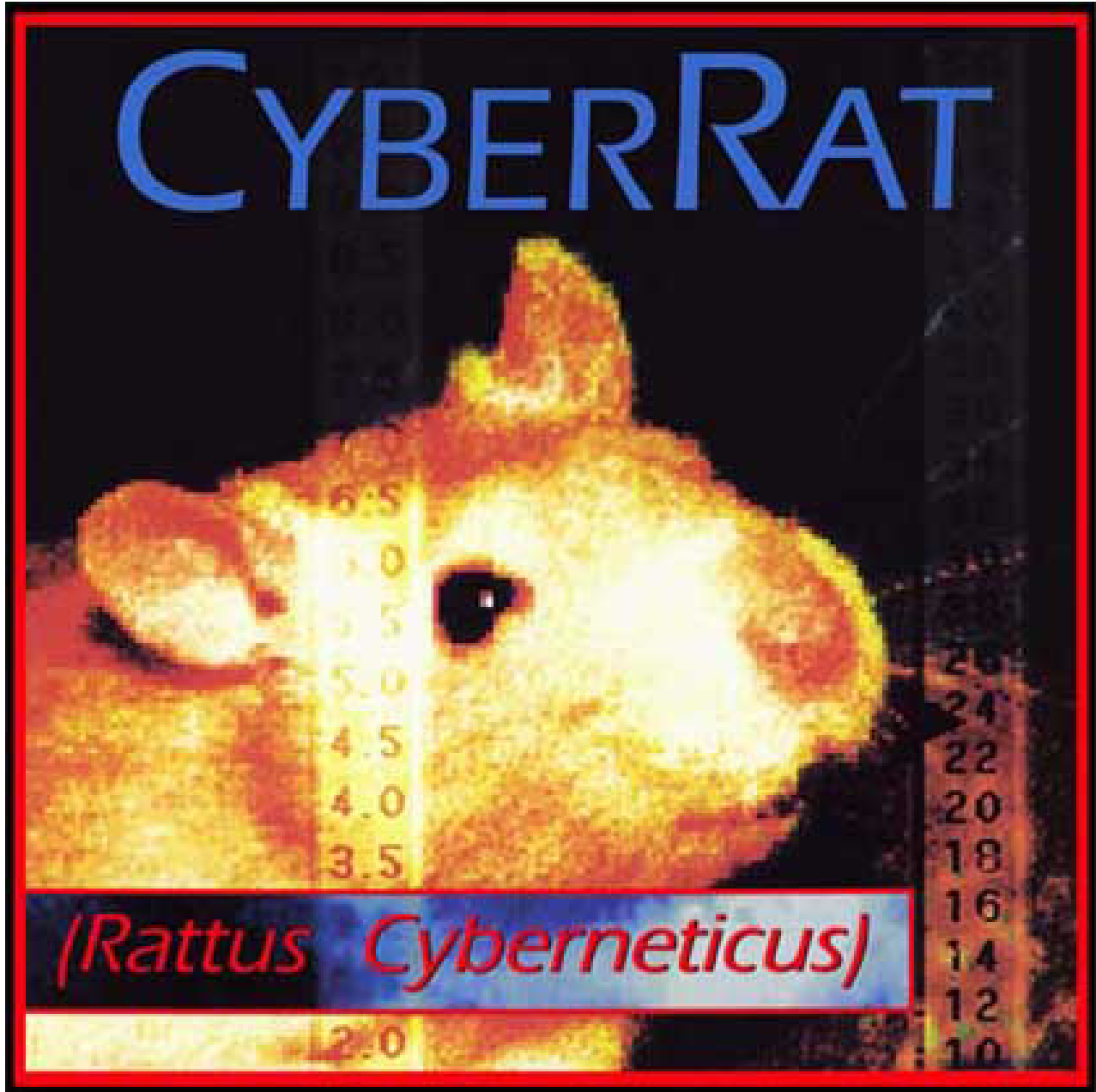
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(AI)², Inc.

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Chapter 1

# Purchasing, Registering, Downloading and Using CyberRat

What do I have to do?

First you need to purchase, then register/activate to establish a student registration for your school/instructor/course on the CyberRat servers, and finally download CyberRat for installation and use on your computer.

1. **PURCHASE** -- Let's Walk Through the Purchase Process:

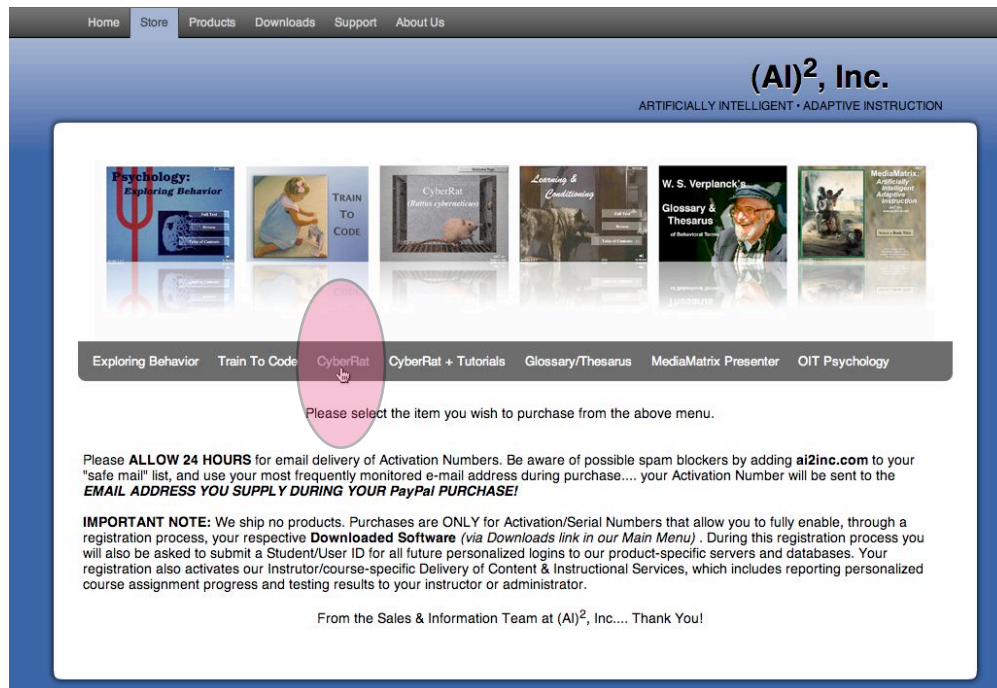   Go to the Home page at **http://www.ai2inc.com/**

Among the tab menu items at the top of this page is the **Store** tab, click on this menu item to access the (AI)², Inc. online **Store**, as illustrated by the pick highlighted area below:
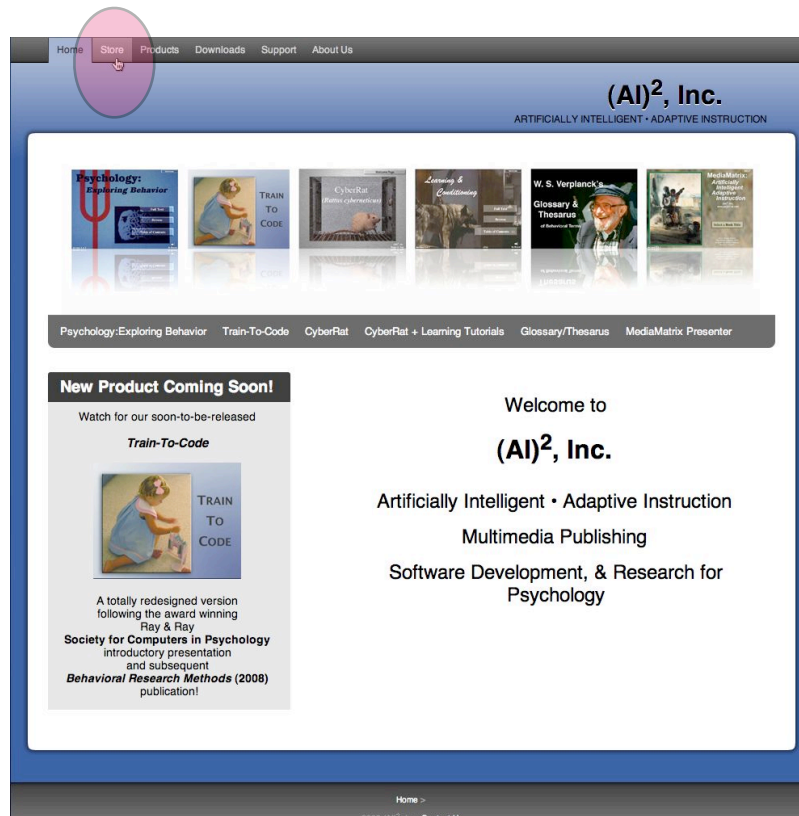
This form of highlighting will be used throughout this User's Guide to point to areas of interest.

What are my Purchase Options?

There are many different products available here, each with its own Menu in the "secondary menu" bar just below the visual display of products. Click on the **CyberRat** secondary menu option, as illustrated here:

This will take you directly to the **CyberRat Purchase Page**, illustrated below.

On this purchase page you are given two alternative payment options to purchase CyberRat for US$32.00:

1. **Purchase via the highly secure PayPal service** (it allows you to use your credit card or e-check without our company seeing any of your credit card information), and you do NOT have to be a member to make this purchase.

2. **Purchase by sending a check** or money order through the US Postal Services. Write the check for $32.00 to be paid to (AI)², Inc. Send it *PLUS YOUR E-MAIL* address to:

<div align="center">

(AI)², Inc.
1400 Bonnie Burn Cir.
Winter Park, FL 32789

</div>

Please note, we *MUST* have your e-mail address to send you the CyberRat Activation Number after receipt of your check. If there is no e-mail address included, we must mail via USPS your Activation Number, which will significantly delay receipt and access to use of CyberRat.

What Did I Buy and What Happens Next?

Within approximately 24 hours (typically much less) of receipt of your purchase you will receive an e-mail with a CyberRat Activation Number that reads pretty much as follows:

Thank you for your purchase of the downloadable version of CyberRat. You have purchased only downloadable software and no product will be shipped to you. You may download as many copies to as many computers as you wish with this single registration. Your serial number is

3FCRxxxxxxxxx (your personal number will be here)

Go to:

http://www.ai2inc.com/Registration/CRregistration/CRregistration.html

to register this number and complete your course registration so your instructor may receive your assignments when you complete them. A fully illustrated User Guide for CyberRat may be downloaded by using the fifth link on the following web page:

http://www.ai2inc.com/AIDownloads/AIDownloads/guide_downloads.html

You may download CyberRat itself beginning at:

http://www.ai2inc.com/AIDownloads/download_index.html

sales & information
(AI)^2, Inc.
http://www.ai2inc.com

2. ACTIVATION/REGISTRATION -- How and What Do I Register?

As the activation e-mail message instructs, go to:

http://www.ai2inc.com/Registration/CRregistration/CRregistration.html

Selecting the CyberRat option on that page will take you to the following page:

The **CLICK HERE** at the bottom of the page illustrated above starts the registration of your Activation/Serial number. First, you Register your serial number….type it in and click Send Information as illustrated below:

Next, you need to submit a **STUDENT ID** number (your university ID) that will also be used as a LOGIN ID when you start using CyberRat. The remainder of the registration process should be self-explanatory as you go through it…you are essentially signing up for the instructor, school, course, section that requires use of CyberRat. This assures the right instructor gets your data when you run experiments!

3. **DOWNLOAD** CyberRat software -- Let's walk through the Download process:

	a. Begin at **http://www.ai2inc.com** where, among the tab menu items at the top of this page is the Downloads tab, click on this menu item to access the (AI)² , Inc. online Store:
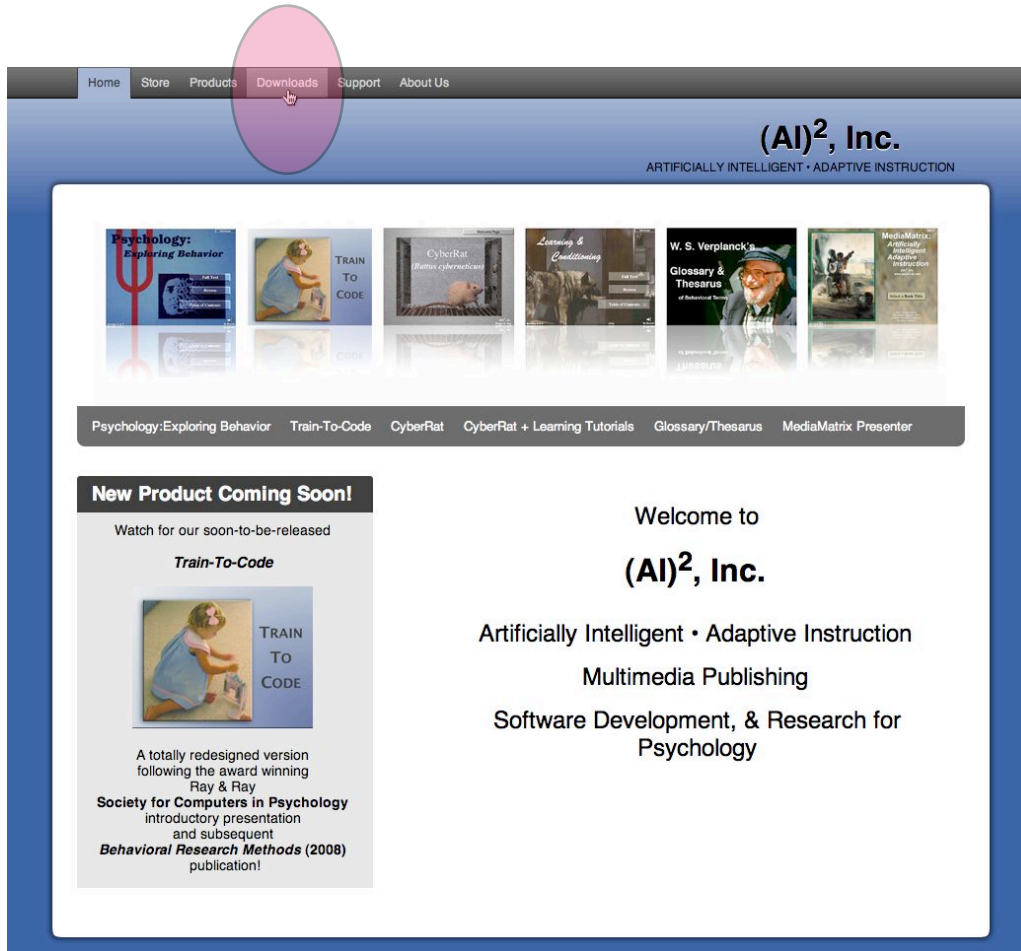
b. When you get to the Downloads main page, there are options to go to the **Mac Products** Downloads (seen below):
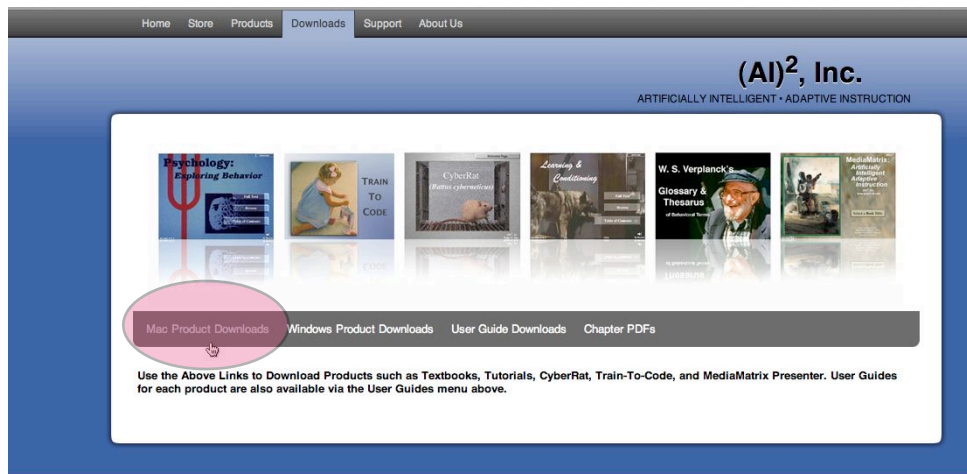
or the **Windows Downloads** Page (seen below):

Windows Product Downloads option

After selecting the Product type that matches your computer's Operating System (Mac/Windows), you will see a list of product download options. Select to download CyberRat, as illustrated here:
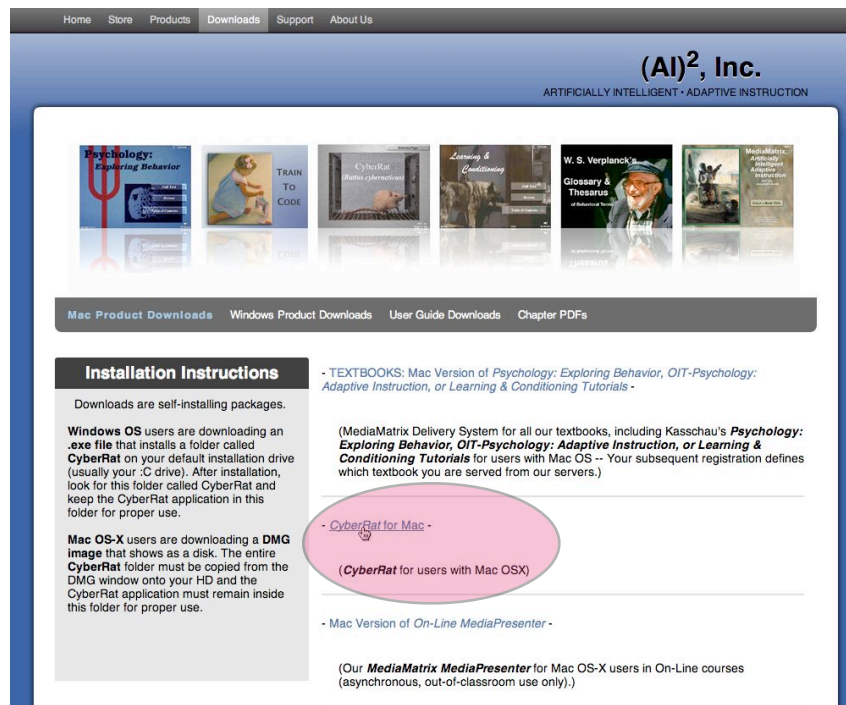
CyberRat for Mac Download option

CyberRat for Windows Download option

Each Download page has Installation Instructions in the left margin window that reads:

Downloads are self-installing packages.

