

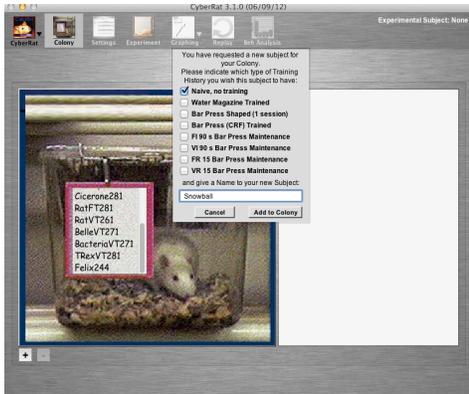
Table 1. Catania's (2007, p. 27) Table 2-1 illustrating his "Basic Behavioral Operations."

Operation	Description	Examples	Usage
1. <b>Observation</b>	No Intervention.	We watch an animal behaving.	-----
2. <b>Stimulus-presentation operation</b>	Stimulus A is presented.	<i>Loud noise (A) startles child. Physician shines light (A) in patient's eye.</i>	Stimulus <i>elicits</i> response; response is <i>elicited</i> by stimulus.
3. <b>Consequential operation</b>	Response B has consequence C (e.g., a stimulus is produced or terminated).	<i>Putting coin in vending machine (B) produces soft drink (C). Touching hot stove (B) produces burn (C). Light goes out (C) when switch is thrown (B).</i>	Response is <i>emitted</i> .
4. <b>Signaling or stimulus-control operation: Superimposed on stimulus presentation</b>	Stimulus D signals presentation of stimulus E.	<i>Lighting (D) precedes thunder (E).</i>	Stimulus <i>elicits</i> response; response is <i>elicited</i> by stimulus.
5. <b>Signaling or stimulus-control operation: Superimposed on consequences</b>	Stimulus F signals response G will have consequence H.	<i>Red traffic light (F) signals that driving through intersection (G) may lead to traffic ticket (H). Ringing telephone (F) signals that answering (G) may provide opportunity for conversation (H).</i>	Stimulus <i>occasions</i> response; response is <i>emitted</i> in presence of stimulus.
6. <b>Establishing operation</b>	Effectiveness of consequence I as a reinforcer or punisher is established.	<i>Food (I) becomes an effective reinforcer after food deprivation. The presentation of shock makes shock removal (I) a reinforcer. When it is important to unlock a door, the key to the door (I) becomes a reinforcer.</i>	An event is <i>established</i> as a reinforcer or punisher. Behavior is <i>evoked</i> by the establishing operation.

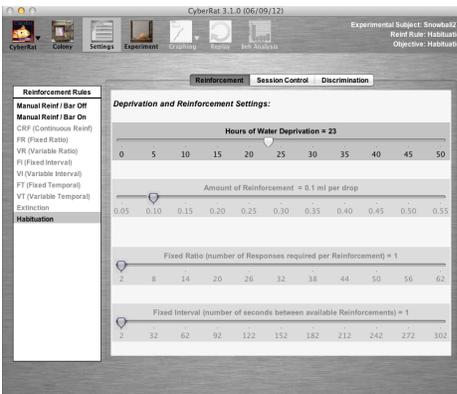
## CyberRat Lab #1 - Observation

First, select a new **naïve rat** in the CyberRat colony room.

Then go to the **Settings** screen and select **Habituation** as the “schedule.” Set the Simulation options to “**Fast-run/No-Video**” and type in **60** for the minutes of the Session Duration. Click the “**Experiment**” button at the top to run your session.



*Colony Room*



*Settings - Reinforcement*

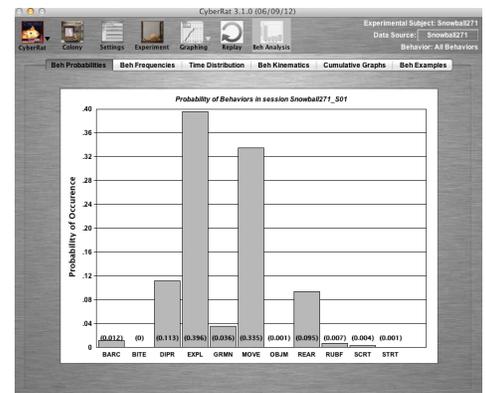


*Settings - Session Control*

After the session is complete, select the **Beh Analysis** graphing icon. From the Behavior Analysis screen, select the “**Behavior Probabilities**” tab. You should now see a bar graph displaying the unconditional probabilities of all behaviors. Take a screen shot of this graph for your executive summary.

Next, click on the **Cumulative Graphs** tab. Under the Behavior menu, select a behavior to graph. In total you will need to **graph** three behaviors: **Grooming, Rearing, and Exploring**. Take a screen shot of each graph for your executive summary.

Replicate this project by selecting a new **naïve rat** and running the project again. Compare data from this rat to that of your previous rat.



*Unconditional Probabilities*



*Cumulative plots*

## **Analysis:**

I. **Define/Describe** - the behavioral operation (see Table 2-1) and the type of session (Habituation) for this lab.

II. **Methodology/Procedure** - Describe the parameters and sequence of this lab.

III. **Discussion** - Interpret the unconditional probabilities (bar graph). Also compare the cumulative plots for all three behaviors (grooming, rearing, or exploring)

What do these figures illustrate? For example, is grooming a high or low rate behavior (and to what benchmark are you comparing it)? Does it have the same rate of occurrence in each successive 10 minute interval across the hour, or does it tend to occur in specific periods? Which ones? Did you anticipate this from your readings about the principle of “Behavioral Hierarchies?”

## **IV. References**

Catania, A. C. (2013). *Learning* (5th ed.). Cornwall-on-Hudson, NY: Sloan Publishing.

Ray, R. D., & Miraglia, K. M. (2011). A sample of CyberRat assignments and their pedagogical functions as experimental activities in a learning course. *Journal of Behavioral and Neuroscience Research*, 9(2), 44-61.

## CyberRat Lab #2 - Stimulus Presentation

Using CyberRat, select the first subject you previously used for the Habituation/observation experimental session.

From the settings screen, select a **VT 90 sec schedule** (Variable Temporal).

Select **Fast Simulation**.

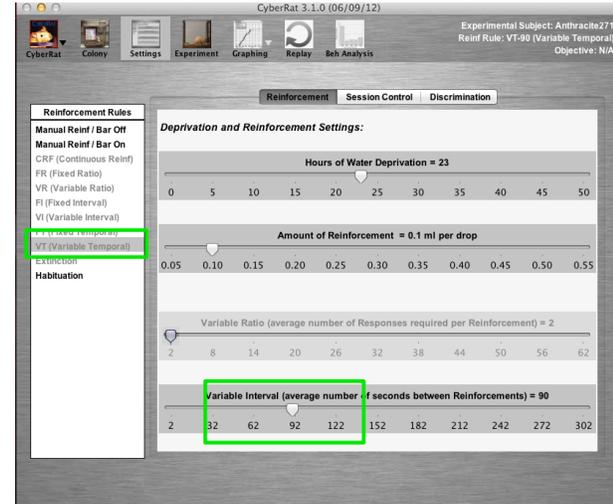
Set your session to **terminate after 11 reinforcements** (using the number of reinforcements criteria rather than duration of session).

Click the “Experiment” button at the top of the screen to **run the session**.

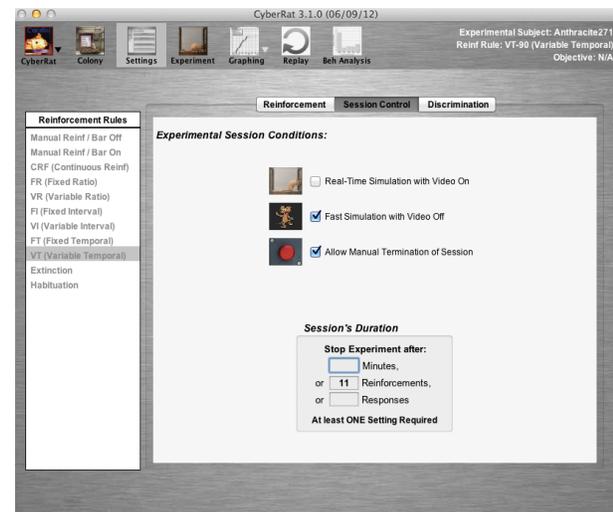
For your data collection in this exercise use the **video replay**.

**Determine the latencies** by calculating the time between each delivery of water and the subsequent drinking of that water. Drinking is operationally defined as the “eye of the animal disappearing from view as the nose enters the water reservoir.” Measure the first 10 presentation-to-drink latencies. If the animal fails to drink prior to the delivery of the next drop, use that delivery time as the “maximum” latency value for that trial.

**NOTE for ANALYSIS and DISCUSSION:** Long latencies indicate a relatively NEUTRAL stimulus vis a vis Elicitation of the “go-to-drink” behavior of the animal. Enter these latency values in an excel spreadsheet and graph (see example figure on the next page).