Windows OS users are downloading an **.exe file** that installs a folder called **CyberRat** on your default installation drive (usually your :C drive). After installation, look for this folder called CyberRat and keep the CyberRat application in this folder for proper use.

Mac OS-X users are downloading a **DMG image** that shows as a disk. The entire **CyberRat** folder must be copied from the DMG window onto your HD and the CyberRat application must remain inside this folder for proper use.

Good luck and enjoy conducting your experiments!

Chapter 2

Getting Started

Summary:

Step 1: You *MUST* be connected to the internet to have full services available while using CyberRat. Establish an internet connection then launch CyberRat.

Step 2: After establishing an internet connection and launching CyberRat, Login with your Student ID number (not the Proof-of-Purchase number).

Details:

CyberRat is a "virtual reality" product implemented through the convergence of advanced interactive digital video, internet databases and behavioral systems technologies. CyberRat has been distributed to you as downloadable software, but *it requires that you also be connected to the internet while you use it.*

Using CyberRat:
Internet Connection and Login Requirements

Once you have downloaded and installed the CyberRat folder on your hard drive, you will be ready to explore how the system works. The CyberRat application provides you with the opportunity to shape rat subjects, just as if you were conducting an actual operant conditioning experiment with real animals. We have made every effort to require the same activities, in the same sequence, as is required in real laboratory conditions. To begin this enterprise, you merely need to launch CyberRat by double-clicking on the application icon that looks like the one shown here:

CyberRat

As the application launches you will see a drop-down field asking you to login, either as a **Visitor** or as a recognized student using your registered student ID number. Let's consider each of these two options and what happens when you select them as your *Login Input.*
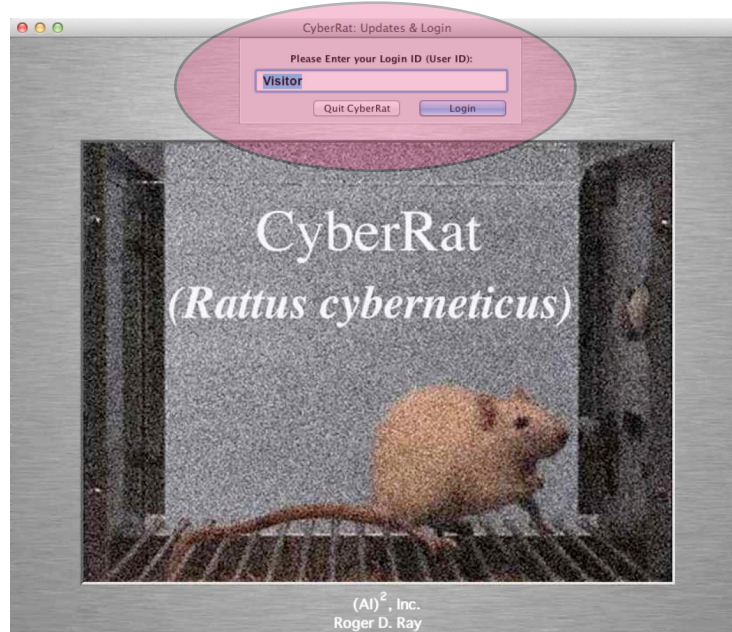
Login as a Visitor to the CyberRat Laboratory

In this section describing how "Visitor" login works, we are assuming that you wish only a brief, and therefore limited, tour of how CyberRat looks and feels. Likewise, we are assuming that you are not actively connected to the internet through your ISP or network connection. Thus to accept the default entry of **Visitor**, merely click the **Login** button (or hit RETURN/ENTER).

What Does Visitor Status Mean with Respect
to What I Can Do in the CyberRat Laboratory?

As a **Visitor** to the CyberRat laboratory, you are not only limited in what you can do with your animal subject, but also certain default assumptions are made by the system to allow you to move directly to shaping your first rat subject to press a lever or "bar." Unlike the individual who registers with a valid student ID number, you *have limited options.* All of these limitations are stated for you immediately after you attempt to login as a **Visitor** through the following message in the **Title Screen:**
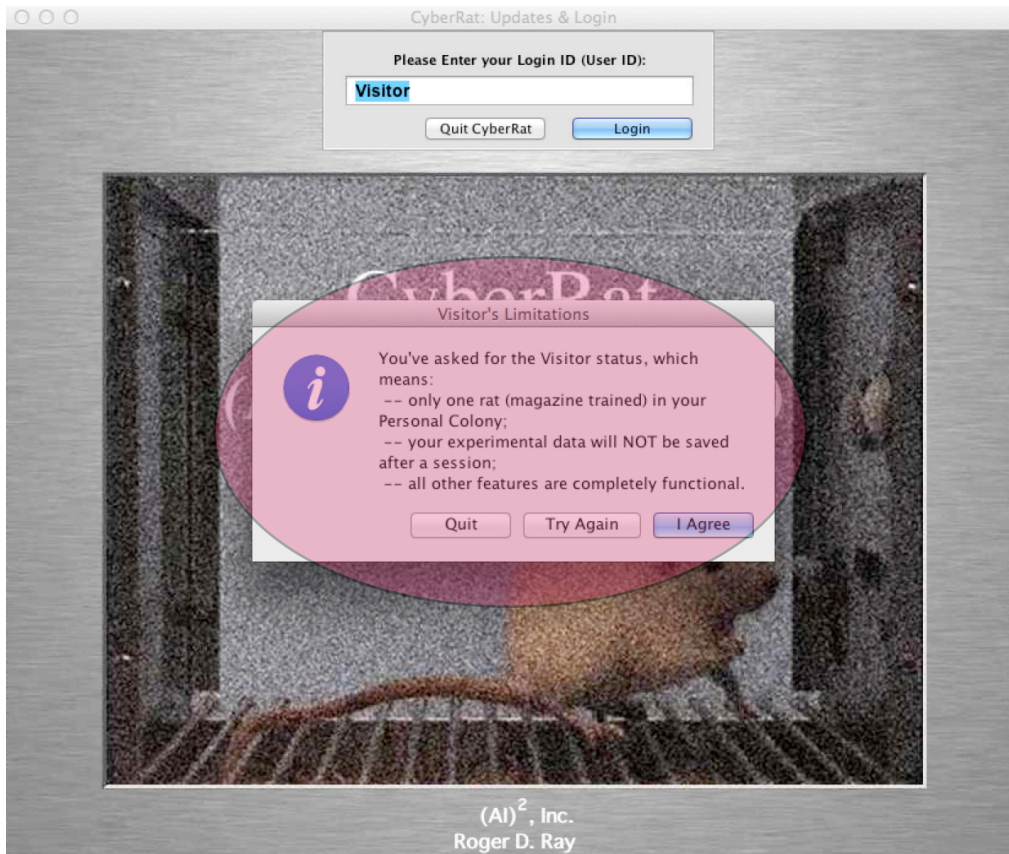
The message popup window, titled "**Visitor's Limitations**," that you will receive states that:

"You've asked for Visitor status, which means:

--only one rat (magazine trained) in your Personal Colony;

--your experimental data will NOT be save after a session;

--during the session all other features are completely functional."

Login as a Registered User
of the CyberRat Laboratory

As noted in Chapter 1, all users of CyberRat are required to first register for an appropriate course and section assignment, even if you are not a student but rather are an "private" user. Beginning at the **http://www.ai2inc.com/Registration/CRregistration/CRregistration.html** home page, follow the "On-line Registration" links to complete this process.

IMPORTANT: As stated previously, if you intend to purchase CyberRat at our on-line e-commerce store rather than your institution's bookstore, you must purchase and receive your CyberRat Proof-of-Purchase number *prior* to registration. For instructions on how to purchase on-line, see Chapter 1.
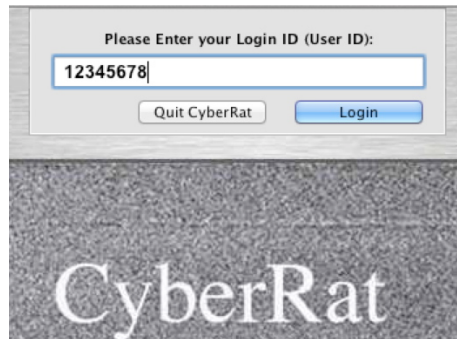
Assuming you have entered your correct student ID in the login field as illustrated above you should soon see a server recognition that confirms who you are with a brief greeting like the one shown below:
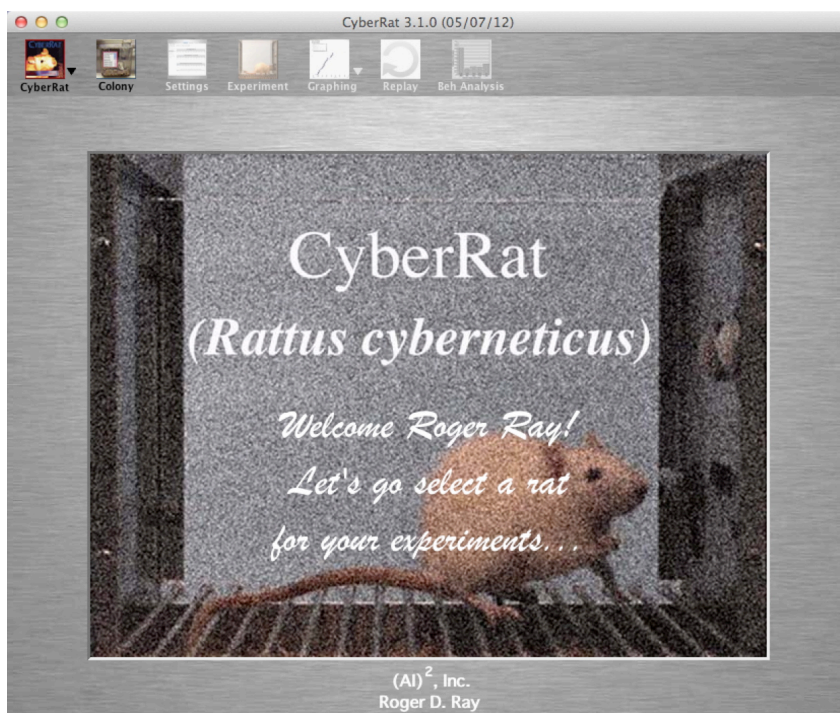
The "Greeting" splash screen you see immediately after login to CyberRat.

Within a couple of seconds, CyberRat will automatically take you to the **Colony** screen for managing your available animals. At this point the applications may also bring up a field displaying any and all messages waiting for you from your instructor concerning assignments or important date announcements broadcast to the entire class, personal

communication sent only to you as an individual, or perhaps even messages from our company, (AI)[2], Inc. about news of importance, as illustrated below:
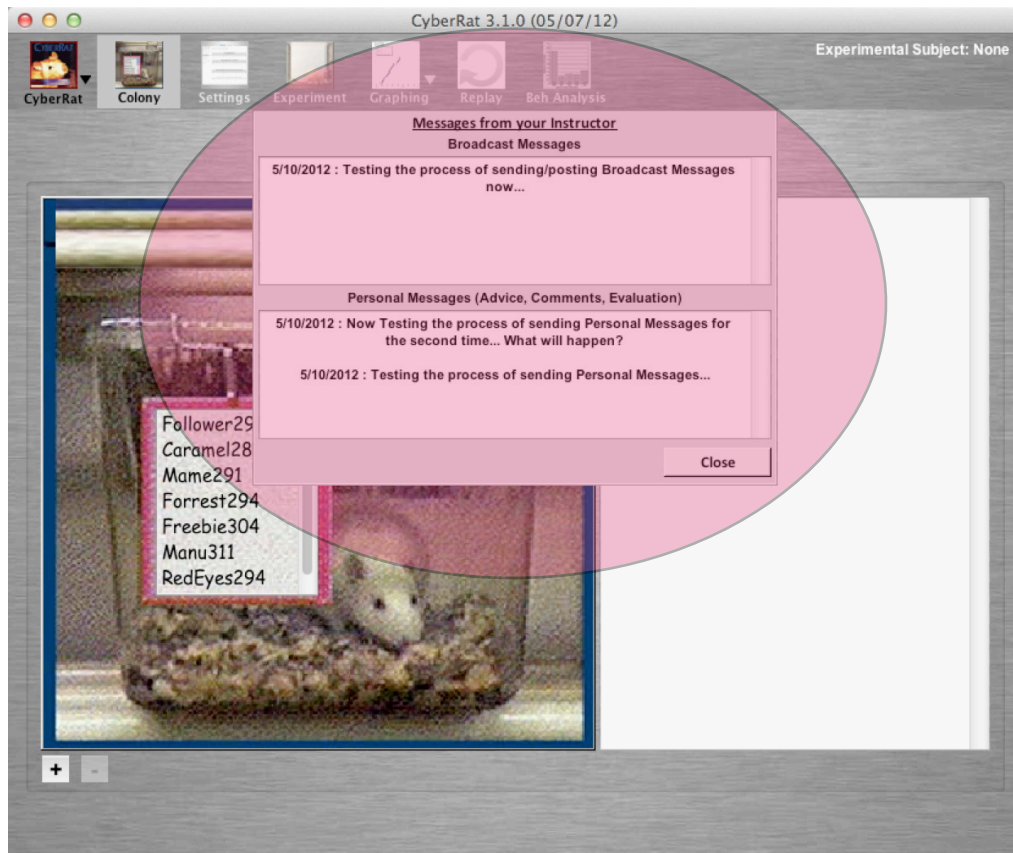
Chapter 3

Using the Colony

Summary:

       Step 1: When in the Colony use the "+" button to add new each experimental animals.

       Step 2: Select the desired experimental history for each new animal subject.

       Step 4: Name (or accept default assigned name) each animal subject.

       Step 5: Select one animal subject for experimentation.

       Step 6: Go to Settings screen to set up your experimental arrangements and parameters.

Details:

When you open CyberRat for the very first time, you have no animals assigned to you for experimentation, and thus must add at least one animal to your personal Colony prior to conducting any experimental sessions. If you leave the colony for any reason, you may return at any time by selecting the Colony menu option at the top of each screen.

Adding an Experimental Subject

To select a new subject use the **"+"** button at the lower-left of the graphic of the animal's home cage as illustrated below:
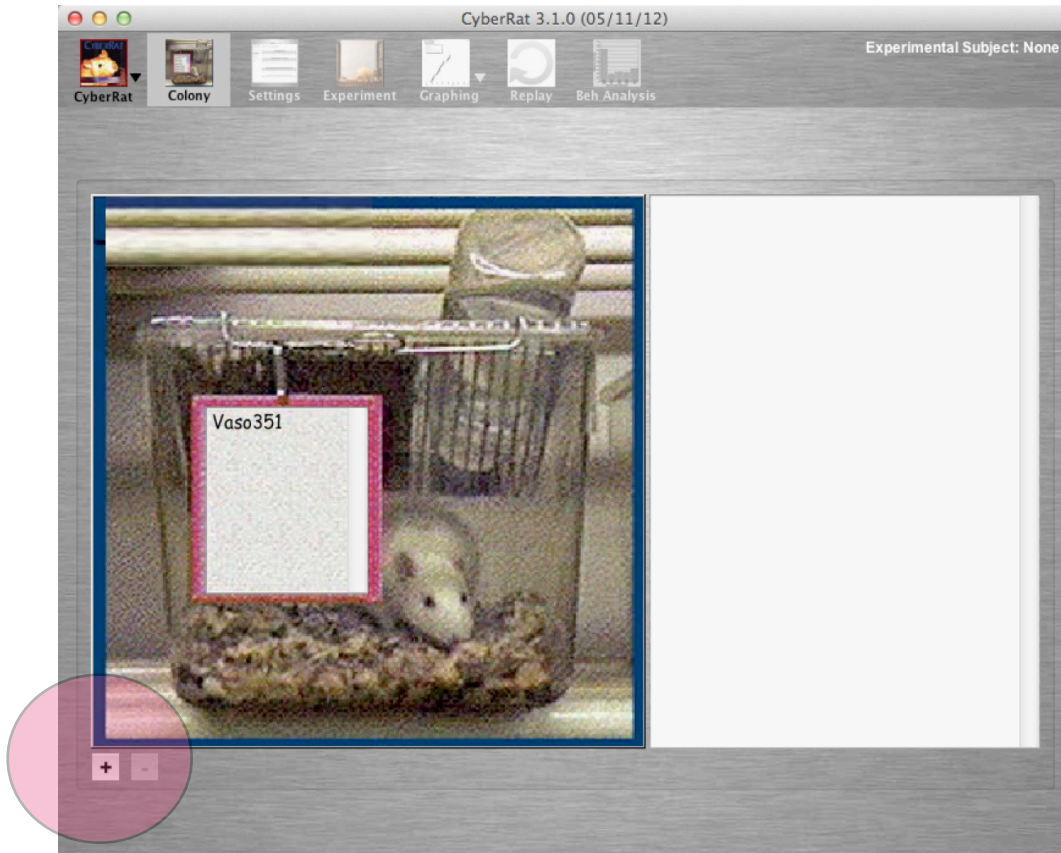
After you have added each new subject, a field appears which requests that you choose a specific **Training History** for this subject. You need to choose the prior experimental/ training history you want for this subject by checking the desired selection:
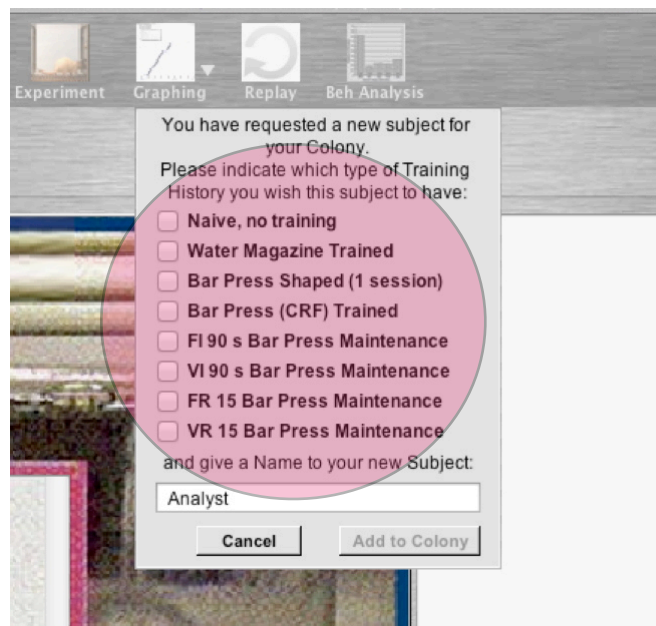
After selecting a specific history for your subject you need either to accept the default name for your new Subject or type in any name you prefer for this specific subject. When satisfied with History and Name, click on the **Add to Colony** button to include this new animal in your colony:
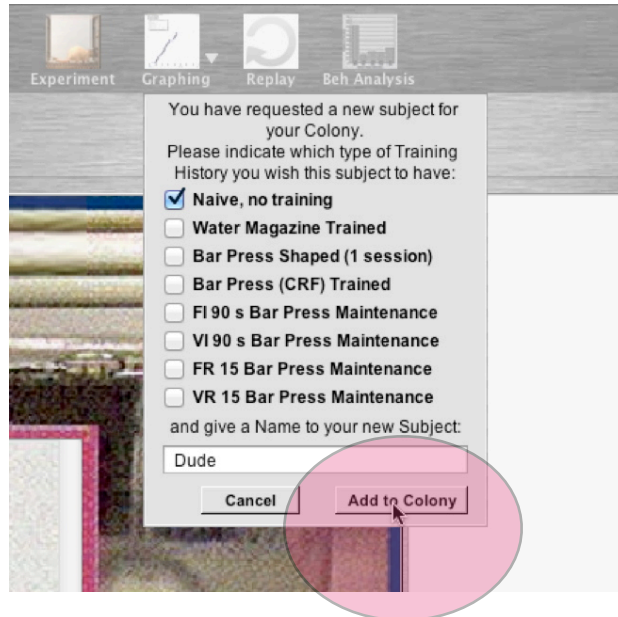
Selecting one of Your Subjects for Experimentation