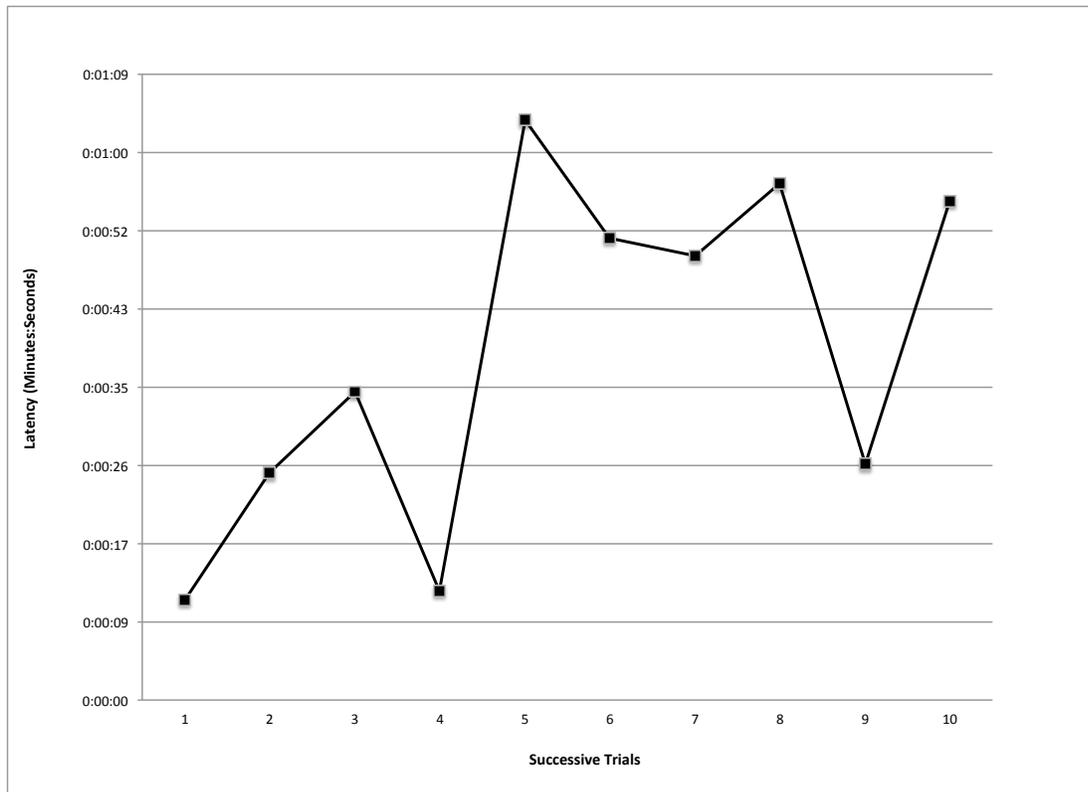
*Settings - Reinforcement*



*Settings - Session Control*



*Replay*



*Illustrative experimental data showing latencies (the time between the stimulus presentation & response) of “drink” behavior following delivery of sound+water across 10 successive presentations via use of VT 90 sec schedule in CyberRat*

## **Analysis - Executive Summary**

**I. Behavioral Procedures** - Identify the behavioral procedure/operation demonstrated in this exercise (include citations).

**II. Methodology/Procedure** - Describe the parameters and sequence of this lab.

**III. Discussion** - Interpret your results (latencies) in terms of the relative strength of the stimulus (include citations). Using Excel, create a line graph that displays these latencies (see example above).

## **IV. References**

Catania, A. C. (2013). *Learning* (5th ed.). Cornwall-on-Hudson, NY: Sloan Publishing.

Ray, R. D., & Miraglia, K. M. (2011). A sample of CyberRat assignments and their pedagogical functions as experimental activities in a learning course. *Journal of Behavioral and Neuroscience Research*, 9(2), 44-61.

## CyberRat Lab #3 - Signaling Stimulus Presentation

*Signaling Stimulus Presentation Operations using CyberRat: Exploring applications of classical conditioning for magazine training and conditioned elicitions*

### Assignment:

**STAGE 1 Procedure:** Using your previous experimental animal, under **Settings->Reinforcement** select manual reinforcement/Bar reinforcement off (**Manual Reinf/Bar Off**). When prompted, select “**Magazine Training Only**” as your objective. Under **Session Control** select **Real-Time Simulation with Video On**. Be sure to keep “**Allow Manual Termination of Session**” checked. Set the **Session’s Duration** to **60 minutes**.

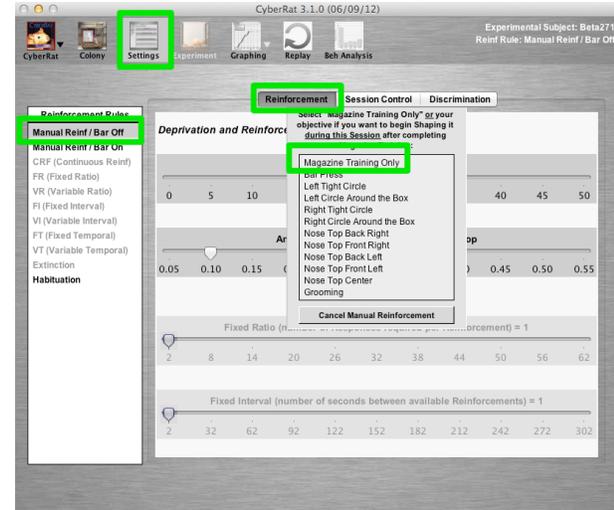
Run Experiment; and during the session, each time the animal is in FRONT of the Water Reservoir, approximately a head’s length away and looking in that direction, click the manual reinforcement button to deliver water. Do this **30** different times. After these 30 stimulus pairings (sound of delivery plus water), terminate your session using the **Manual Termination** button. We will next conduct a test for a change in your previously measured latency by repeating our previous Stimulus Presentation experiment. There are no graphs associated with Stage I in this assignment!

**STAGE 2 Procedure:** Using the same subject, once again set parameters to a VT 90 second schedule by clicking on the **Settings->Reinforcement** menu button and selecting **VT (Variable Temporal)** from the **Reinforcement Rules**. Adjust the **Variable Interval** slider to **90** under the **Deprivation and Reinforcement Settings**.

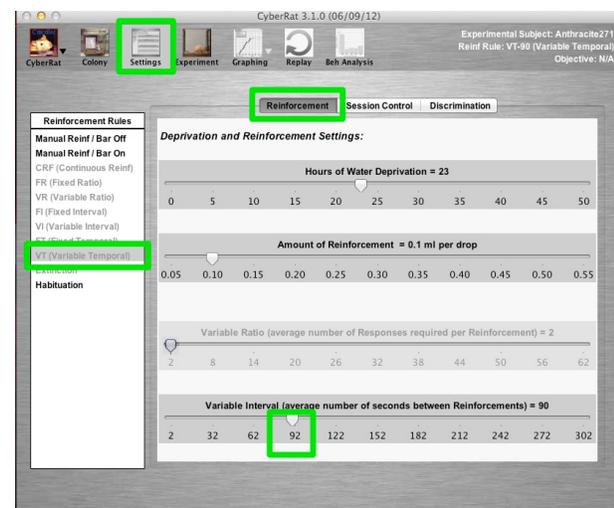
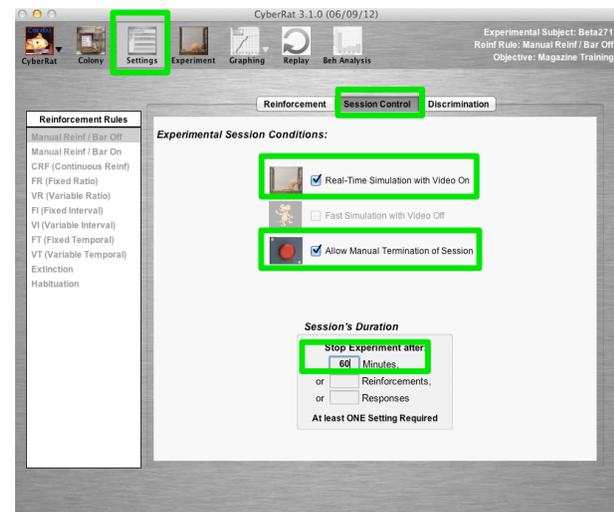
Under **Session Control**, select **Fast Simulation with Video Off**.

Set your **Session’s Duration** to **terminate after 11 reinforcements** (using the number of reinforcements criteria rather than duration of session).

Click the “**Experiment**” menu button at the top of the



*STAGE 1: Settings - Reinforcement- Bar Reinf OFF Select Magazine Training Only*

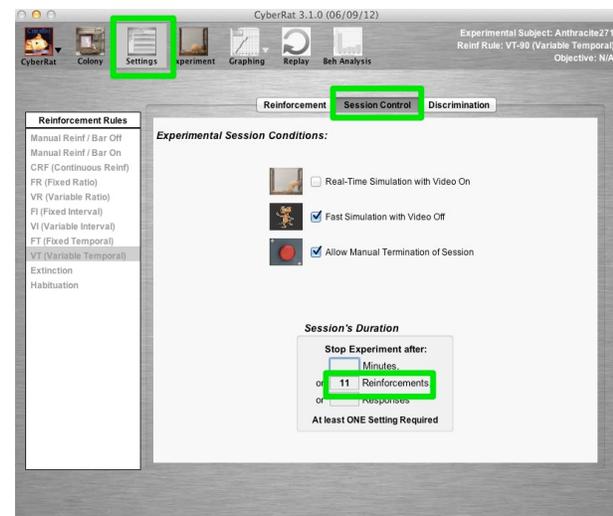


*STAGE 2: Settings - Reinforcement*

screen to run the session.

After the session is complete and the program transitions to the graphing screen, click ok to dismiss the pop-up message.

For your data collection in this exercise use the **Replay** screen. Utilize the controls at the bottom of the screen to play/pause the video playback. For best results avoid using the playhead scrubber.