Clicking on any name in the listing of Subjects you have in your personal colony will select that animal for your current experimentation:
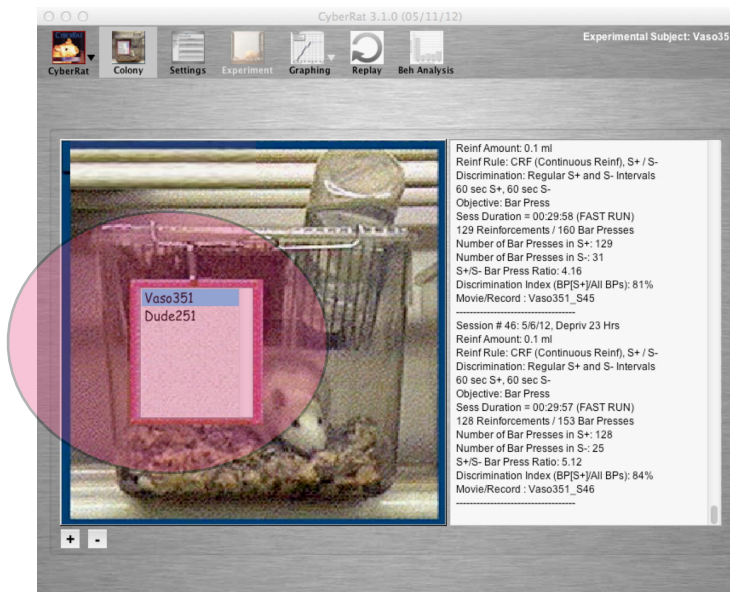
Immediately upon selection of an animal, several menu options that were previously deactivated when you first logged in will now become activated, thus indicating that you have several options of working with this selected subject. You may select any specific session from the journal of past experimental sessions to then review via the **Graphing**, **Replay**, or **Beh Analysis** tools available in CyberRat, all of which we'll consider in subsequent chapters. You will also see the option for selecting the **Settings** menu that takes you to the screen where you establish experimental settings, rules, and parameters for conducting a new experimental session. We will consider details of this process in the next chapter.
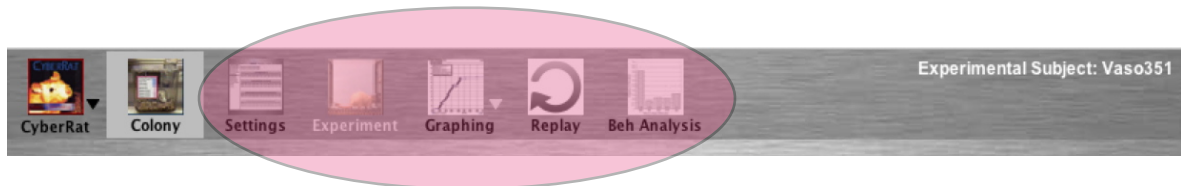
Your Personal Experimental Journal

As soon as you select an animal from the listing of all subjects in your colony, that animal is not only selected as the currently active Experimental Subject, but also you will see to the right a complete experimental journal for this selected animal:
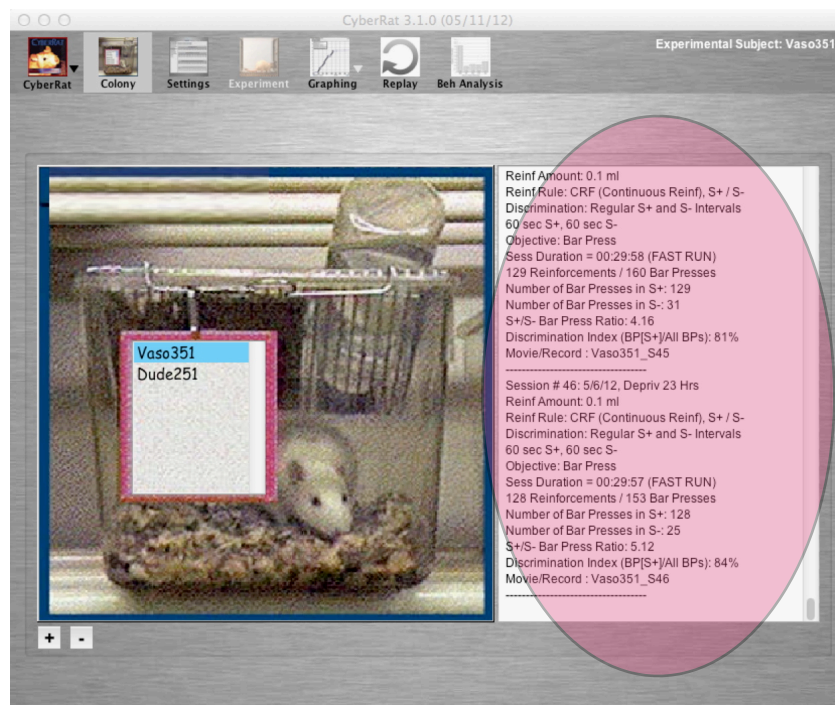
The beginning entry in this journal includes individual subject details, such as initial training history, weight and an ID number that helps instructors know something about this individual animal's learning parameters. Following that is a complete session-by-session history of the subject's experimental treatments, including all experimental rules and other parametric setting details.

Eliminating a Subject from Your Personal Colony

If you would like to permanently remove an animal from your personal colony for any reason--for example to replace one subject with another animal--simply select the name of that animal in your subject listing and then click on the "-" button at the lower-left of the graphic. This will present you with a confirmation popup that explains what is about to happen and gives you an opportunity to either confirm your decision or to cancel the request to delete the subject:
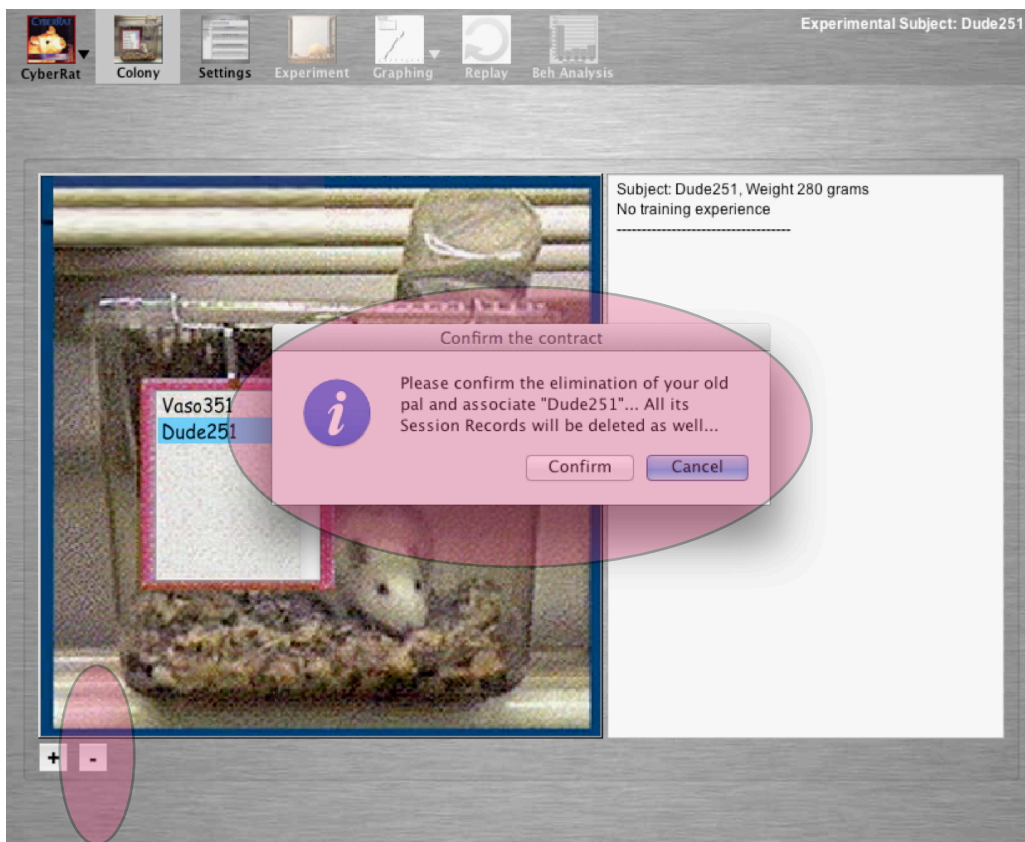
 Clicking on "**Confirm**" will bring a confirmation window notifying you of the complete elimination of your selected subject from your personal colony.

Chapter 4

Setting Experimental Rules and Parameters

The "**Settings**" screen allows you to establish all of the experimental conditions you wish to use for your experimental session. These are organized by three Tabs labeled Reinforcement, Session Control, and Discrimination and allow you to establish rules for how water reinforcement will or won't be available (which may also include identifying which category of behavior you wish to reinforce—such as bar pressing, turning in circles, rearing, etc.), how much reinforcement to deliver each time, how many hours your animal has been isolated from the water reinforcement (deprivation schedule), how long you want your session to be before it auto-terminates, whether you wish to use (and with what rules) Stimulus Discrimination training, etc. Let's consider each tab screen in detail.

Setting the Active Reinforcement Schedule:

Of course, one of the first things you will want to do is to set the "**Reinforcement Rules**" for your planned experiment. Depending upon the history of the animal you have selected for your current Experimental Subject, some options are dimmed to indicate that they aren't logically consistent with that animal's current training history. For example, if you have selected a Naive animal with no prior experimental training, you may only Habituate that animal to the experimental chamber or begin "magazine training" by manually delivering water (and possibly arranging for the bar/lever to also deliver water if pressed). This training teaches the animal to respond by going to drink whenever you deliver water reinforcement. On the other hand you cannot, for example, apply a Continuous Reinforcement schedule rule for delivering water when the animal presses the lever/bar because you haven't yet trained the animal to bar press through appropriate shaping procedures. Likewise, you cannot select an alternative "Amount of Reinforcement" associated with each delivered drop if you plan only to conduct a session focused on Habituation to the chamber, as no water is available. Thus all of the "Setting" sliders except Water Deprivation are also dimmed appropriately for what you CAN logically adjust as you establish your experimental settings. You should begin by selecting the "Reinforcement Rule" as illustrated below for a Naive experimental subject:
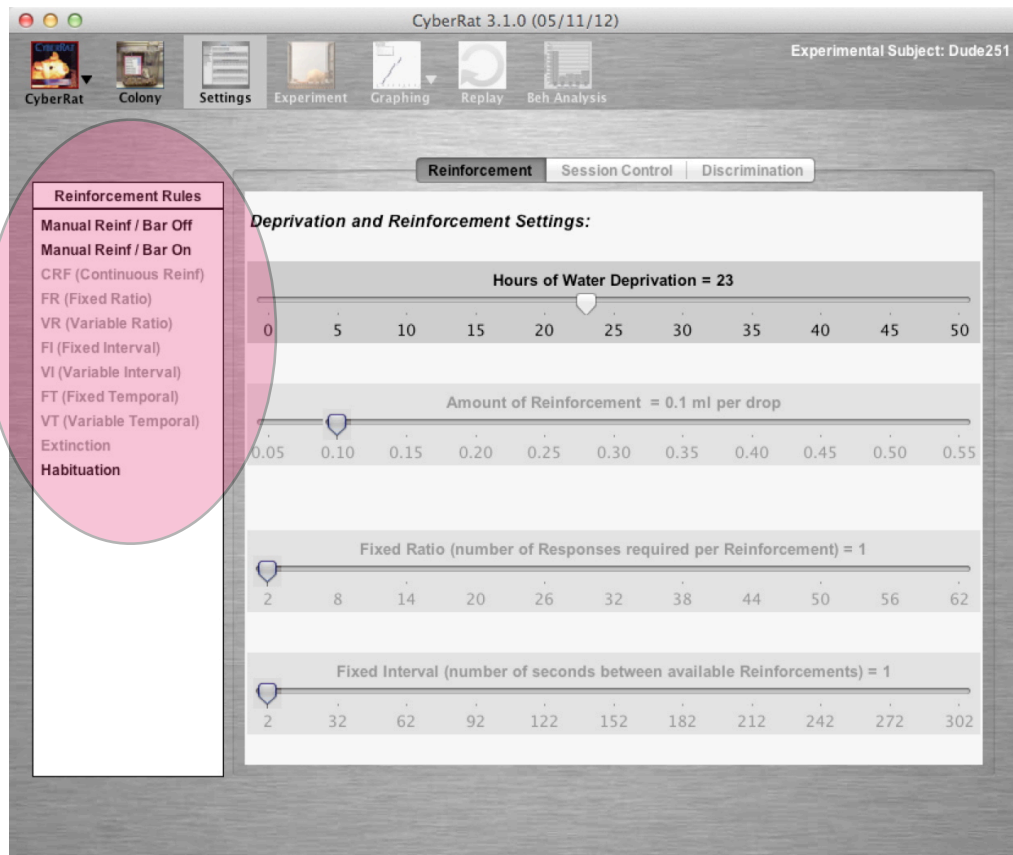
As with most operant conditioning chambers, the one used for **CyberRat** is equipped to sense automatically the occurrence of only one type of behavior--the depression of the bar that protrudes into the chamber in the center of the left wall. This allows the apparatus to track "bar pressing" behaviors and to automatically deliver reinforcement to the subject based upon any of several alternative rules. Thus, if you plan to have bar presses automatically reinforced by the experimental equipment, you must select a schedule for this reinforcement by using the **Reinforcement Rules**. Selection of a given rule/schedule automatically gives you the appropriate slider selectors for setting required parameters. Be sure you set all parameters required.

The specific options, and the rules that each follows, that may be offered (depending upon animal's training history) by the **Reinforcement Rules** panel may be summarized as follows:

> **Manual Reinforcement / Bar Off**:   The subject will not be exposed to any *automatic* reinforcement schedule, only your use of the Manual delivery button (illustrated in the next chapter) is possible. Selecting Manual Reinforcement allows

you to train and maintain any response class you wish, but you must deliver each reinforcement yourself, using whatever "contingency" rule you wish.

Manual Reinforcement / Bar On: You may also select to manually deliver water, say for magazine training or even bar-press shaping purposes, but also "with Bar On" to thus allow the animal to gradually shift from your manual delivery to auto-delivery for pressing the bar/lever.

CRF Reinforcement: The experimental subject will receive reinforcement for each instance of a bar press. Because all bar presses are automatically reinforced, the experimenter is not required to set any slide parameters for reinforcement.

Fixed Interval: The subject will receive reinforcement for the *first bar press response made after a fixed length of time*. The experimenter must set the length of this *fixed* time interval during which the subject will not be reinforced by sliding the indicator on the slide parameter scale to the desired interval.

Variable Interval: The subject will receive reinforcement for the *first bar press response made after a varying length of time*. The experimenter must set the length of this *varying* time interval during which the subject will not be reinforced by sliding both the *maximum* time and the *minimum* time indicators on the slide parameter scale to the desired *maximum* and *minimum* time units within which the subject will *not* be reinforced. Establishing both a maximum and a minimum will cause a simple mean number to also be established, and the indicator will automatically adjust to that number.

Fixed-Ratio: The subject *will be reinforced after a fixed number of bar presses*. The experimenter will need to set the slide indicator at the desired number of presses.

Variable-Ratio: The subject *will receive reinforcement after a varying number of bar presses*. The experimenter will need to set the *maximum* and *minimum* number of bar presses after which the subject will be reinforced. Establishing both a maximum and a minimum will cause a simple mean number to also be established, and the indicator will automatically adjust to that number.

Fixed Temporal: Under this setting a drop of water "reinforcement" is delivered strictly on a regular, or fixed, timed schedule every X seconds, and is delivered totally independently of what the animal is doing.