**Determine the latencies** by calculating the time between each delivery of water and the subsequent drinking of that water.

Drinking is operationally defined as the “eye of the animal disappearing from view as the nose enters the water reservoir.” Measure the first 10 presentation-to-drink latencies. If the animal fails to drink prior to the delivery of the next drop, use that delivery time as the “maximum” latency value for that trial. Plot your new values along with your original stimulus presentation values in your excel spreadsheet and re-graph.

STAGE 2: Settings- Session Control

**Reminder:** Relatively long latencies can indicate a relatively NEUTRAL stimulus vis-a-vis Elicitation of the “go-to-drink” behavior of the animal. What has happened to your previously long latencies after your administration of 30 trials of Classical Conditioning?

### Analysis - Executive Summary

I. **Behavioral Procedures:** Introduce the behavioral operation (signaling stimulus presentation; see Catania, 2013, Table 2-1) and define Magazine Training.

II. **Method/ Procedure:** Describe the settings and sequence for both phases.

III. **Discussion:** Interpret your results. Include a line graph that depicts both your first subject’s baseline phase (previous data) and experimental phase latencies (this assignment).

Consider the following:

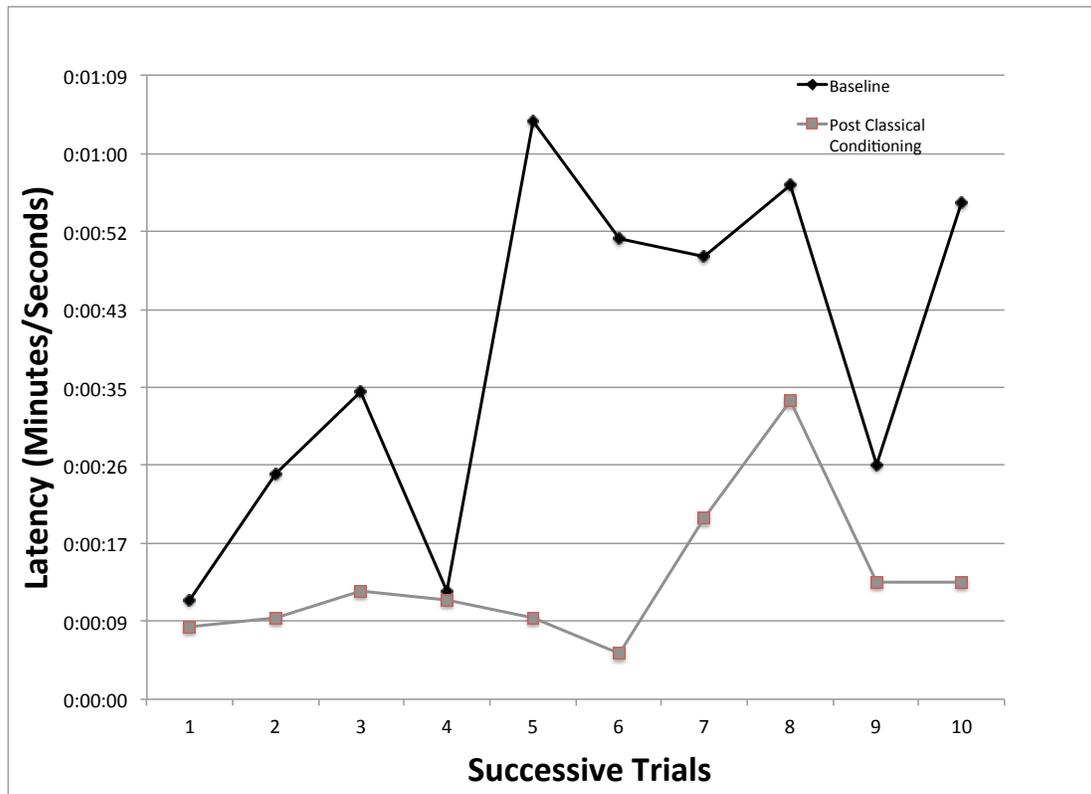
How do your data confirm (or not) the effects of classical conditioning (see example figure on the following page)? Finally, consider why even these shorter latencies in CyberRat are typically longer than those observed with your live animals (hint: video clip lengths). Note that this is one of CyberRat’s more significant shortcomings as a simulator.

### IV. References:

Catania, A. C. (2013). *Learning* (5th ed.). Cornwall-on-Hudson, NY: Sloan Publishing.

Ray, R. D., & Miraglia, K. M. (2011). A sample of CyberRat assignments and their pedagogical functions as experimental activities in a learning course. *Journal of Behavioral and Neuroscience Research*, 9(2), 44-61.

Ray, R. D., Belden, N. R., & Eckerman, D. A. (2005). *Learning and conditioning tutorials*. Winter Park, FL: (AI)2, Inc.



*Example Figure: Illustrative experimental data showing latencies of “drink” behavior following delivery of sound+water across 10 successive presentations via use of a VT 90 sec schedule in CyberRat before (Baseline) and after 30 trials of “magazine training” (Post Classical Conditioning).*

## CyberRat Lab #4 - Shaping

*Details of Consequential Operations and the impact of Establishing Operations on these Consequential Operations using CyberRat: Shaping a new operant response, the rate of that response under a Continuous Reinforcement (CRF) schedule, and the impact of alternative durations of pre-experimental deprivation on within-session satiation to water as a reinforcer*

### Lab Assignment:

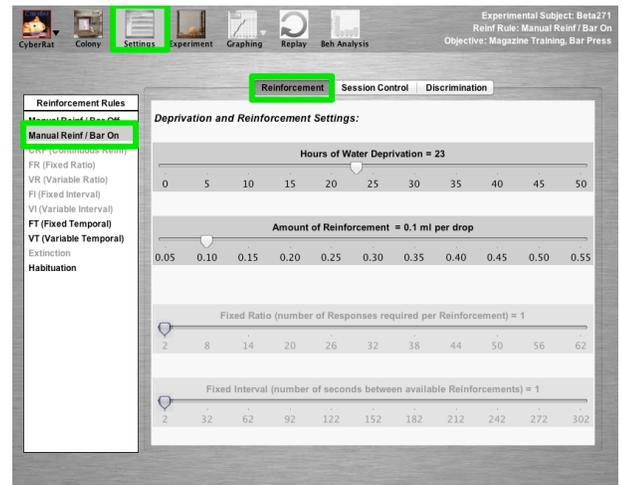
**STAGE 1.** Read the Learning & Conditioning Tutorials Appendix Topics, which is downloadable as a pdf at the bottom of the following webpage: [http://www.ai2inc.com/AIDownloads/AIDownloads/chpt\\_downloads.html](http://www.ai2inc.com/AIDownloads/AIDownloads/chpt_downloads.html)

**STAGE 2 - Shaping Procedure:** From the colony, select the same first animal that you have already run through Habituation, Elicitation Testing, and Magazine Training. Under **Settings->Reinforcement->Reinforcement Rules** Select “**Manual Reinforcement with Bar Reinforcement on**” (**Manual Reinf/Bar On**). Under the **Session Control** tab select “**Real-Time Simulation with Video On**” and confirm that “**Allow Manual Termination of Session**” is also checked. Set the **Session’s Duration** to **30 Minutes**.

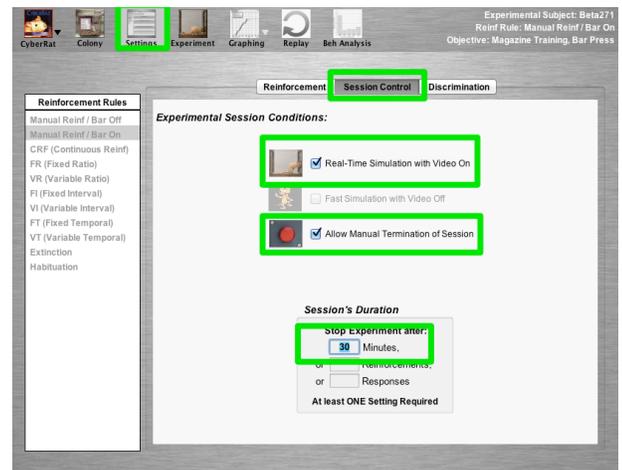
Click the “**Experiment**” menu button at the top of the screen to run your session. Conduct as many successive 30 minute sessions in CyberRat as might be required to successfully shape your animal to BAR PRESS consistently for more than 10 bar presses (click the “**Experiment**” menu button at the top of the screen to run another session with the same settings).

Note: At the conclusion of each session the program will transition to the graphing screen. If there are no target behaviors (default bar presses) to graph a message will appear on the screen. Click OK to dismiss the pop-up message.