Variable Temporal: Under this setting a drop of water "reinforcement" is delivered strictly on an irregular, or variable/random, timing schedule every X seconds on average, and is delivered totally independently of what the animal is doing.

Extinction: No bar presses will be reinforced under this setting, although some prior training of some behavior is assumed to have already taken place. Therefore, the experimenter will *not* need to set any other reinforcement schedule parameters.

Habituation: No water is available during this setting condition, including bar presses or any other behavior. No behavior will be reinforced under this setting and no prior training except perhaps earlier Habituation is possible.

If you have selected a **Manual Reinforcement Schedule with the Bar OFF**, the system assumes you are intending to shape an alternative form of behavior. In order to know how to graph this behavior, a list of alternative forms of behavior the graphing system can recognize is immediately offered for your selection, thus somewhat limiting the alternative forms of training and/or behavior you can shape in CyberRat:
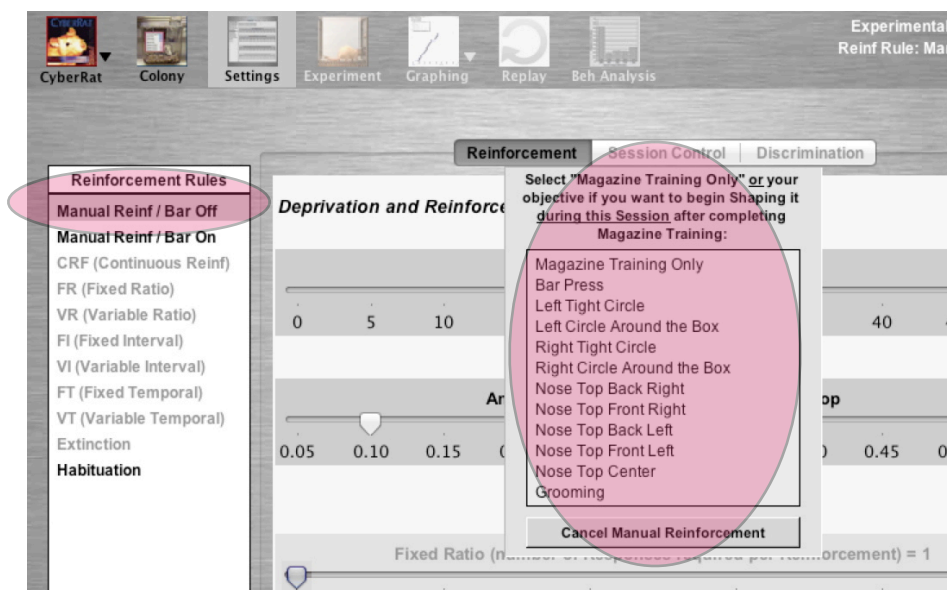
There are four potential slide indicators located on this screen, depending upon whether you select a schedule of reinforcement that needs parameter setting specifications. Each of these sliders serves a different function. Each of these functions has a default setting for new experimenters, but each also allows you to change settings for the desired schedule of reinforcement, the amount of water delivered for each reinforcement, and the number of hours your subject has been deprived of water prior to the experiment. For example, if you selected a Fixed Ratio (FR) schedule of reinforcement, the Ratio slider would also activate in addition to the Deprivation and Amount sliders, thus allowing you to establish the number of bar presses required for delivering each reinforcement, as illustrated below:
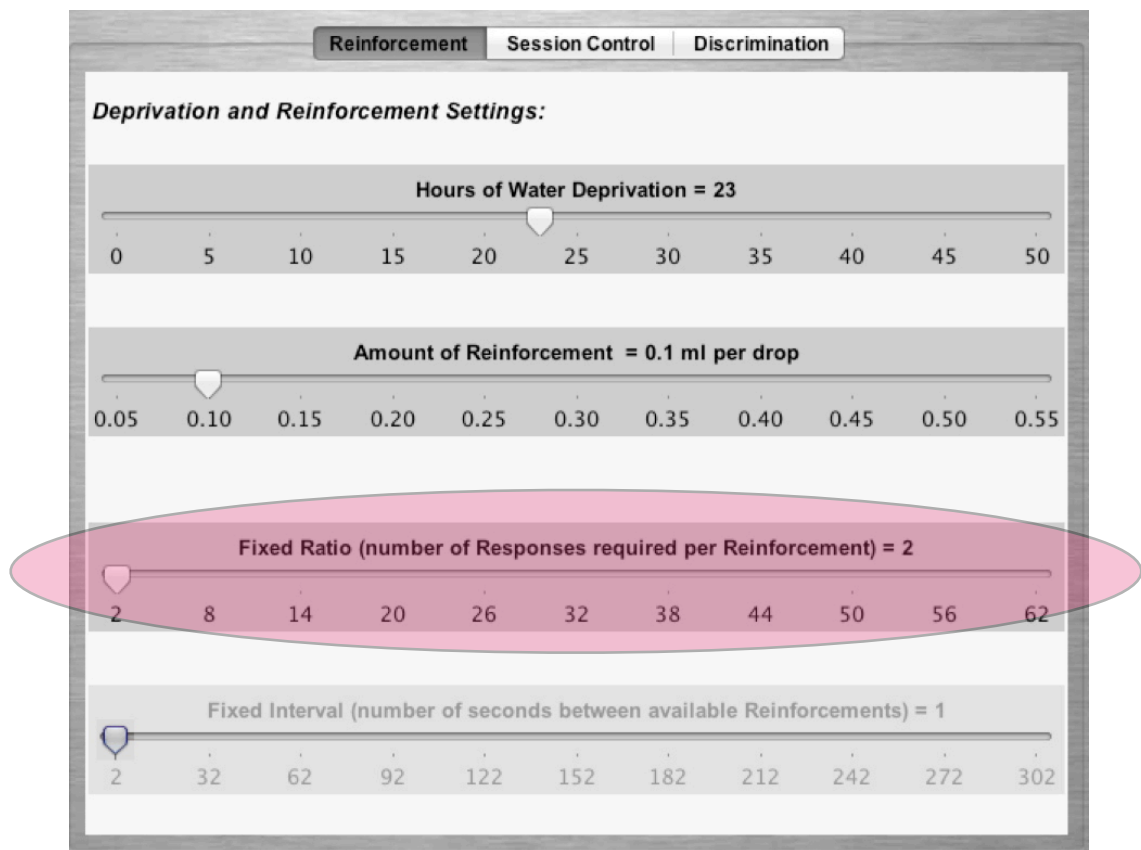
Default Parameter Settings

The equipment in this laboratory is always set to a commonly used default setting for all parameters. These include:

1. A Continuous Reinforcement (**CRF**) schedule, set to deliver a drop of water *automatically* for each **Bar Press**. This setting also allows the experimenter to

deliver reinforcement manually, as will be described in Chapter 5 on **Conducting an Experiment**.

2. A **.1 ml** Magnitude of Reinforcement
3. A **23-hour** deprivation from last available water schedule.

Setting the Magnitude or Amount for Each Reinforcement

Water is the type of reinforcement metaphorically used for experimentation in the CyberRat laboratory. The amount of water delivered per reinforcement is measured in terms of percentage of the maximum water intake your subject will consume in the first *ad libitum* drinking bout following deprivation. The normal setting for this magnitude of reinforcement parameter is between **.05 ml** and **.55 ml** *per drop delivered*. This allows you approximately **20 to 40** minutes of continuous reinforcement without satiation to constant reinforcement deliveries. You may reset it to any level up to maximum by dragging the sliding indicator up or down to the desired level. Higher settings, of course, result in much faster satiation.

Setting the Number of Hours of Water Deprivation

As in all experiments using reinforcement, you need to deprive your subject of any access to the reinforcer prior to experimentation. In the case of CyberRat, this means setting the number of hours that water has been inaccessible to your subject. Different deprivation schedules will, of course, have quite different impacts on your experiment. A frequently used deprivation schedule is 23 hours, where the subject is used in an experimental session only once each day at the same time. Typically, the subject receives water both during, and for a limited time period immediately following, that singular session. To invoke a current deprivation history for your subject, merely slide the indicator to the desired number of hours without water access. **Each new experimental session will assume this setting.**
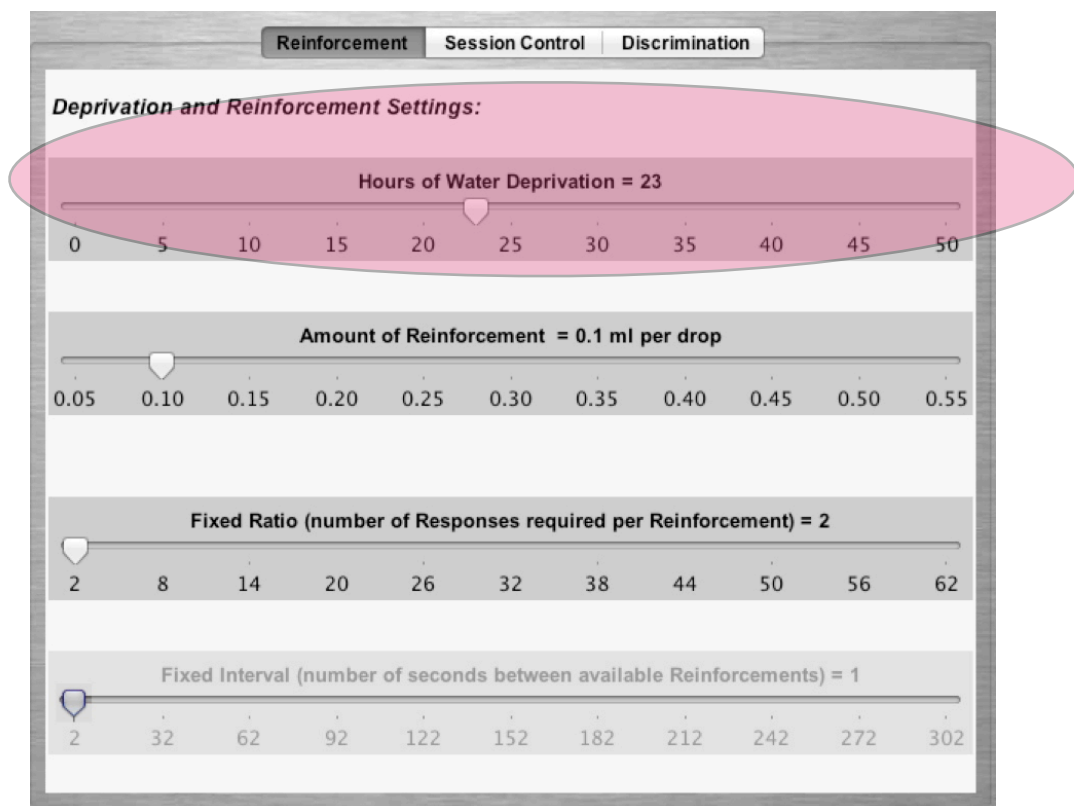
Setting Parameters for Stimulus Discrimination Training

CyberRat is also capable of learning to discriminate whether a Green light is on or a Red light is on. To establish the parameters for this, begin by checking the "**Discrimination**" **Tab** on the **Settings** screen. This brings you to the panel layout illustrated below:
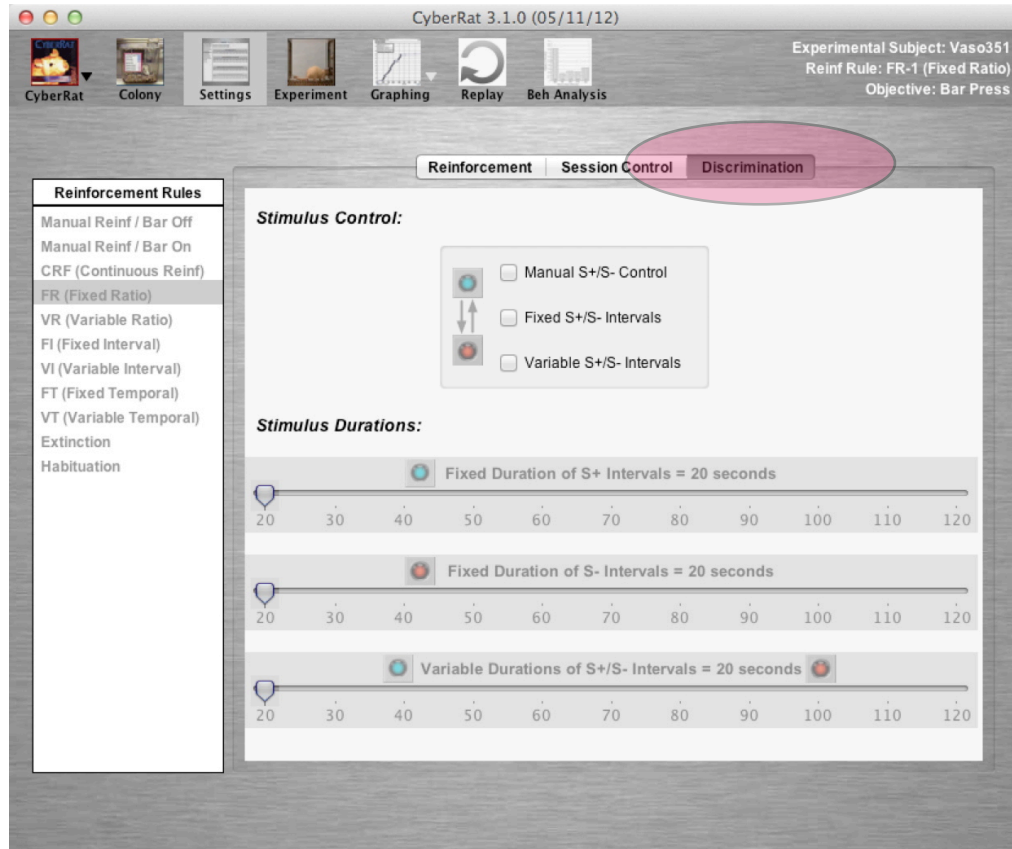
Until you select to use one or another type of **Stimulus Control** (top panel highlighted below), all selections and sliders on the Discrimination Tab panel are dimmed (deactivated). So your first action is to select either Manual, Fixed-Schedule, or Variable-Schedule control of Green/Red light alternations. Without selecting one of these options, **NO SPECIFIC LIGHTING** will appear during your experimental session.:
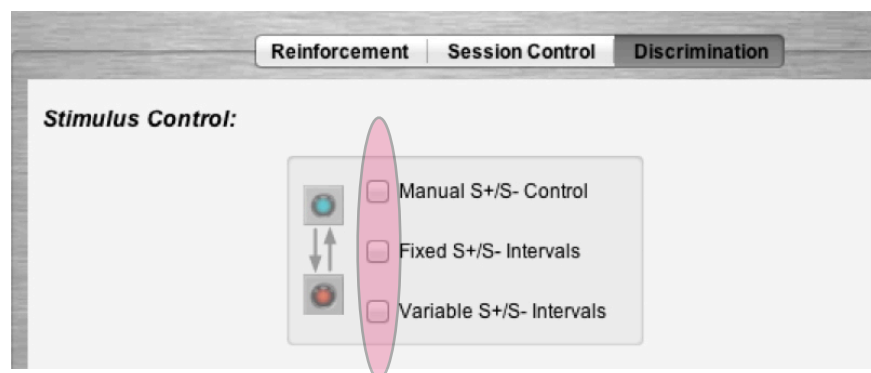
The Manual S+/S- Control selection allows you to *manually* control the light conditions by **clicking on the light itself** during your experiment (useful if you wish to use some unique procedure), or you may select to have *automated* control of light presentations. There are two alternatives for automated control. The first is the use of a "Fixed" or regular schedule, with the S+ set for some specific duration that doesn't fluctuate, and the S- set for another (same or different) duration that also doesn't fluctuate. Alternatively, you may wish to have a "variable" S+/S- schedule, with some average duration, which you may set, but which randomly varies in real durations around that average. Appropriate or relevant sliders allowing you to establish lighting duration parameters each activate depending upon your choice of types of Stimulus Control. For example, the illustration below shows a setup for alternating S+ with S- as each successive 60 seconds elapse within a given stimulus condition:
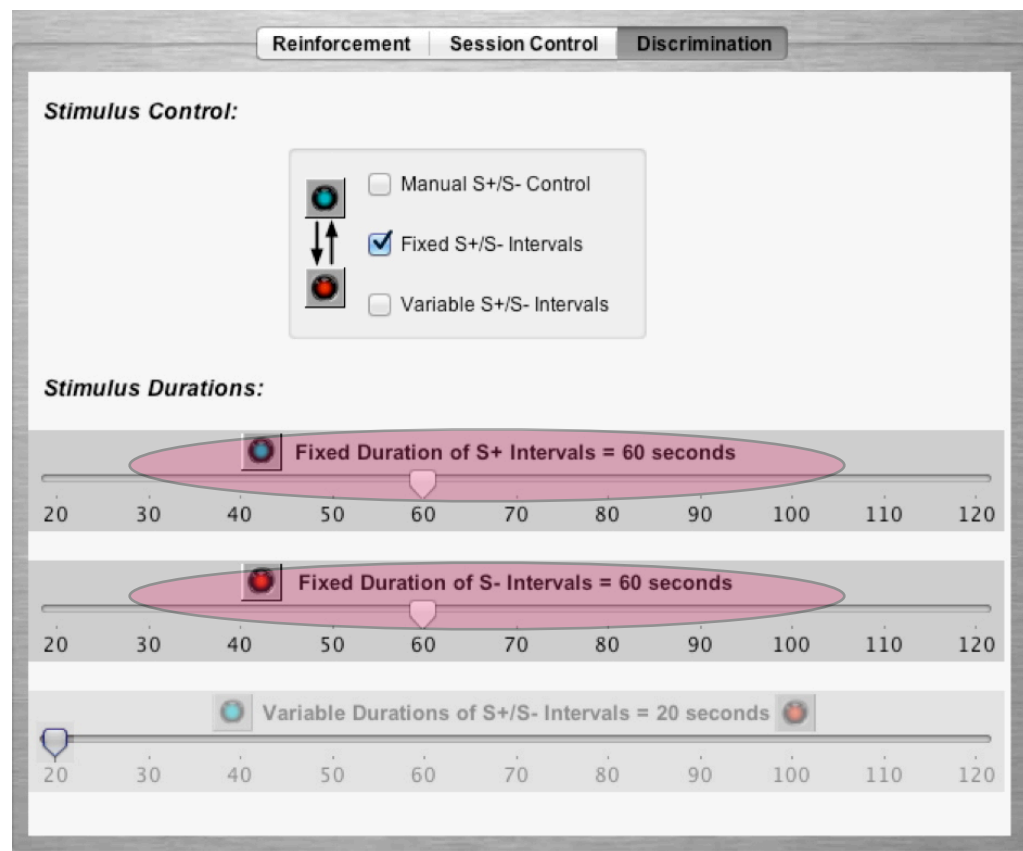
Setting other Session Control Parameters

The final Settings required determine how, and how long, your session will be conducted. For example, you may select to view your entire experiment while it runs (*actually required for all Manual Reinforcement conditions, including magazine training and*

shaping behavior) or to "place your animal in the chamber and return when the experiment is complete" by using CyberRat's unique "**Fast Simulation**" mode that *plays no video during the conduct of the session*. The default settings are to use Real-Time Simulation with Video "On" for viewing your animal and to allow Manual (early) Termination of your Session if you desire to quit the session prior to its set duration (after which it will self-terminate).

In most experiments you will also want to set the Session Duration so the experimental session self-terminates after a fixed time interval, or alternatively, some number of reinforcements or even after a set number of bar presses. As noted above, may also decide to allow a "**Manual Termination**" that overrides this automatic session termination in cases where you might wish to abort an experimental session. The default Session's Duration is 30 minutes (as illustrated above), and retyping this to any desired alternative will reset for that newly typed duration.

Chapter 5

Conducting an Experiment and Viewing Results

Once you have established all of the required Settings for an experimental session, you may select to begin your experiment by choosing the Experiment menu icon in the menu area as illustrated below:
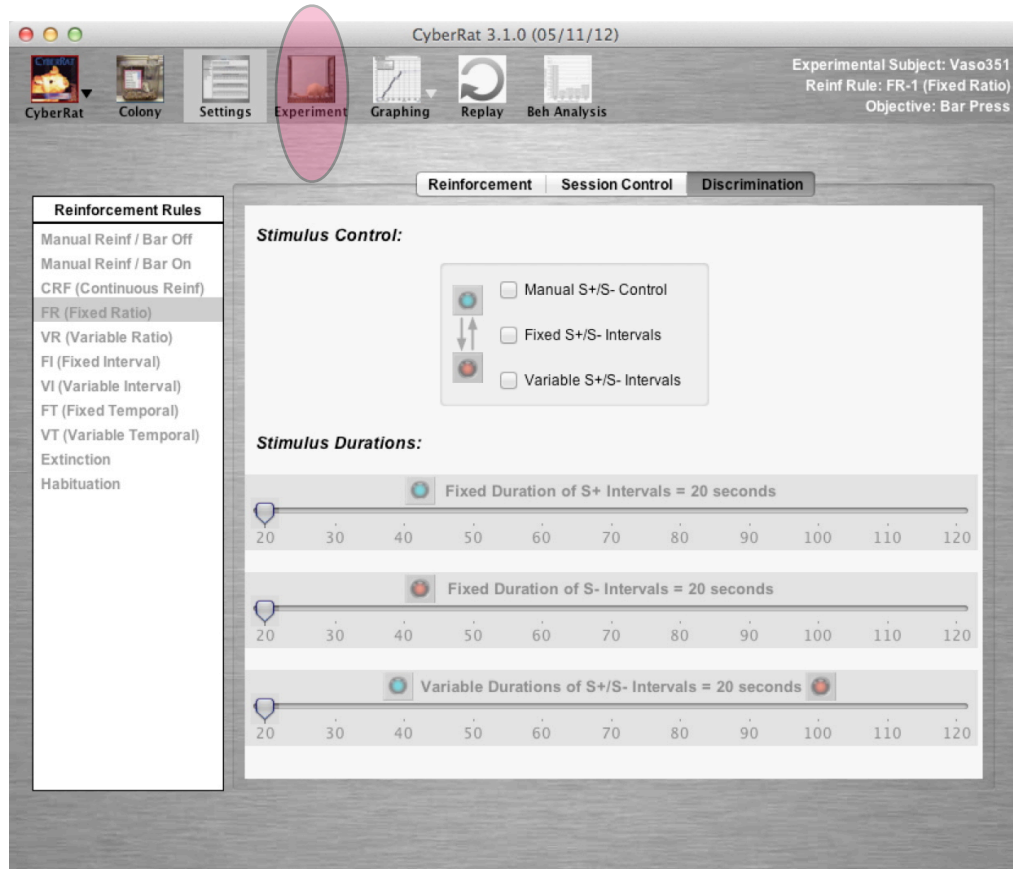
You will typically select this menu item when you have completed setting the experimental parameters for your experiment at the Settings screen as illustrated above, but you may actually select this option from any screen within CyberRat once you have already conducted one session with established settings. Thus you may conduct a **SERIES** of equivalent sessions one after another without having to visit the Settings screen if you haven't exited/quit the CyberRat application. The most typical example of this is selecting to conduct another session as you complete a review of the previous session from the Graphing screen. In any case, clicking on **Experiment** will launch a new session for your Selected Experimental Subject (shown in the upper-right " status information" area) and

using the established Settings last set. Each new Session begins with either the video showing your rat being placed into the operant conditioning chamber, as seen below:

Or if your Settings were set for Fast Simulation with No Video Showing, you will see an animated cartoon dancing rat as illustrated next:

If you selected one of the two possible reinforcement rules that have **Manual Reinforcement** available, the green **Manual Reinf** button in the panel to the right of the operant chamber will be activated, not dimmed--and activation means that clicking this button will deliver a drop of water reinforcement for whatever the animal is doing at the exact time you clicked this button. ***This is thus a very important button if you are shaping a new behavior!***

As is also shown in the illustration above, placed just above the reinforcement button are two counters that show you: 1) the number of times reinforcement has been delivered, whether manually or automatically through the animal's own bar pressing; and 2) the

number of behaviors meeting criteria for your experimental training objective (typically **bar pressing**).

Ending Your Sessions:

Sessions may end in one of two ways. If you have selected the "**Allow Manual Termination of Session**" option in your Settings, you will see an activated "**End Session**" button at the lower right of your screen (if it is dimmed, you have this setting unchecked at the Settings screen under the **Session Control** Tab's panel). Clicking on this button will terminate the session at any time:

Alternatively, if you established a parameter to determine a fixed length for your session, when the clock reaches that time the session will self-terminate. Upon termination the experimental window will close and you will be taken automatically to the **Graphing** screen (and the corresponding menu icon will be highlighted to indicated this) where you can view your results in a cumulative response record of the session, as illustrated below:

Cumulative Frequency of Behavior "Bar Press" during Session Vaso351_S48
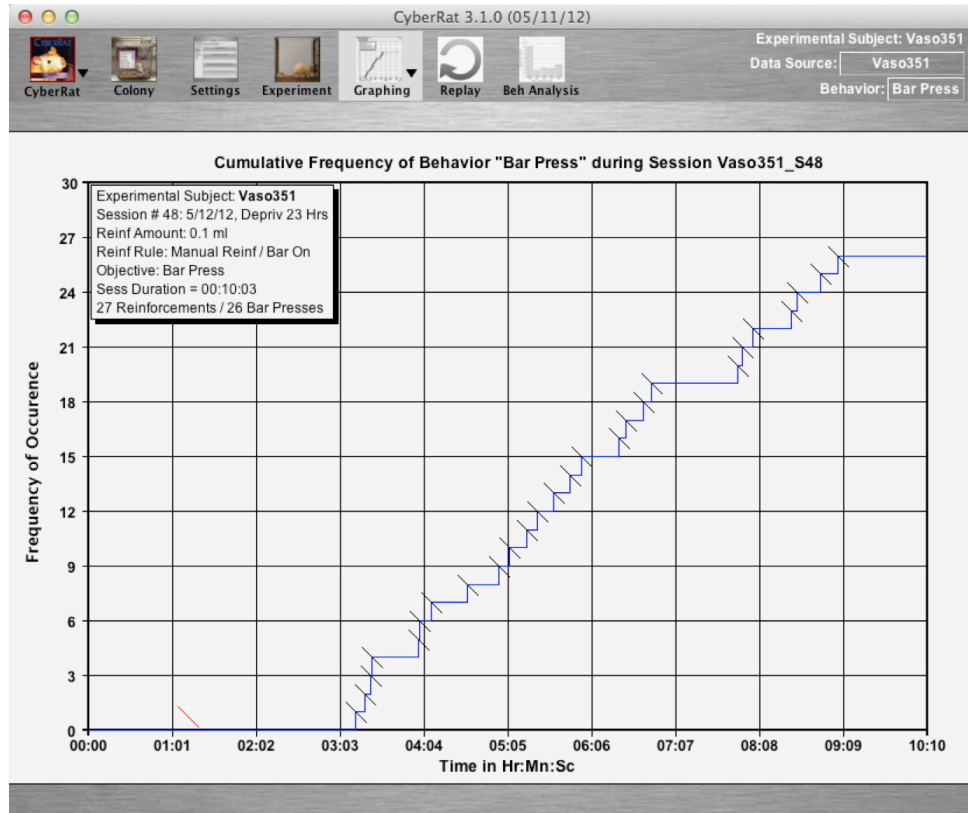
Other Features:
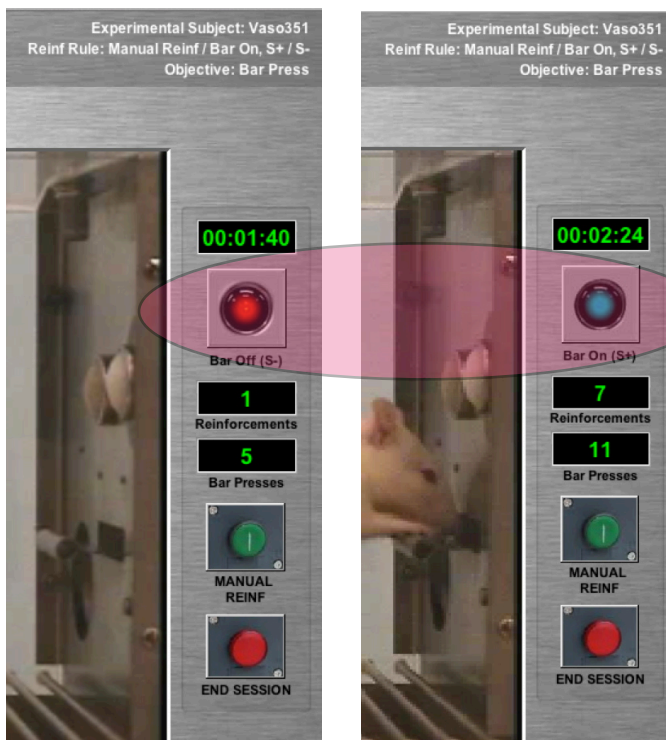
If you have set your experimental parameters to include a stimulus discrimination component, you will see the Discrimination Stimulus (S-) along with the "Bar Activation" status light on the right of the experimental window. Which light is "on" will tell you the current status of experimental conditions for the animal, as illustrated at left If you have set your Discrimination schedule to **Manual**, **clicking on the lights** will alter their status.

Chapter 6

Graphing Experimental Results

The CyberRat laboratory offers you a sophisticated graphing system to help you analyze and report your data. Because you may graph your data long after you actually conduct your experiment, or you may wish to compare one session or subject with another, the graphics system offers you a wide range of options. But having a wide range of options implies that you must inform the graphics system quite precisely about the data you wish to plot. Thus we will consider the many options and requirements of this powerful system.

Selecting a Subject, Session, and Behavior to Graph

As noted at the end of Chapter 5 concerning Experiments, when a session has been completed it always takes you to view the results of that session on the **Graphing** screen. In this section we will cover how to graph other sessions and/or other subject's data. This option exists in slightly different forms, depending on the screen from where you start. For example, if you have just logged into CyberRat and wish only to review some prior Experiments, you may select an animal and review its experimental Journal on the **Colony** screen. If you find a session you wish to graph, you may simply select that section and click on the Graphing menu to see that selected session's graph (the same is true for selecting **Replay** or **Beh Analysis** menus with that session selected). An illustration of this procedure is illustrated below:
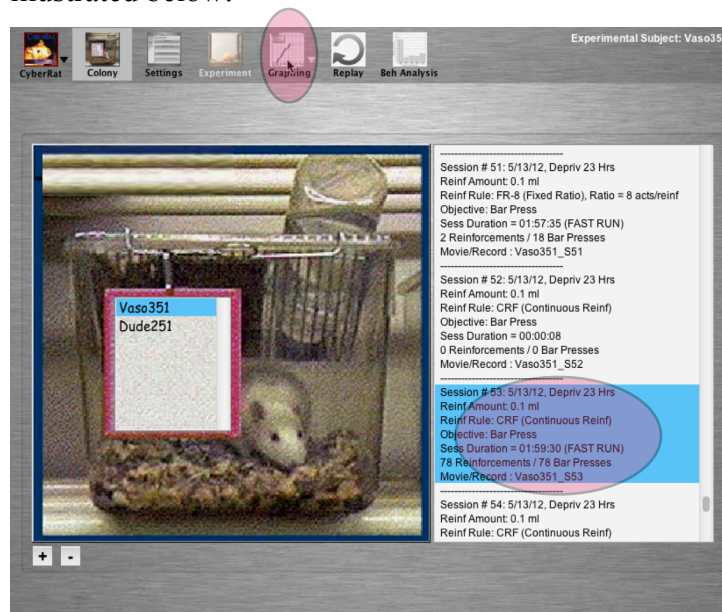
Alternatively, you may wish to graph data from alternative experiments while you are on the Graphing screen itself. There are options for doing this right on this screen. If you merely wish to graph an alternative session for an animal that is already the focal "selected" animal, simply click on the **label** "Data Source" and it will cause a drop-down copy of the journal to appear with the currently graphed session selected. Selecting any desired alternative session from this journal listing will immediately graph that selected session:
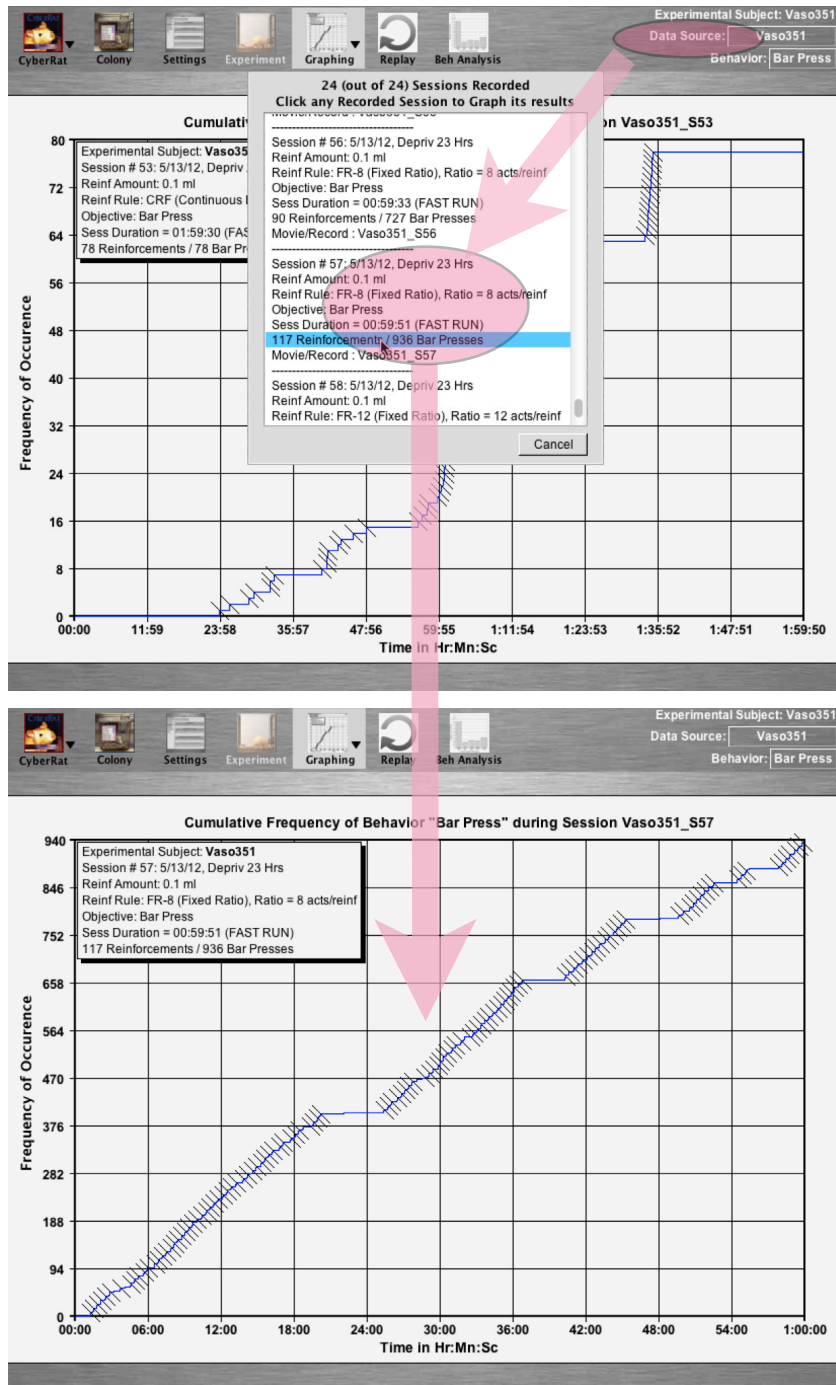
If you wish to graph a session for an alternative animal subject, simply use the "Data Source" **menu** (instead of the **label**) to find the animal you wish. Selecting that animal will give you the corresponding journal for that subject. Of course you may also select the currently selected animal as an alternative means for opening that animal's journal as well. And again, selecting any desired alternative session from this journal listing will immediately graph that selected session:
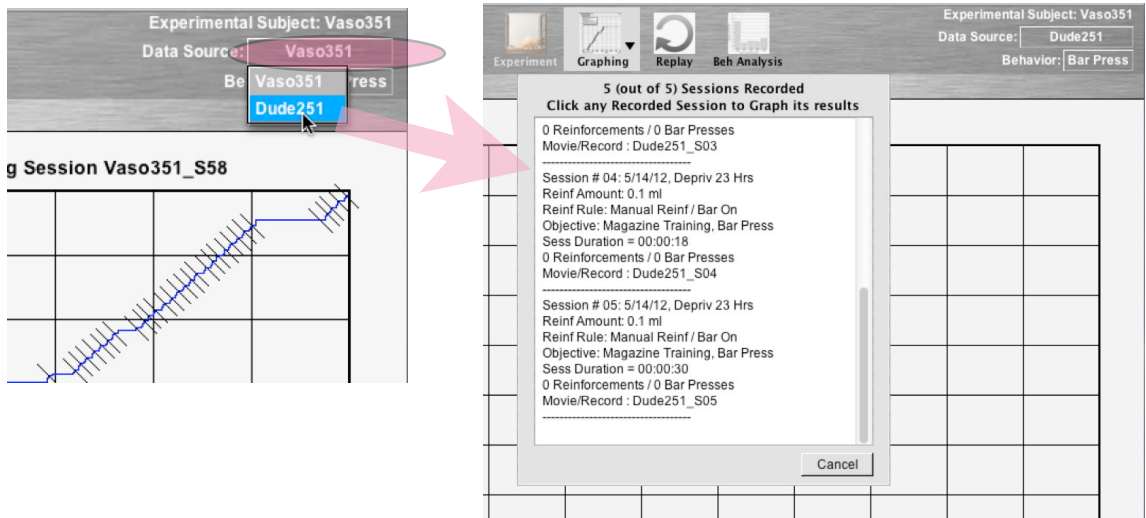
After selecting your desired subject and session, the data for the current default behavior category will be graphed for that selection. If you wish to view any alternative behavior corresponding to that same session, you may do so by selecting from one of the various alternatives offered in the "**Behavior**" menu, as illustrated below:
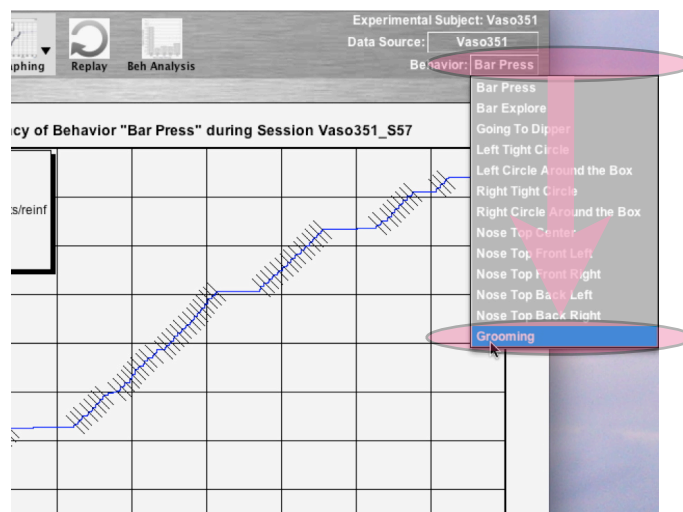
Click on the behavior you wish to have plotted in your graph. In the illustration below, Going to the Water Dipper is graphed, along with all deliveries of reinforcement for bar pressing (marks in red at the bottom of the graph) during that session:
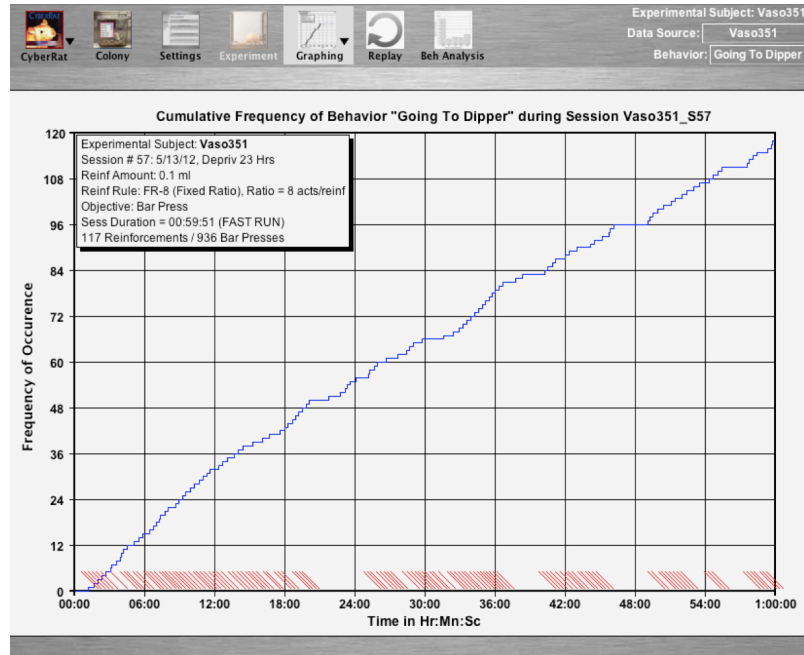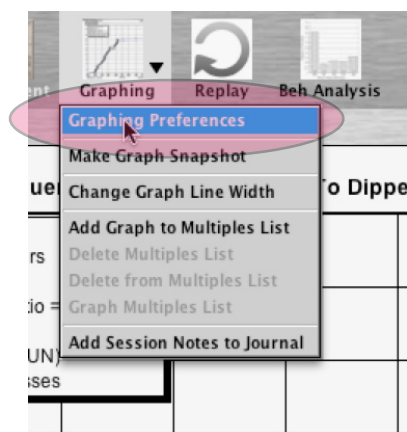