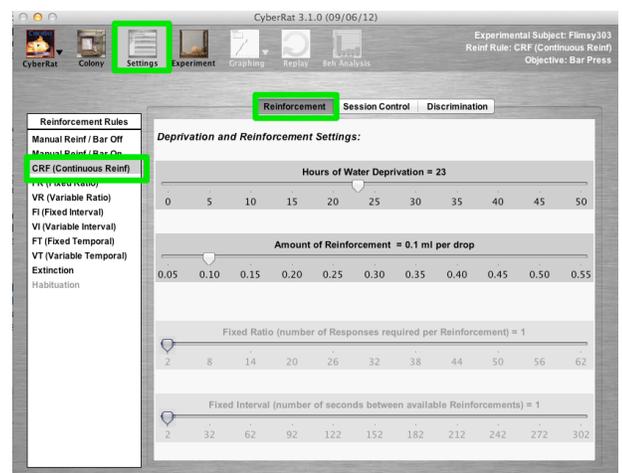
Upon successful completion, conduct 3 additional 60



STAGE 2: Settings - Reinforcement  
Manual Reinf/BarOn



STAGE 2: Settings - Session Control  
Real Time- 30 Min. Sessions



STAGE 2: Settings - Reinforcement CRF

min FAST SIMULATION (No Video) “Maintenance” sessions using the CRF Schedule. Under **Settings>Reinforcement** select **CRF** under the **Reinforcement Rules**. Under the **Session Control** tab select “**Fast Simulation with Video Off.**” Set the duration of the session to **60 minutes**. Click the “**Experiment**” menu button at the top of the screen to run your session. Run an additional two sessions (total of 3).

**STAGE 3 - Adjusting Deprivation Procedure:** What do you think is the role of alternative settings for deprivation regarding how fast the animal reaches satiation in CRF sessions? How would you investigate this in CyberRat (hint: an example graph of some experimental probes appear below using 23 hours vs. 12 hours, vs. 1 hour Deprivation settings).

Run 3 additional 60 min FAST SIMULATION (No Video) sessions: One at 23 hours of water deprivation, one at 12 hours, and one at 1 hour.

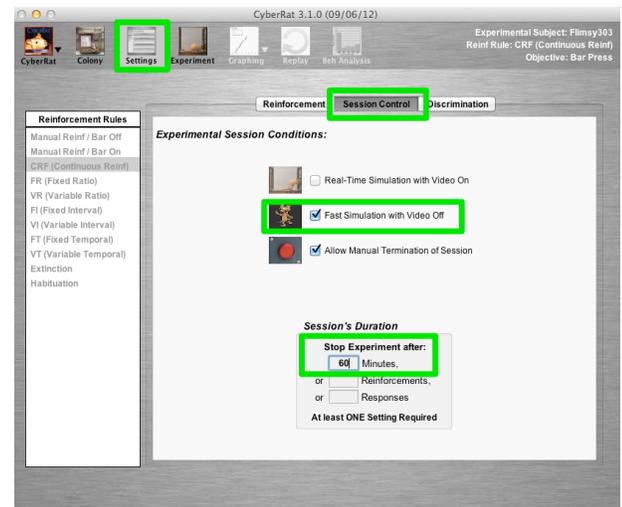
Session 1 (23 hours): Under **Settings>Reinforcement** move the **Hours of Deprivation** slider to **23**. Under **Reinforcement Rules**, select **CRF**. Under the **Session Control** tab select “**Fast Simulation with Video Off.**” Set the duration of the session to **60 minutes**. Click the “**Experiment**” menu button at the top of the screen to run your session.

Session 2 (12 hours): Under **Settings>Reinforcement** move the **Hours of Deprivation** slider to 12. Under **Reinforcement Rules**, select **CRF**. Under the **Session Control** tab select “**Fast Simulation with Video Off.**” Set the duration of the session to **60 minutes**. Click the “**Experiment**” menu button at the top of the screen to run your session.

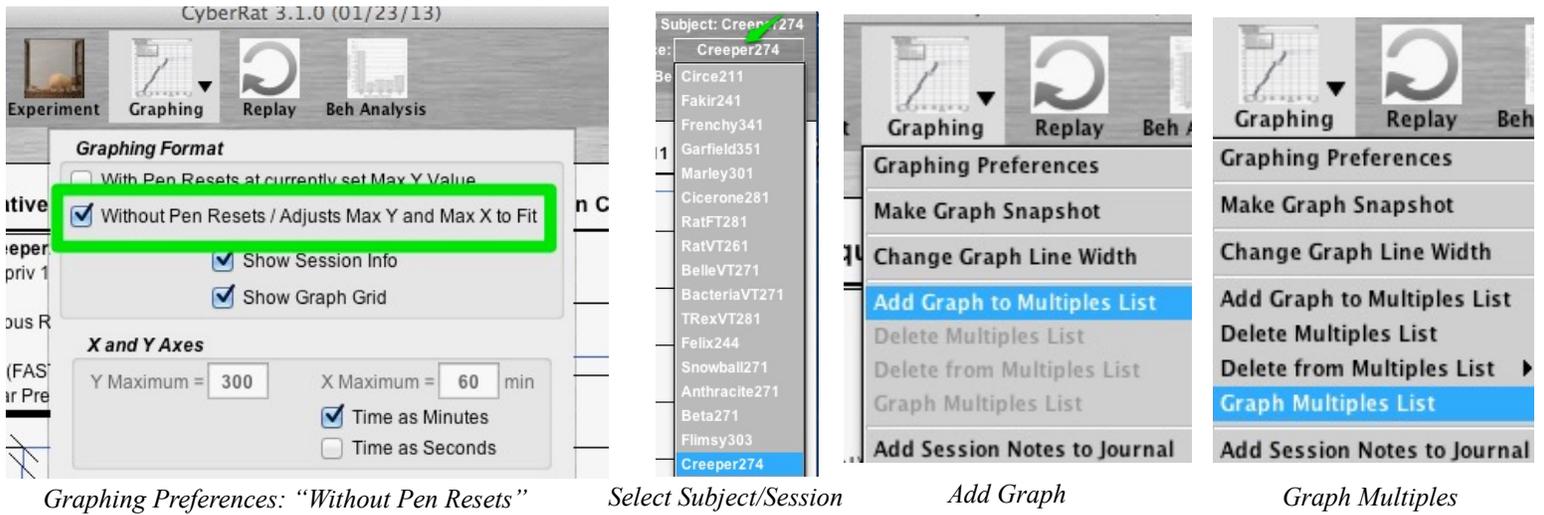
Session 3 (1 hour): Under **Settings>Reinforcement** move the **Hours of Deprivation** slider to 1. Under **Reinforcement Rules**, select **CRF**. Under the **Session Control** tab select “**Fast Simulation with Video Off.**” Set the duration of the session to **60 minutes**. Click the “**Experiment**” menu button at the top of the screen to run your session.

**Graphing - Creating a “Composite” Graph.** See Ch 6 pp. 43 - 45 of the *CyberRat User’s Guide* for additional details ([http://www.ai2inc.com/Downloads/CyberRat\\_User's\\_Guide\\_V3.pdf](http://www.ai2inc.com/Downloads/CyberRat_User's_Guide_V3.pdf)).

First, confirm that under the **Graphing** menu button-> **Graphing Preferences** “**Without Pen Resets**” is selected.



*STAGE 2: Settings - Session Control  
Fast-Sim 60 Min.*



Next, click on your subject which is located on the right hand side of the screen to reveal your subject's **journal**. Click on the 23 hour deprivation session to graph those data.

Under the Graphing menu button, select **"Add Graph to Multiples List"**

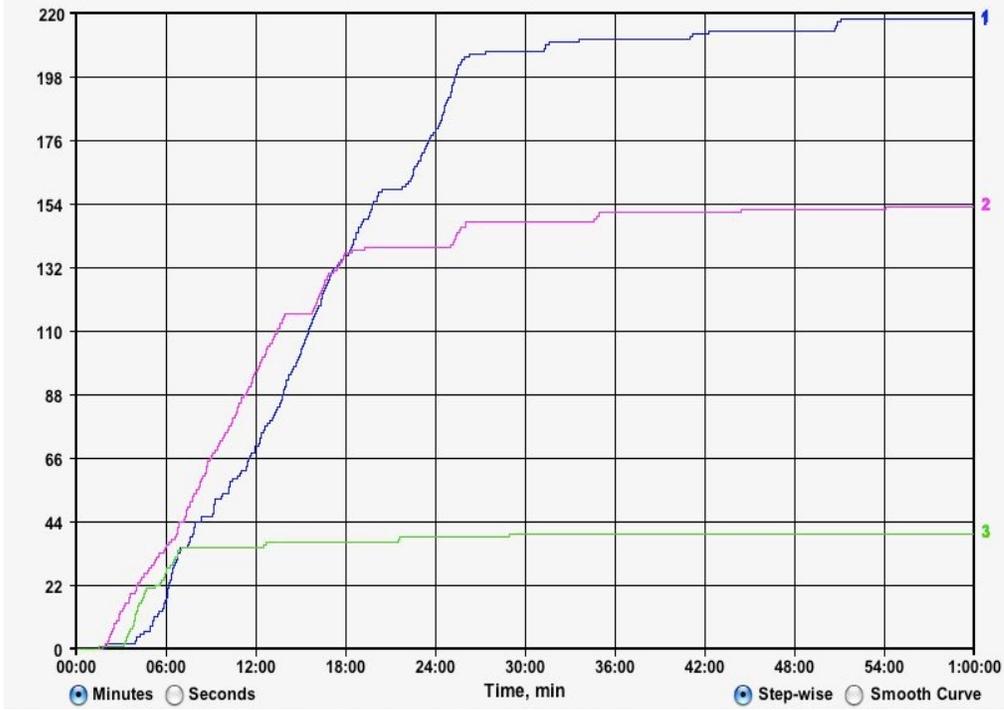
Next, select your subject again and graph the 12 hour deprivation session. Add this session to **"Multiples List"** by selecting **"Add Graph to Multiples List"** from the Graphing menu button.