Alternative Preference Settings for Graphing Your Data

The Graphing menu offers several alternatives for selection. The first is **Graphing Preferences**, as illustrated below:

Selecting the **Graphing Preferences** option gives you a panel with several alternatives for establishing alternative ways of viewing your data:
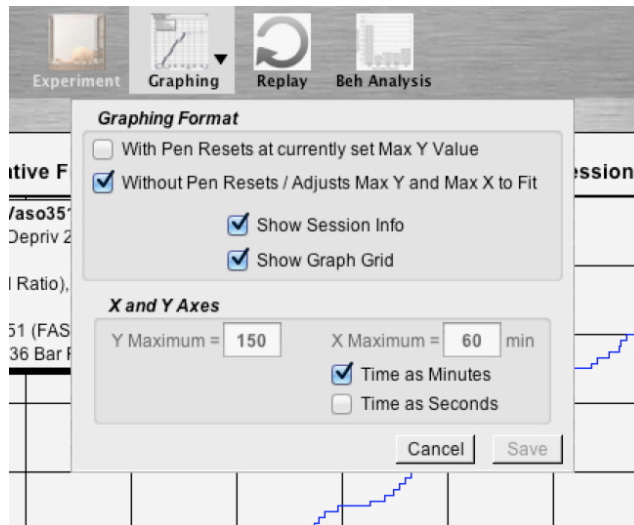
The first set of options are between viewing your cumulative record in the traditional format used originally by paper-and-pen cumulative recorders where a fixed width of paper required the recording ink-pen to "reset" back to the time (X) axis when the top of the paper/graph was reached because of high cumulative response counts. An example of a graph using this setting is illustrated below in a graph that has 150 as the maximum Y (count) value:
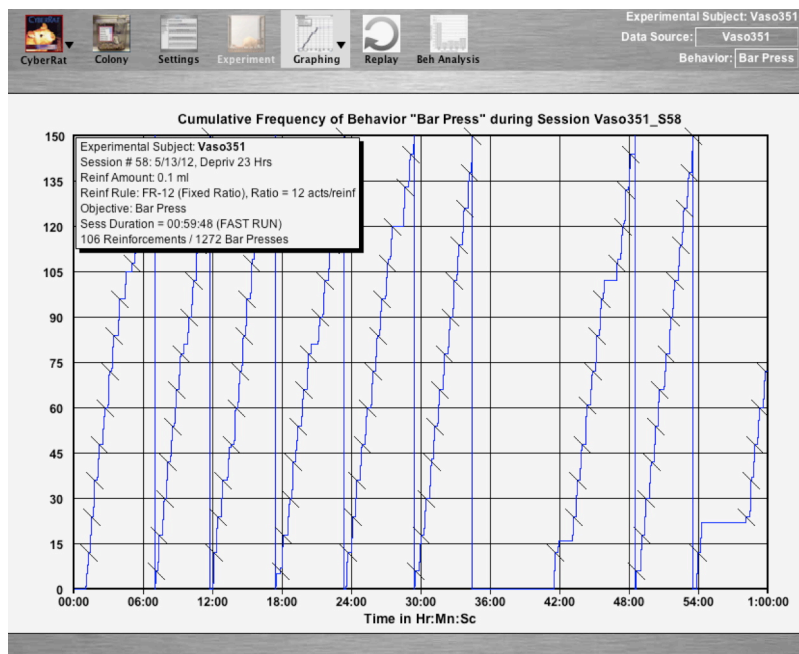
The alternative preference setting, which is without pen resets, places all data within the space offered by the graphic screen by adjusting the maximum Y scale to automatically accommodate the frequency data of that session. Of course this mode makes it inconvenient to compare data from different sessions because the scale will change with each session depending on the total frequency count being graphed each tim. But comparing sessions is also difficult if the pen resets because of the many different graphing segments. Thus if you wish to view more than one session, CyberRat offers the opportunity to graph multiple graphs superimposed on one another as a "set" of graphs (see details in the corresponding section of the Graphing Menu discussion later in this chapter) where the maximum frequency of the set determines the maximum common Y value for all graphs in the set. This implies, of course, that you must have your graphing preferences set for "Without Pen Resets" to have the multiple graphing "set" option available, since resets can't be accommodated in such comparisons.

Other Graphing Format options allow you to show or hide the Session's information field and to show or hide the internal Graph Grid markings. Likewise, if you have the Format set for Pen Resets, you can change the maximum X and/or Y values for each axis, and you may change from the "minutes" default to showing total seconds for the duration (X axis) of your session. Be sure to "Save" any preference changes you make to keep them as your personal defaults.

## Other Graphing Menu Alternatives: Make Graph Snapshot

The Graphing menu offers you the opportunity to save "snapshots" of your graph suitable for copying into a word processing application document, as illustrated below:
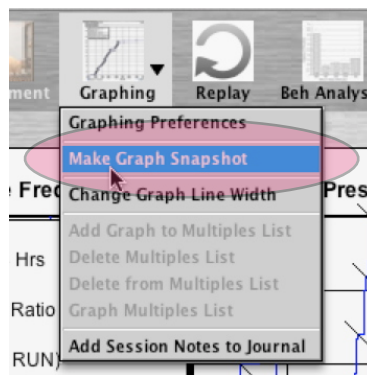
This makes it convenient if you are assigned to write experimental reports and wish to include Figures illustrating specific data from an experiment. You will immediately see a

"feedback" confirmation of the name and desktop-location of each screen snapshot you make, as illustrated here:
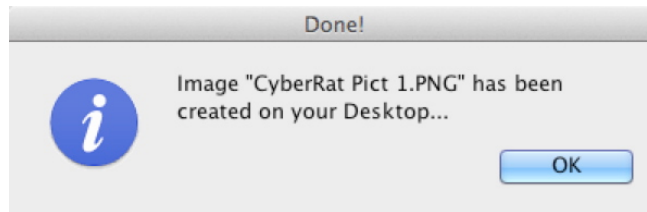
The image created removes all obvious "CyberRat application graphics and labels your graph with your name in the upper-right corner to confirm for your instructor that it was truly your animal being graphed, as is illustrated by comparing the graph below that was made from the same screen as was used to illustrate "pen resetting" topic above:
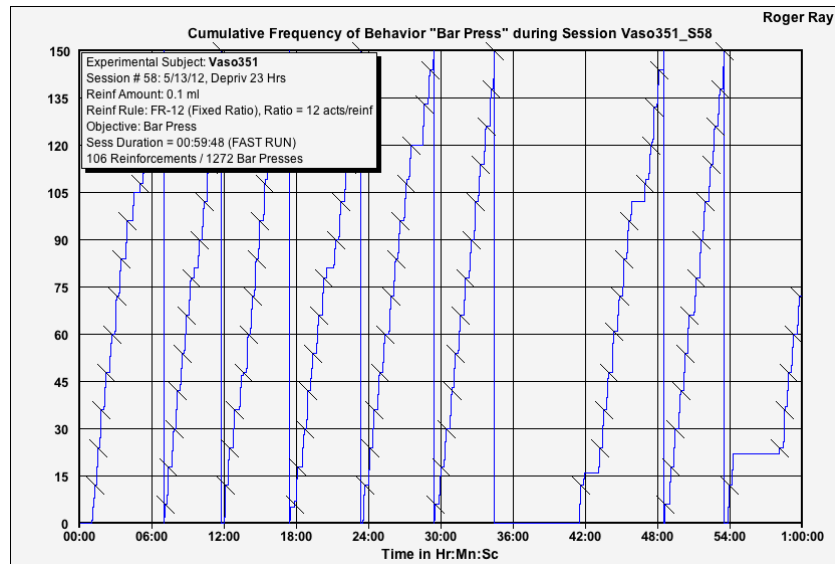
Other Graphing Menu Alternatives: Add Session Notes and Reports to Your Subject's Journal
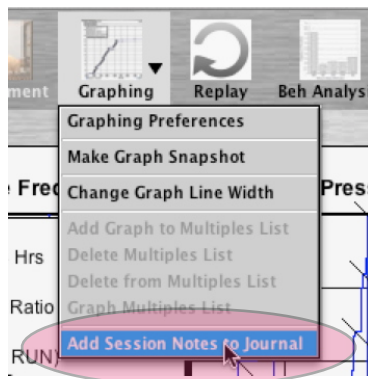
The last option on the Graphing menu allows you to add Notes, Comments, or Assignment Completion markings to your currently selected Session for saving to your subject's experimental Journal or reporting to your instructor. The drop-down panel that appears is clearly labeled as to which Subject and Journal entry is the target of your information, and also which area is to be used for typing or check-marking:

Your "Notes" will go directly into the specific Session's "information" panel, but "Problem Reports" and marking a session as "Completed" will be posted as "general reports" to your instructor for viewing in via the CyberRat Administrative application used for course management. That information will appear associated with your name in that course administrative system.

Other Graphing Menu Alternatives: Create a Set of Multiple Graphs

As noted in the section on Graphing Preferences, if you have your Preference for Format set for "Without Pen Resets" you will also have the multiple graphing "set" option(s)

available within your Graphing menu. The first of these options is for adding an current graph to a "Set" of multiple graphs that you intend to graph as a "composite" graph showing multiple sessions for the same animal or even for different animals if you wish. This option appears alone if you have no other graphs stored on your list:
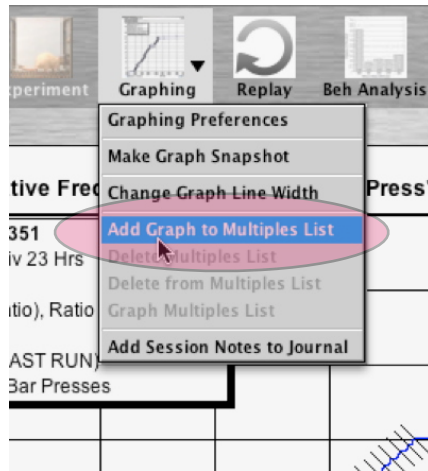
Selecting this option will save the currently graphed session in a "Multiple Session" list that begins to appear next to the Information Panel on your graph, as illustrated here:
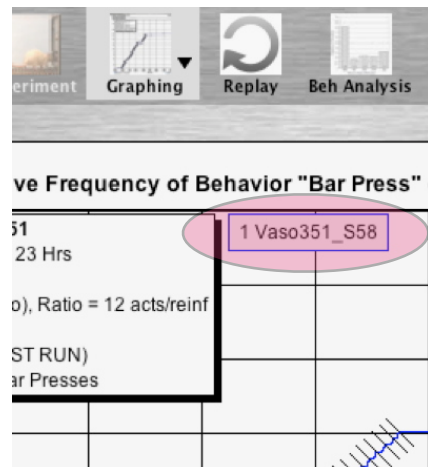
Selecting more sessions will add to the list, with each item successively "numbered" with a listing number (i.e., 1, 2, 3, etc.):
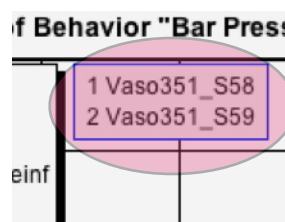
As you work on your Multiple Sessions listing, more menu items appear allowing you "list editing" capabilities. These include "Delete Multiples List," which clears the entire listing, and "Delete from Multiples List" with an associated sub-listing for selecting any session you wish to remove from your current list, as illustrated below:

As you are composing your list of the sessions you wish to plot on a single graph, you may select to graph the current list. An illustration of 3 graphs as a single set of graphs is provided below. Note the numbering that corresponds to the item-index number on the list and alternative colors for each session (the Information panel has momentarily been removed by using the corresponding Preferences setting, since only the last session's information is ever provided in that panel):

Zooming in on Graph Details:

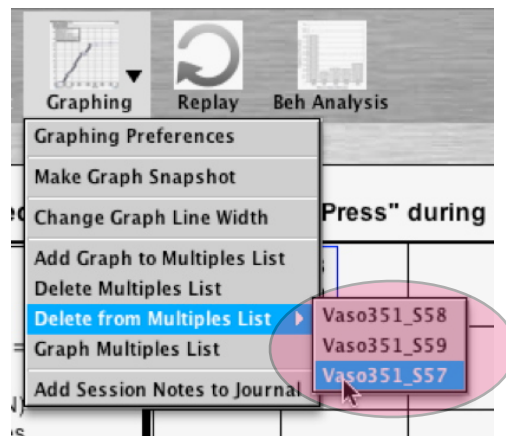There are two "hidden features" in the Graphing area that allows you too see extra details. The first of these is the "Zoom-in" feature that allows you to enlarge the details of a given segment of your graph. This is often quite useful for seeing details such as FI scallops or FR break-runs that are typically obscured by low-resolution plots of an entire session. To **Zoom**, merely click-and-drag your mouse (or "swipe) from the desired beginning to the desired ending (i.e., from left-to-right) of the segment you wish to view in high-resolution format. To return your graph to normal view, simply swipe across the graph from right-to-left using the same click-and-drag or swipe technique, as illustrated in the sequence below that is zoomed to reveal the "run/pause" patterns associated with S+ (light vertical bands) and S- (grey vertical bands):
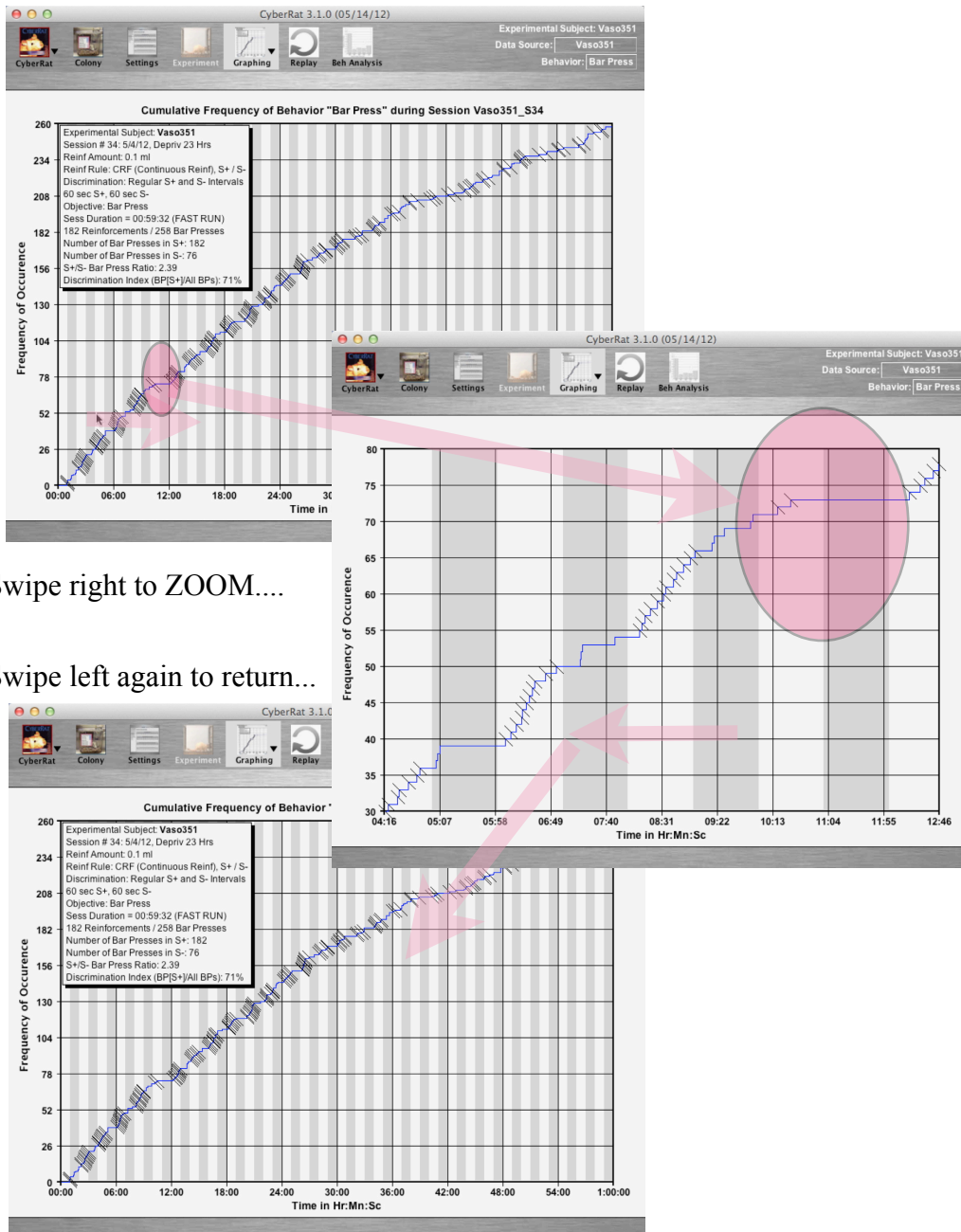
Swipe right to ZOOM....

Swipe left again to return...

Reviewing Video Corresponding to Graphics:

The second "hidden feature" in the Graphing area that allows you too see extra details is the video playback "inset" tool. This feature allows you to review your archived video record corresponding to any session while it is superimposed on your graphic. This is especially useful for translating actual on-going behaviors into their graphic abstraction depicted on the cumulative record and vice versa. To do this, merely click, while also

holding down the "Shift" key as you click, on the section of the graph above the X-axis (i.e., the corresponding Session Time) that you wish to begin viewing:
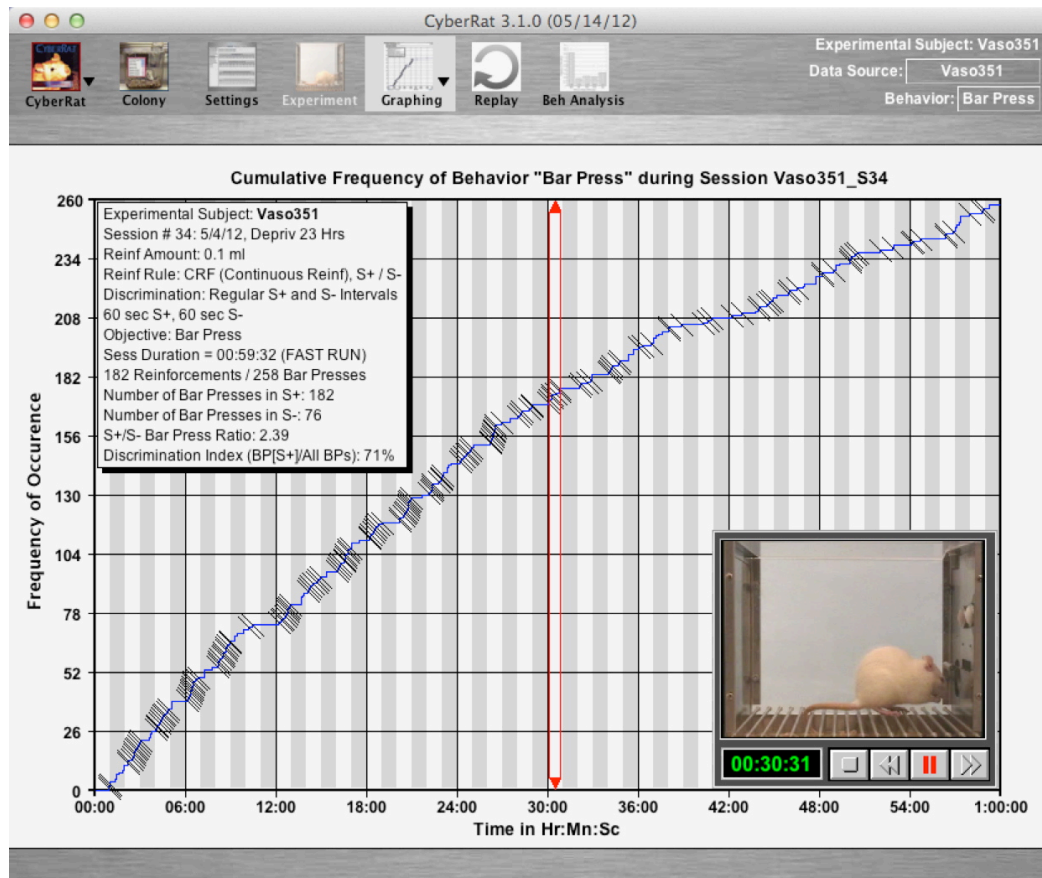
This video viewing window is also movable (hold your mouse down and drag) so you can easily adjust it to see any hidden graphic details. Moving it will pause the movie, so you need to start the play again when you have it positioned.

Chapter 7

Replaying a Session's Video Record

Any time you complete an experimental session or select an alternative archived session from the Experimental Journal for any animal, you may note the activation of a menu item labeled Replay:
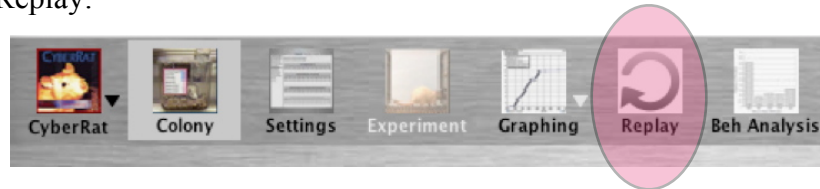
It doesn't matter whether you conducted your session via Fast Simulation or with Video On, completing any session properly (i.e., with an active internet connection linking CyberRat to its home (AI)², servers) will save a video play-back script making it possible to review the entire session as real-time video. Thus, for example, if you simply launch the CyberRat application, let it take you to the Colony, select an animal and any corresponding section, then selecting the Replay menu will allow you to play back that session exactly as if you were observing the actual experiment (including S+/S- lighting conditions and counter advances), as illustrated in the sequence below. You may also use the "play head scrubber" to advance to any time in the video you wish to observe.
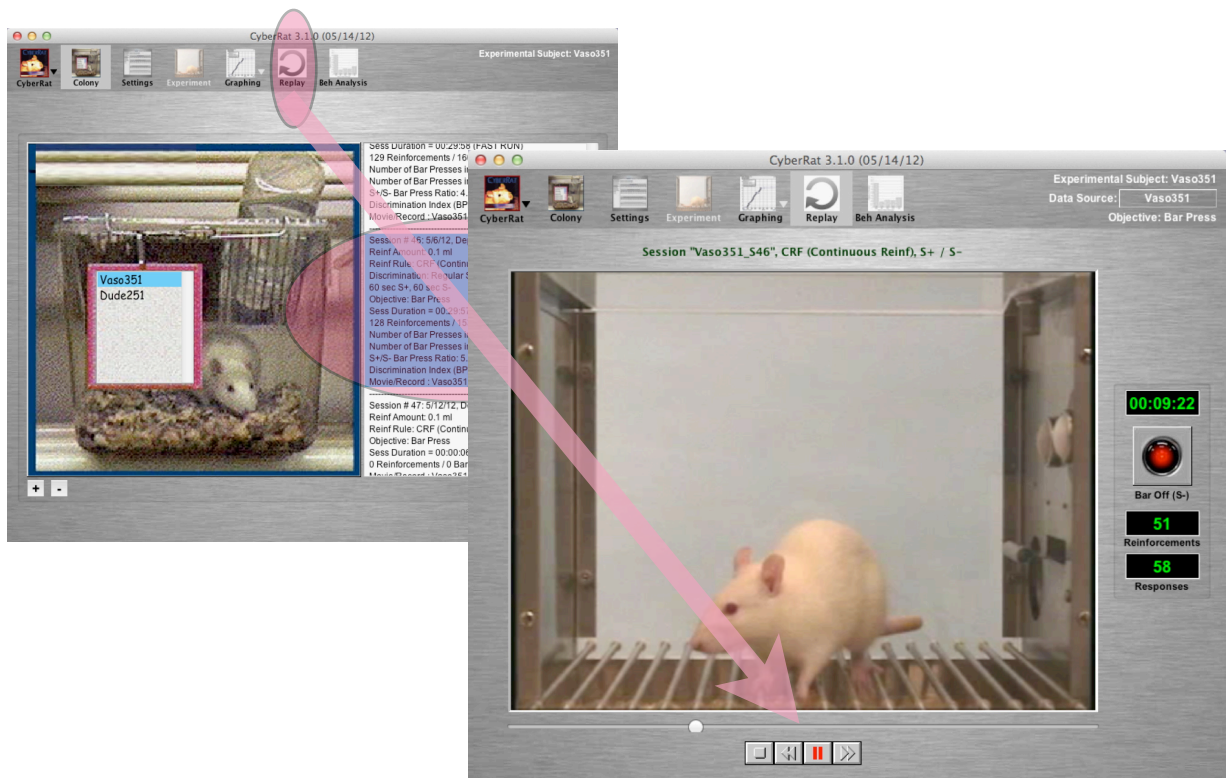
Chapter 8

Multiple Behavior Analysis

CyberRat includes not only the traditional Operant approach to analyzing an experimental session via Cumulative Graphing techniques, but it also gives users the option of viewing a multi-behavioral perspective on experimental sessions. Using a built-in "expert's" coding system based on a behavioral taxonomy very similar to that introduced in publications by Ray and Brown (1975, 1976), the **Beh Analysis** section of CyberRat allows users to see how targeting one class of behaviors for reinforcement also impacts virtually all other behavioral classes when a simple inclusive coding system is used for continuously coding all successive behaviors of an animal. Further, this section of CyberRat allows users to learn how an expert coded each successive behavior by showing a real-time continuous coding of any video as it plays back in the "Examples" tab of the Beh Analysis screen.

For those not yet familiar with the descriptive research methods underlying the use of multi-behavioral coding and the sequential analysis techniques afforded by continuous recording of such multiple behaviors, we highly recommend not only the Ray and Brown articles cited above, but also Bakeman and Gottman's (1997) primer on observational methodology. For a discussion of further research implications we also recommend Ray and Delprato's (1989) article on various strategies and tactics implicit in this approach. All of the articles mentioned here that were authored by Ray and colleagues are available as pdf files on the (AI)2 web site at:

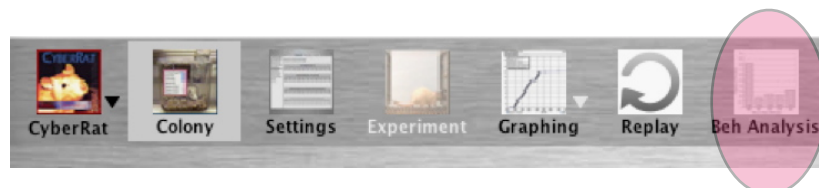**http://www.ai2inc.com/AIDownloads/AIDownloads/pub_downloads.html**

As with Graphing and Replay menus, any time you complete an experimental session or select an alternative archived session from the Experimental Journal for any animal, you may note the activation of the **Beh Analysis** menu at the end of the menu array.