Next, graph and add the 1 hour deprivation session to **"Multiples List."**

Note: If you make a mistake (i.e., select the wrong session to graph) you may delete the last session added to the list by clicking on the **Graphing** menu button and selecting **"Delete from Multiples List"**. If you would like to delete the entire list (start over) select **Graphing->Delete Multiples List**.

Lastly, under Graphing select **"Graph Multiples List."**

Take a screenshot of the figure for use in your executive summary by clicking on the **"Graphing"** menu button and selecting **"Make Graph Snapshot"** [image saved to desktop]. Click OK to dismiss the pop-up message.



*Example Figure: Sample Bar Press and within-session water satiation results typical of alternative Pre- Experimental Deprivation Settings of 23 hours (labeled as 1 on the right hand Y-axis), 12 hours (labeled as 2 on the right hand Y-axis), and 1 hour (labeled as 3 on the right hand Y-axis). NOTE: This graph was created using the "Graph Set" feature explained on pp. 43-45 in the CyberRat User's Guide (available at: [http://www.ai2inc.com/Downloads/CyberRat\\_User's\\_Guide\\_V3.pdf](http://www.ai2inc.com/Downloads/CyberRat_User's_Guide_V3.pdf))*

## **Analysis: Executive Summary**

- I. **Define:** Introduce the shaping process and define the behavioral operations used in this laboratory sequence (Consequential Operations & Establishing Operations; Catania, 2013, Table 2-1).
- II. **Method & Procedure:** Summarize the settings and sequence of this lab. Briefly explain how the first set of three fast simulation sessions were used to confirm stable bar press rates.
- III. **Discussion:** Interpret your results (refer to your graph). Be prepared to describe:
  - a) Bar-press warm-ups as habituation to being introduced into the chamber, and
  - b) Satiation as another potential form of habituation to water (cf., McSweeney & Murphy, 2000; McSweeney, 2004). What do you think is the role of alternative settings for deprivation regarding how fast the animal reaches satiation in CRF sessions?

## **IV. References:**

- Catania, A. C. (2013). *Learning* (5th ed.). Cornwall-on-Hudson, NY: Sloan Publishing.
- Ray, R. D., & Miraglia, K. M. (2011). A sample of CyberRat assignments and their pedagogical functions as experimental activities in a learning course. *Journal of Behavioral and Neuroscience Research*, 9(2), 44-61.
- Ray, R. D., Belden, N. R., & Eckerman, D. A. (2005). *Learning and conditioning tutorials*. Winter Park, FL: (AI)2, Inc.

## CyberRat Lab #5 - Extinction

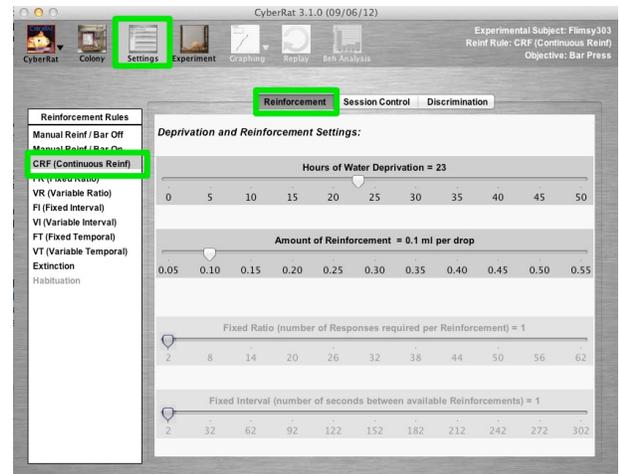
*Ending pre-established Consequential Operations: The process of response extinction and spontaneous recovery across sessions*

### Assignment:

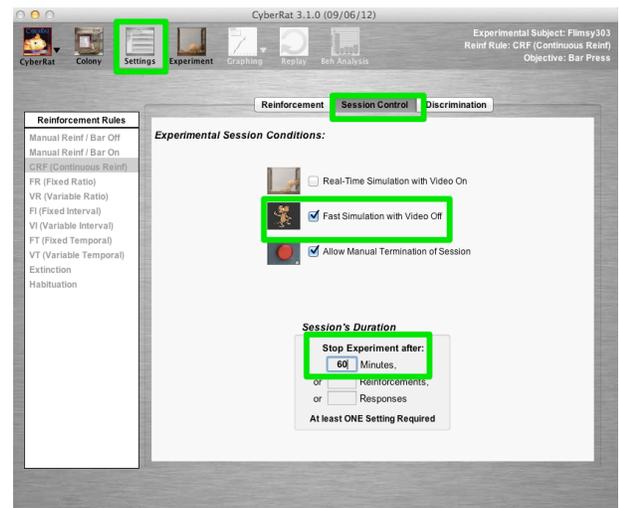
**STAGE 1 Procedure:** Select your well trained animal from the **Colony** room and then go to the settings screen by clicking on the “**Settings**” menu button and select **CRF** under **Reinforcement Rules**. Under session control, select “**Fast Simulation with Video Off.**” Set the **Session’s Duration** to **60 minutes**. Click the “**Experiment**” menu button at the top of the screen to run your session. Run two additional sessions using the above settings for a total of 3 fast simulation sessions.

**STAGE 2 Procedure:** After completing the three sessions assigned in Stage 1, and while this same animal is selected, return to the settings screen by clicking on the “**Settings**” menu button and change the **Reinforcement Rules** selection to **Extinction**. Under the **Session Control** tab select “**Fast Simulation with Video Off.**” Set the **Session’s Duration** to **60 minutes**. Click the “**Experiment**” menu button at the top of the screen to run your session. Run a total of 3 extinction sessions.

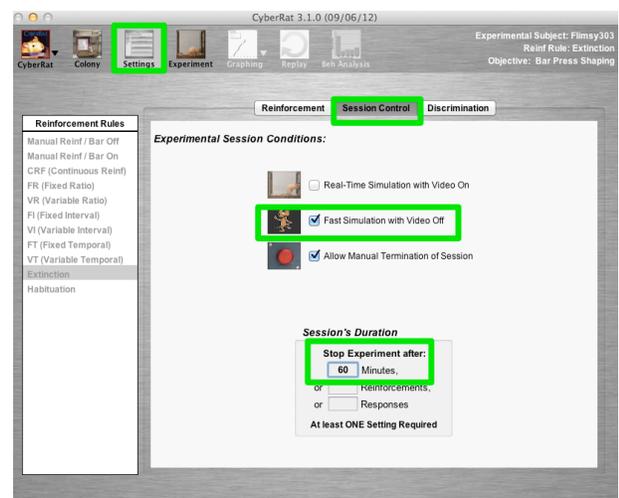
Graph the three Extinction sessions in the sequence they were conducted. Adding multiple sessions to a graph are explained in Ch 6 pp. 43-45 of the *CyberRat User’s Guide* (available at: [http://www.ai2inc.com/Downloads/CyberRat\\_User's\\_Guide\\_V3.pdf](http://www.ai2inc.com/Downloads/CyberRat_User's_Guide_V3.pdf)). Review CR #4 for additional graphing instructions.



STAGE 1: Settings - Reinforcement CRF



STAGE 1: Settings - Session Control  
Fast Sim- 60 Min. Sessions



STAGE 2: Settings - Reinforcement Ext  
Session Control Fast Sim - 60 Min. Sessions

## Analysis: Executive Summary

I. **Concepts:** Introduce Consequential Operations (see Catania, 2013, Table 2-1). Define/describe the process of response extinction. Define/describe spontaneous recovery.

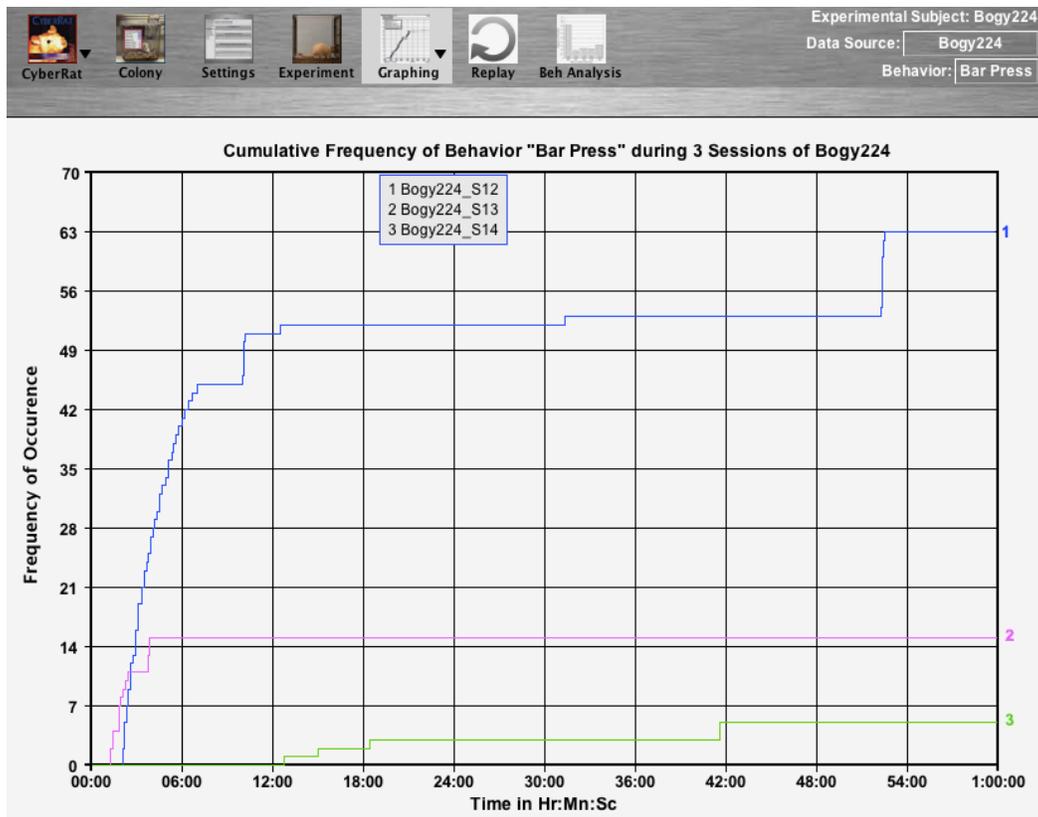
II. **Method & Procedure:** Summarize the settings and sequence of this lab. Briefly explain the role of the three fast simulation CRF sessions.

III. **Discussion:** Interpret your results. Describe the effects of extinction on bar pressing rates and the signs on spontaneous recovery.

## IV. References:

Catania, A. C. (2013). *Learning* (5th ed.). Cornwall-on-Hudson, NY: Sloan Publishing.

Ray, R. D., & Miraglia, K. M. (2011). A sample of CyberRat assignments and their pedagogical functions as experimental activities in a learning course. *Journal of Behavioral and Neuroscience Research*, 9(2), 44-61.



Example Figure: Sample Results illustrating the extinction of previously conditioned bar pressing across 3 successive sessions labeled 1-3 on the right hand Y-axis. NOTE: This graph was created using the "Graph Set" feature explained on pp. 43-45 in the CyberRat User's Guide (available at: [http://www.ai2inc.com/Downloads/CyberRat\\_User's\\_Guide\\_V3.pdf](http://www.ai2inc.com/Downloads/CyberRat_User's_Guide_V3.pdf))

## CyberRat Lab #6 - Discrimination

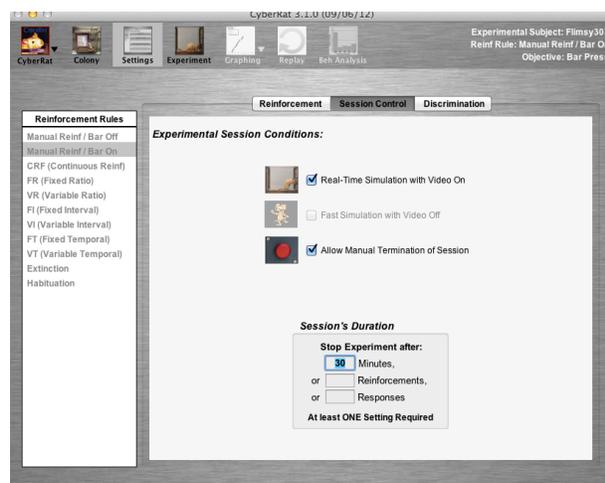
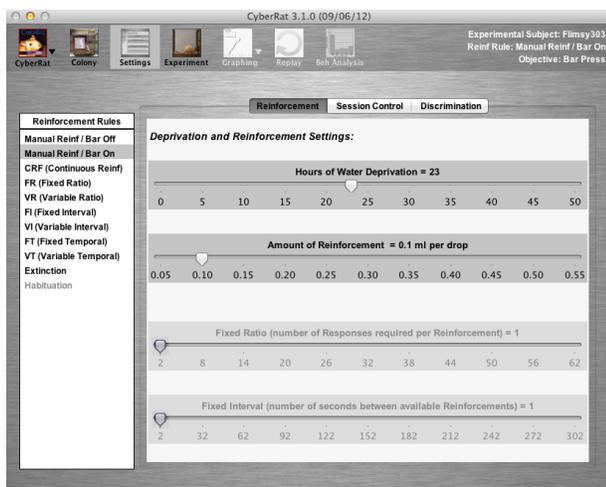
*Assignment on Signaling Consequential Operations: Tracking the development of reliable stimulus discrimination using the discrimination ratio measure.*

LAB ASSIGNMENT: *Tracking the Stimulus Discrimination Development Curve*

**Overview:** Following retraining of bar pressing, choose *Fast Simulation* mode, select a VR 3 reinforcement schedule, and then set *CyberRat's* stimulus control (discrimination) schedules to 60 sec S+ and 60 sec S-. Next, run as many sessions as required to get a stable discrimination index for 5 successive sessions. Stability will be defined as +/- 5 percentage points around a maximum determined ratio minus .05 discrimination index value (example:  $.92 - .05 = .87$  in Example Figure 10). Record your discrimination index in an excel spreadsheet and graph the process' development curve. Include results and discussion of these phenomena in your executive summary on Stimulus Control of Behavior. Complete your assignment by including these data and a discussion of how they address the general concept of stimulus perception.

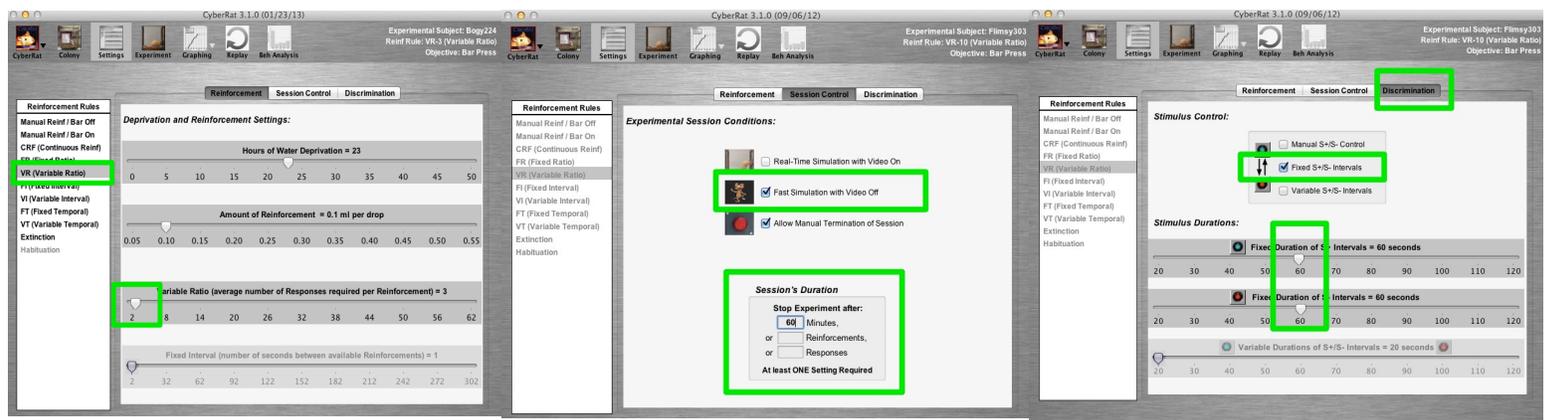
**STAGE 1.** Retrain your previously conditioned and extinguished *CyberRat* animal to bar press using the “**Manual Reinforcement with Bar Reinf On**” setting for Reinforcement Rules. Retrain using “**Real-Time Simulation with Video On**”. **Run as many 30 minute sessions as needed.**

**Run a 60 minute CRF fast simulation (video off) maintenance session to confirm bar pressing (see Example Figure 7).**



*STAGE 1: Settings - Reinforcement  
Manual Reinforcement/Bar On*

*STAGE 1: Settings - Session Control  
Real-Time Video 30 Min. Sessions*



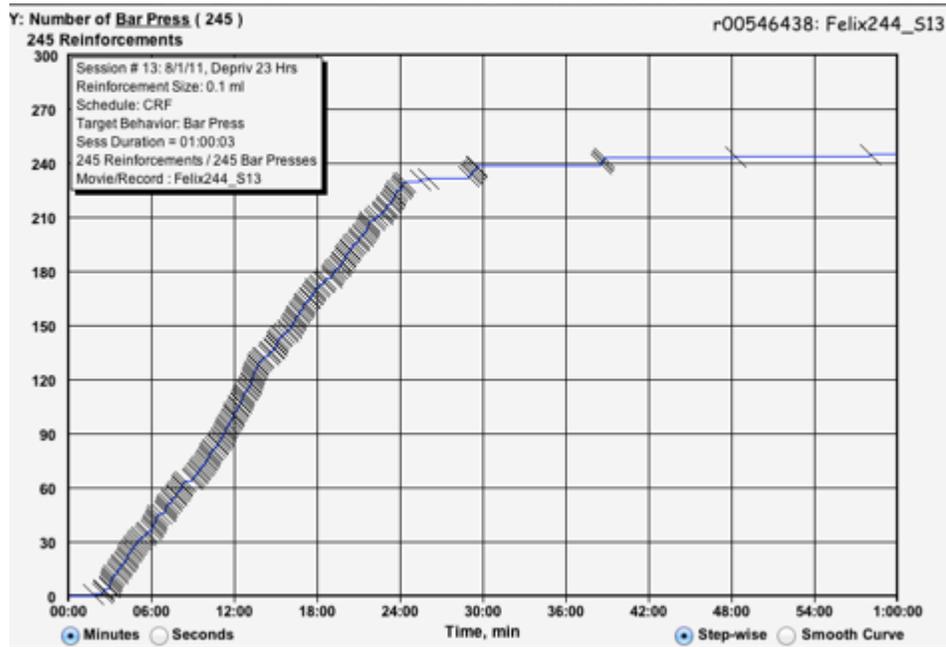
STAGE 2: Settings - Reinforcement **VR 3** STAGE 2: Settings - Session Control **Fast Sim 60 Min.** STAGE 2: Fixed S+/S- Intervals

**STAGE 2 Objective:** Run a series of discrimination sessions using a VR 3 reinforcement schedule and Fast simulation mode until you get a stable discrimination index for 5 successive sessions. Stability will be defined as +/- 5 percentage points around a maximum determined ratio minus .05 discrimination index value (example:  $.92 - .05 = .87$  in the Example Figure).