Use the **Beh Analysis** menu to open this screen and to explore its six tabs and associated panels, the default (first) being **Beh Probabilites**, as illustrated here:
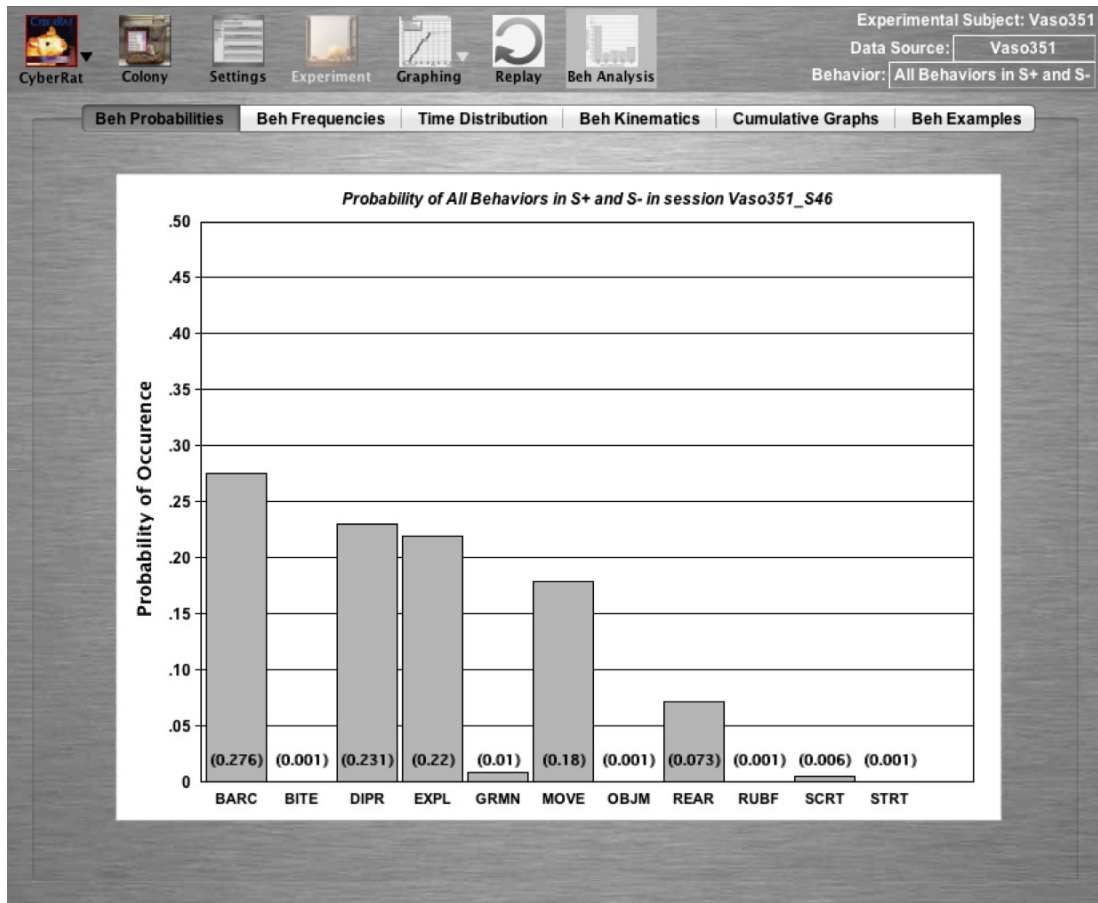
The above illustration shows a distribution of what Catania (2007) has called "the behavioral hierarchy" as observed throughout this entire session. But this example has been selected especially because it illustrate an additional feature in the Beh Analysis screen--the ability to compare "whole session" and specific S+ vs. S- "setting conditions" within that session. Thus the information panel in the upper right shows a setting labeled "All Behaviors in S+ and S-" --as illustrated in the zoomed image below:
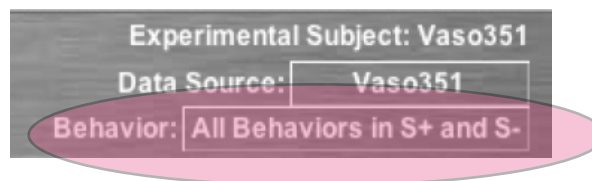
Changing this selection, first to **All Behaviors in S+** as illustrated here:
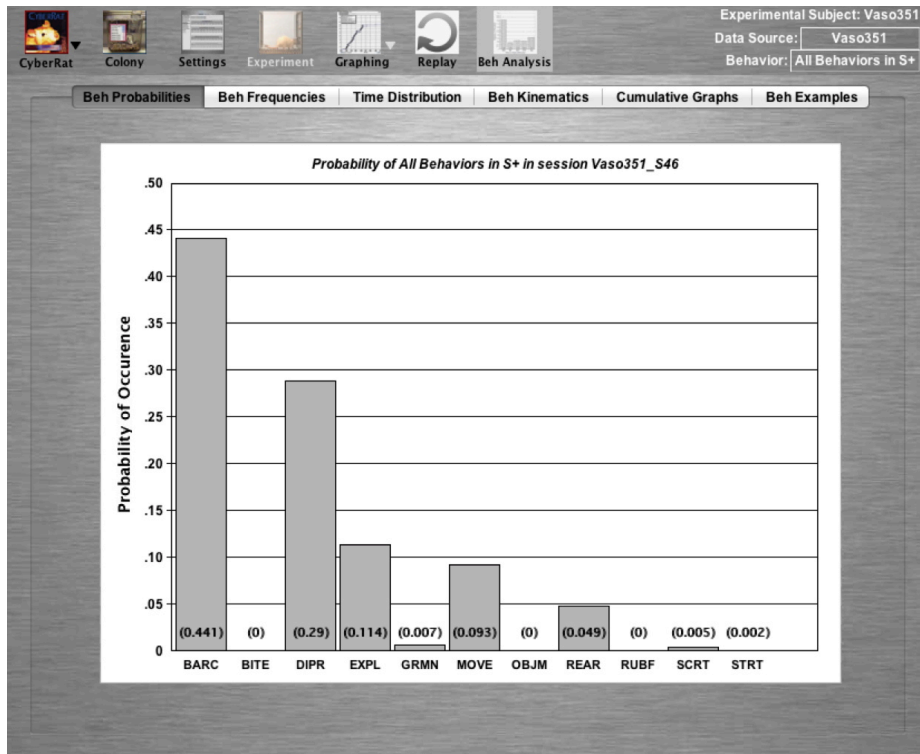
And then to All Behaviors in S- as illustrated next:
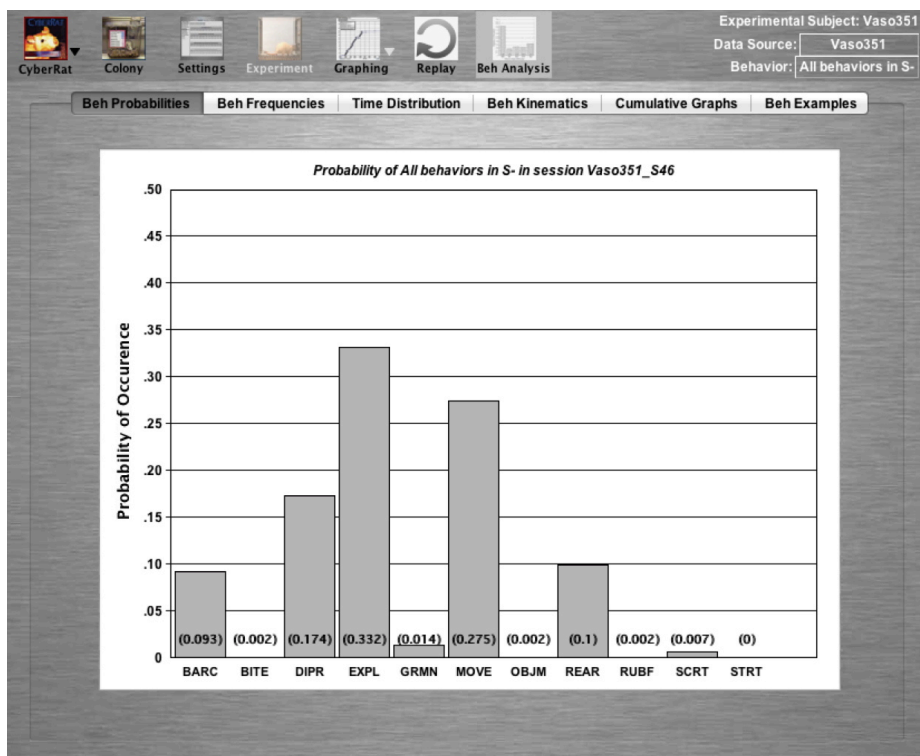
These three examples all represent the same session. But considered together, they illustrate quite dramatically how non-representative the distribution of probabilities is when the two lighting conditions are ignored by aggregating the session into one analysis. Behavioral probabilities are quite different for **S+**, where **Bar Contacts/Pressing** account for 44% of all behavioral occurrences and **Exploring** is only approximately 11% of occurrences. Compare this to the 9% for **Bar Contacts** and 33% for **Exploring** during S- and you begin to appreciate that **S-** is having as significant an influence on behavioral distributions just as **S+** is. The second tab allows the user to see the actual frequencies of each behavioral category, not simply the relative frequency (probability). The **Time Distribution** tab offers a detailed table illustrating how time is distributed /budgeted for each category of behavior in each condition:

Experimental Subject: Vaso351
Data Source: Vaso351
Behavior: All Behaviors in S+

Beh Frequencies	Time Distribution	Beh Kinematics	Cumulative Graphs	Beh Examples

Data for session Vaso351_S46 (All Behaviors in S+)

Behavior	Mean Duration, sec	Total Duration, sec	% of Total Time
BARC	0.447	117.2	0.067
BITE	0	0	0
DIPR	2.698	466.8	0.267
EXPL	1.173	79.733	0.046
GRMN	3.783	15.133	0.009
MOVE	0.962	52.933	0.03
OBJM	0	0	0
REAR	1.738	50.4	0.029
RUBF	0	0	0
SCRT	1.244	3.733	0.002
STRT	2.467	2.467	0.001

Total Time (MM:SS): 13:08

Experimental Subject: Vaso351
Data Source: Vaso351
Behavior: All behaviors in S-

Cumulative Graphs	Beh Examples

Data for session Vaso351_S46 (All behaviors in S-)

| Behavior	Mean Duration, sec	Total Duration, sec	% of Total Time
BARC	0.644	34.8	0.02
BITE	0.267	0.267	0
DIPR	1.142	115.333	0.066
EXPL	1.591	307	0.176
GRMN	2.425	19.4	0.011
MOVE	1.072	171.467	0.098
OBJM	1.533	1.533	0.001
REAR	3.217	189.8	0.109
RUBF	1.933	1.933	0.001
SCRT	1.533	6.133	0.004
STRT	0	0	0

Total Time (MM:SS): 14:07

Behavioral kinematics describe how the animal changes from doing one thing (the Preceding Behavior) and begins doing something else (the Succeeding Behavior). This "matrix" shows the "sequential/conditional probability" for each type of behavior-to-behavior change throughout the session or within each stimulus condition.

**Beh Kinematics in** Probabilities **for Session Vaso351_S46 (All behaviors in S-)**

* Matrix cells show Conditional Probabilities, column "Total" lists Unconditional Probabilities

Succeeding Behavior

Pre/Suc	BARC	BITE	DIPR	EXPL	GRMN	MOVE	OBJM	REAR	RUBF	SCRT	STRT	TOTAL
BARC	0.43		0.2	0.19		0.07		0.11				0.09
BITE								1				0
DIPR	0.22			0.58	0.07	0.08		0.04		0.01		0.17
EXPL	0.03	0.01	0.16			0.65	0.01	0.13	0.01	0.01		0.33
GRMN			0.75	0.13		0.13						0.01
MOVE	0.01		0.27	0.58	0.01			0.14		0.01		0.28
OBJM				1								0
REAR	0.02		0.17	0.45		0.36						0.1
RUBF				1								0
SCRT				0.75				0.25				0.01
STRT												0

(rows labeled along left margin: **Preceding Behavior**)

Total Probability: **0.99**

There is also a tab for generating a cumulative graph that allows the user to select from each behavioral category to look for changes in rate across time throughout the session. The category "Grooming" is illustrated both in the menu:
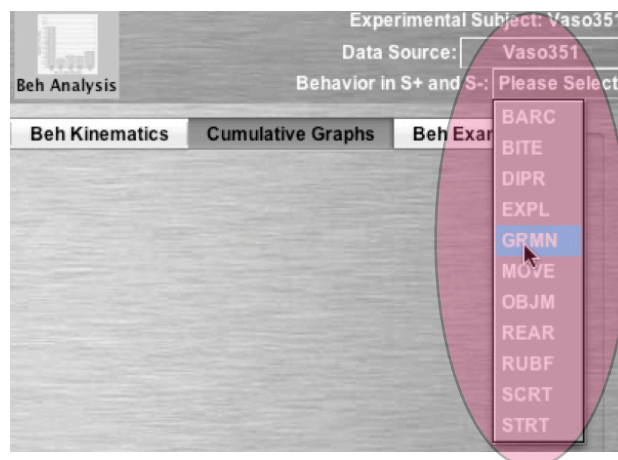

...and in the resulting cumulative graph that illustrates how grooming occurs within each
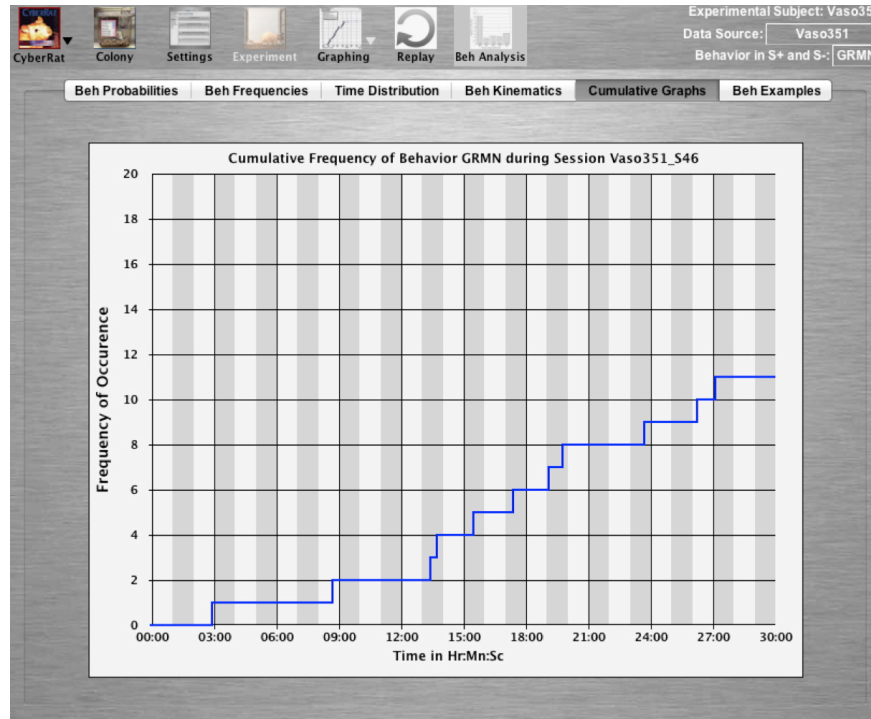
and every lighting condition across the entire session: Grooming occurs most frequently after approximately 13 minutes have elapsed, and almost exclusively within **S-** lighting conditions thereafter.
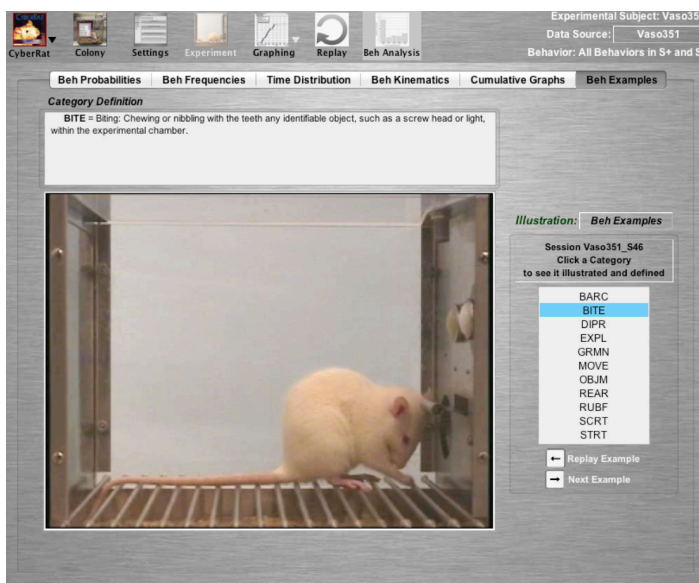
And finally, there is a tab for viewing **Examples** of each category (viewed by clicking on the taxonomy listing next to the video) one-by-one, along with an "operational definition" of the selected category, as illustrated at left. Better yet, you can use the **Illustration** menu to select the **Session Coding.**
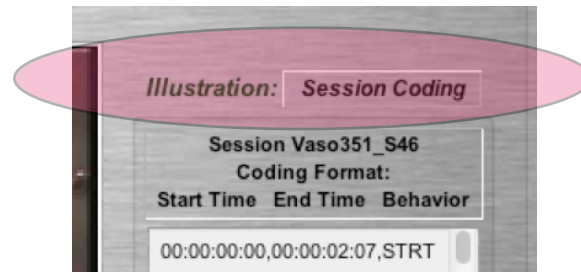
This view illustrates how an Expert researcher would have used this taxonomy to collect a "continuous coding record" that accounts for every behavior on an inclusive (i.e., the categories describe *everything* the animal is doing without gaps in description) and mutually exclusive (i.e., no two categories can occur at the same time) basis throughout the session:
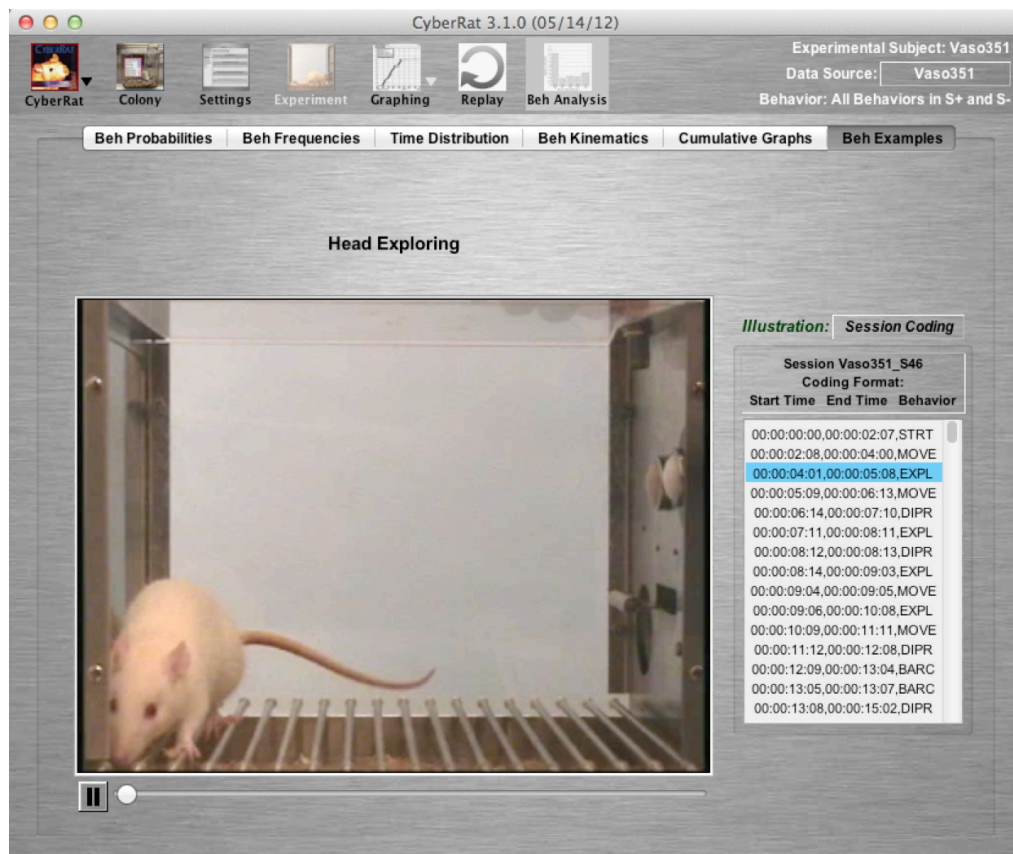
Chapter 9

Quit/Exit CyberRat

It is extremely important to exit from CyberRat correctly so your personal data get updated on the CyberRat server. To quit or exit from within the CyberRat laboratory, go to the main CyberRat button at the upper left of each screen and select Quit/Exit:
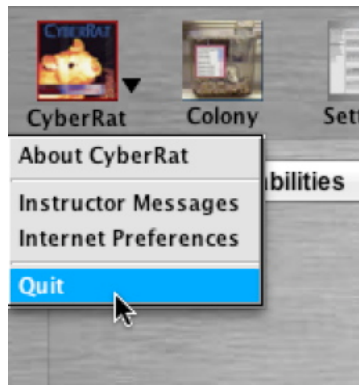
References

Bakeman, R., & Gottman, J. M. (1997*). Observing interaction: An introduction to sequential analysis* (2nd edition). Cambridge University Press.

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Ray, R. D. & Delprato, D. J. (1989). Behavioral systems analysis: Methodological strategies and tactics. *Behavioral Science, 34*, 81-27.