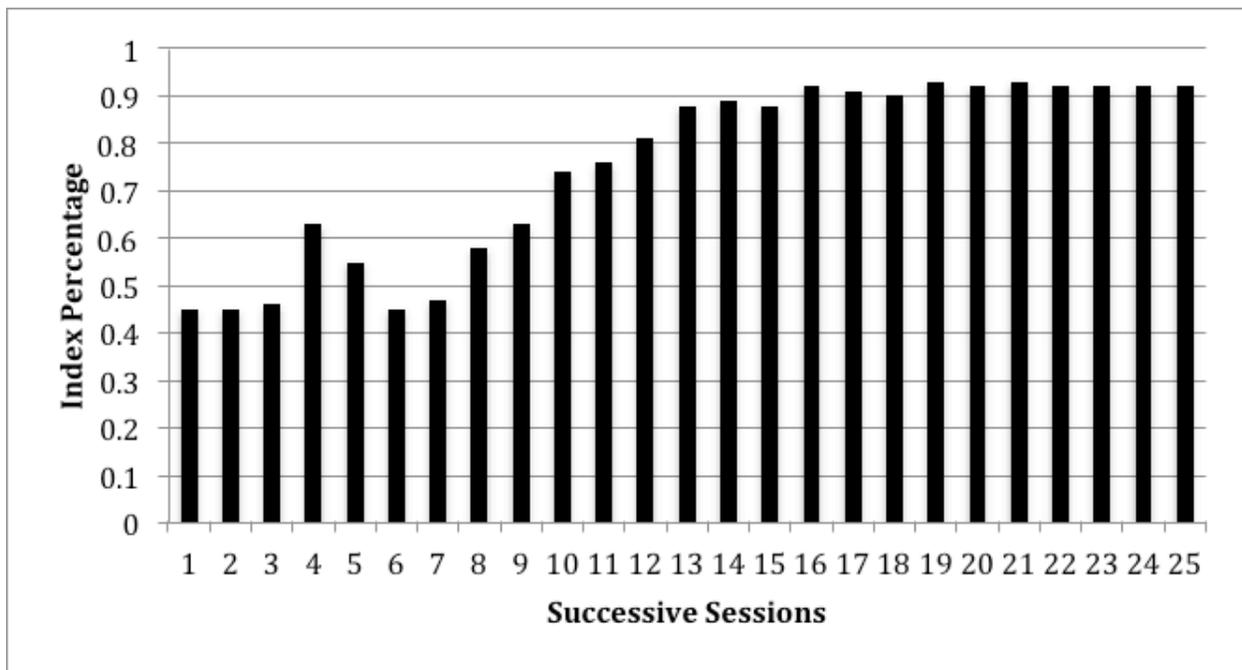
**Procedure:** Click on the **Settings** menu button. Under the **Reinforcement** tab select **VR (Variable Ratio)** from the **Reinforcement Rules** list. Next, move the **Variable Ratio** slider to **3** under **Deprivation and Reinforcement settings**. Click on the **Sessions Control** tab and select “**Fast Simulation with Video Off.**” Set the **Session’s Duration** to **60** minutes. Click on the **Discrimination** tab. Under **Stimulus Control**, select **Fixed S+/S- Intervals**. Under **Stimulus Durations** set the **Fixed Duration of S+ Intervals** to **60** seconds. Set the **Fixed Duration of S- Intervals** to **60** seconds as well. Now, click the **Experiment** menu button to run the experiment. Repeat as needed until you reach a stable discrimination index across 5 consecutive sessions.

470 Experimental Subject: **Bogy224**  
 423 Session # 26: 2/20/13, Depriv 23 Hrs  
 Reinf Amount: 0.1 ml  
 Reinf Rule: VR-3 (Variable Ratio), S+ / S-, Mean Ratio = 3 acts/reinf  
 376 Discrimination: Regular S+ and S- Intervals  
 60 sec S+, 60 sec S-  
 Objective: Bar Press  
 Sess Duration = 00:59:16 (FAST RUN)  
 329 84 Reinforcements / 462 Bar Presses  
 Number of Bar Presses in S+: 254  
 Number of Bar Presses in S-: 208  
 282 S+/S- Bar Press Ratio: 1.22  
 Discrimination Index (BP[S+]/All BPs): 55%

*Session's Discrimination Index*



Example Figure 7: Sample results illustrating confirmation of Post-Extinction Bar Press Retraining.



Example Figure 10: Discrimination Index plotted across a series of 25 successive sessions under an alternative 60 sec S+/S- schedule setting for stimulus discrimination.

## **Analysis: Executive Summary**

### **I. Define:**

Define signaling consequential operations (see Catania, 2013, Table 2-1) and the concept of stimulus control (discrimination). Describe a VR 3 reinforcement schedule.

### **II. Method & Procedure:**

Summarize the settings/procedure. Describe the stimulus control (discrimination) schedule.

### **III. Discussion:**

Discuss retraining your previously extinguished subject. Interpret your discrimination index as graphed. Discuss these phenomena in relation to the stimulus control of behavior. How do they address the general concept of stimulus perception. Create one fast simulation CRF graph (confirming Post-Extinction Bar Pressing) and one Discrimination Index graph.

### **IV. References**

Catania, A. C. (2013). *Learning* (5th ed.). Cornwall-on-Hudson, NY: Sloan Publishing.

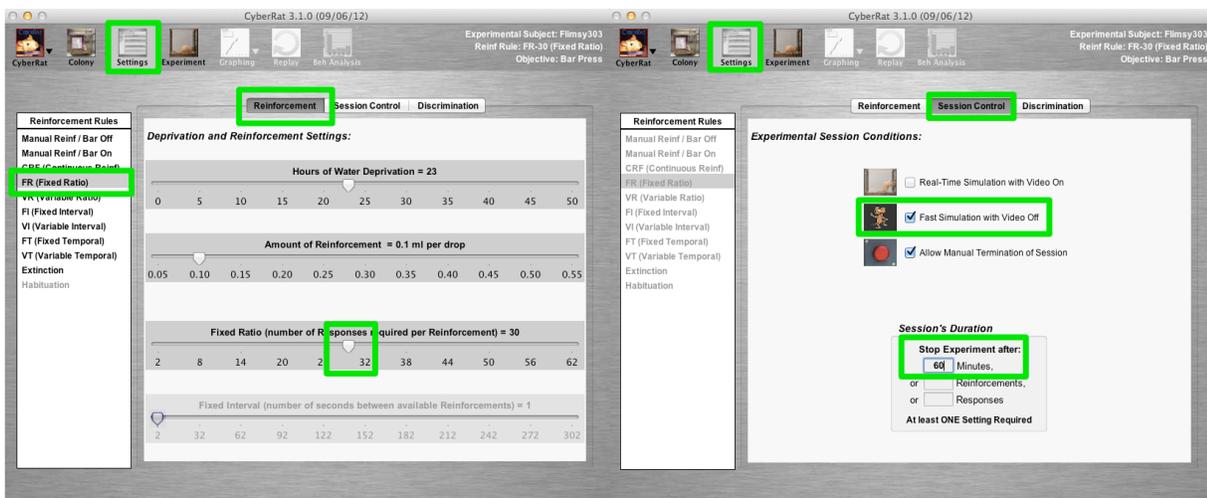
Ray, R. D., & Miraglia, K. M. (2011). A sample of CyberRat assignments and their pedagogical functions as experimental activities in a learning course. *Journal of Behavioral and Neuroscience Research*, 9(2), 44-61.

## CyberRat Lab #7 - FR Schedules & Ratio Strain

*Intermittent Scheduling of Consequential Operations: How response rates change across time under alternative schedules of consequences*

### Assignment:

**STAGE 1 Procedure:** Run 3 successive 60 min VR 3 “maintenance” sessions using Fast-Simulation Mode to generate a stable rate of responding. To do this, select **Variable Ratio (VR)** under **Settings->Reinforcement->Reinforcement Rules**. Use the slider to adjust the **Variable Ratio** to 3. Under **Session Control**, select “**Fast Simulation with Video Off.**” Set the **Session’s Duration** to **60 minutes**. Click the “**Experiment**” menu button to run the session. Run this session two more times for a total of three session.



STAGE 2: Settings - Reinforcement **FR30**

STAGE 2: Session Control **Fast Sims - 60 Min.**

**STAGE 2 Objective:** Run five consecutive 60 minute FR 30 sessions. **Procedure:** Set the experimental schedule to fixed ratio under **Settings->Reinforcement->Reinforcement Rules** and use the slider to adjust the **Fixed Ratio** to 30 under **Deprivation and Reinforcement Settings**. Under **Session Control**, select “**Fast Simulation with Video Off.**” Set the **Session’s Duration** to **60 minutes**. Click the “**Experiment**” menu button to run the session. Run this session 4 more times for a total of 5 session.

Consider why your animal may have stopped responding on this intermittent schedule. Look up the concept of *ratio strain* in Catania (2013) and see how it might apply to the five sessions you just conducted.

**Graphing Procedure: Creating a “Composite” Graph.** See Ch 6 pp. 43 - 45 of the *CyberRat User’s Guide* for additional details.

First, confirm that under the **Graphing** menu button-> **Graphing Preferences “Without Pen Resets”** is selected.

Next, click on your subject’s name which is located on the right hand side of the screen to reveal your subject’s **journal**. Click on the first of the five FR 30 sessions to graph those data.

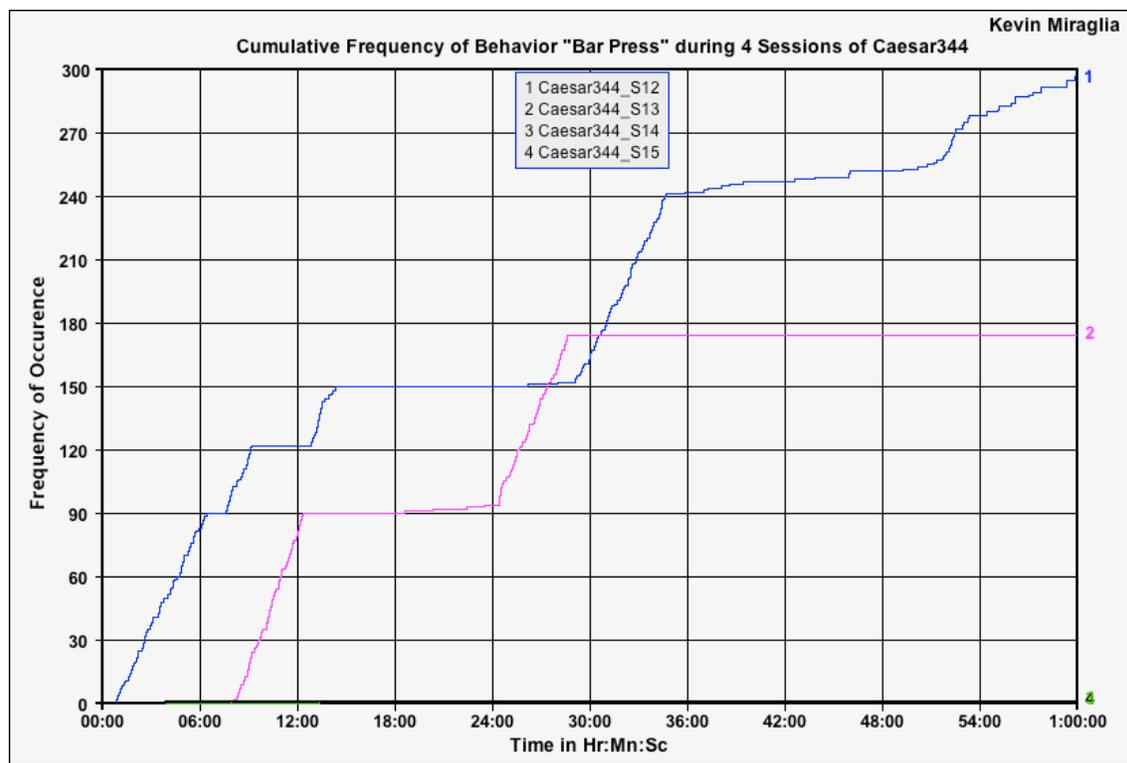
Under the Graphing menu button, select **“Add Graph to Multiples List”**

Next, select your subject again and graph the second session. Add this session to **“Multiples List”** by selecting **“Add Graph to Multiples List”** from the Graphing menu button. Repeat this process for the remaining sessions. If there were no bar presses for a session there will be nothing to graph. If this occurs, click OK to dismiss the pop-up message.

Note: If you make a mistake (i.e., select the wrong session to graph) you may delete the last session added to the list by clicking on the **Graphing** menu button and selecting **“Delete from Multiples List”**. If you would like to delete the entire list (start over) select **Graphing->Delete Multiples List**.

Lastly, under Graphing select **“Graph Multiples List.”**

Take a screenshot of the figure for use in your executive summary by clicking on the **“Graphing”** menu button and selecting **“Make Graph Snapshot”** [image saved to desktop]. Click OK to dismiss the pop-up message.



Example Figure: Sample results from five successive Post-CRF Sessions using FR 30 and illustrating a ratio-strain that results in extinction (session five had zero bar presses)

## Analysis: Executive Summary

### I. Define:

Introduce intermittent scheduling of consequential operations and define an FR 30 schedule.

### II. Method/Procedure:

Summarize the settings and sequence of this lab.

### III. Discussion:

Discuss Ratio-Strain and include a graph for that shows the first 5 successive FR-30 Sessions (i.e., showing ratio strain) NOTE: There will not be a line to graph if your subject did not bar press during the session.

### IV. References:

- Catania, A. C. (2013). *Learning* (5th ed.). Cornwall-on-Hudson, NY: Sloan Publishing.
- Ray, R. D., & Miraglia, K. M. (2011). A sample of CyberRat assignments and their pedagogical functions as experimental activities in a learning course. *Journal of Behavioral and Neuroscience Research*, 9(2), 44-61.

## CyberRat Lab #8 - Leaning FR Schedules

*Intermittent Scheduling of Consequential Operations: How response rates change across time under alternative schedules of consequences*

**Lab Assignment Objective:** Your objective is to get to an FR 30 ratio schedule without straining the schedule. This gradual “successive approximation to schedule” process is called “leaning” the schedule. To lean the schedule successfully, use *Fast Simulation* mode, run your previously Bar-Press trained and CRF maintained animal for successive 60 min sessions in the following order:

**Session 1-3 - FR 3**

**Session 4-6 - FR 10**

**Session 7-9 - FR 15**

**Session 10-12 - FR 20**

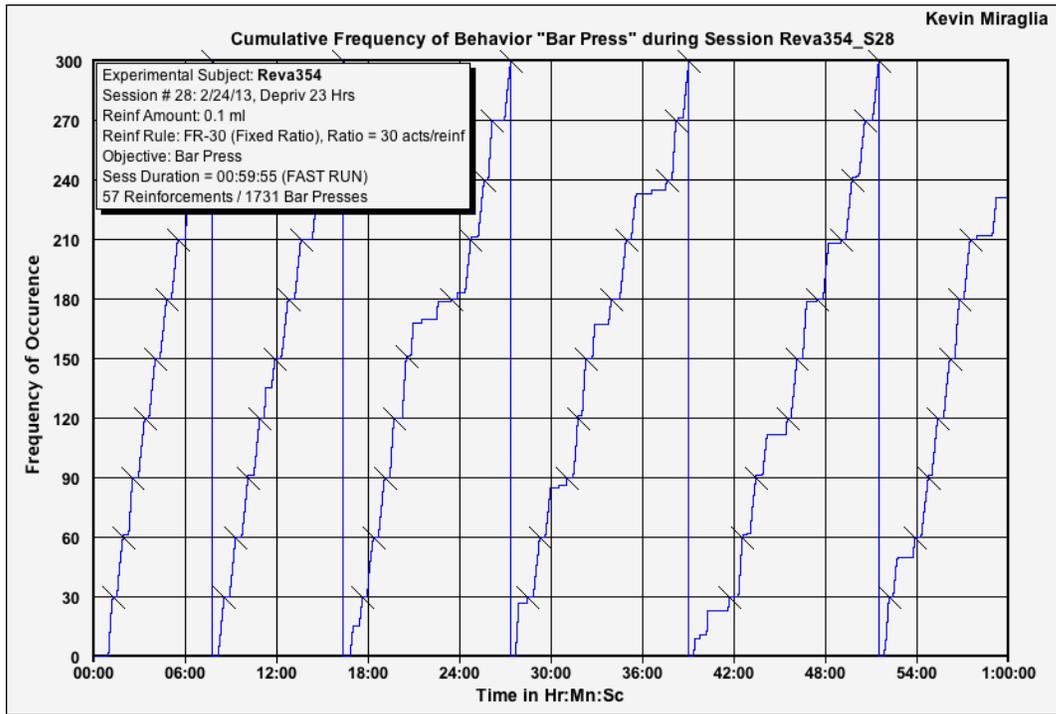
**Session 13-15 - FR 30**

**Note:** Confirm that your subject bar pressed during the first FR 3 session. If your subject did not bar press during the session you will need to go back and retrain your animal using “**Manual Reinforcement with Bar Reinf On**” under reinforcement rules. Retrain using “**Real-Time Simulation with Video On**” and “**Allow Manual Termination of Session.**” Run as many **30 minute sessions** as needed. Now that your animal is bar pressing again proceed to Stage 1.

**STAGE 1 Procedure:** Set the experimental schedule to fixed ratio under **Settings->Reinforcement-> Reinforcement Rules** and use the slider to adjust the Fixed Ratio to **3** under **Deprivation and Reinforcement Settings**. Under **Session Control**, select “**Fast Simulation with Video Off.**” Set the **Session’s Duration** to **60 minutes**. Click the “**Experiment**” menu button to run the session. Run this session 2 more times for a total of 3 sessions. Next, adjust the schedule to an **FR-10** and run 3 consecutive “**Fast Simulation with Video Off**” sessions. Follow these with 3 **FR-15** “**Fast Simulation with Video Off**” sessions. Next, adjust the schedule to an **FR-20** and run 3 consecutive “**Fast Simulation with Video Off**” sessions. Finish with 3 **FR-30** “**Fast Simulation with Video Off**” sessions.

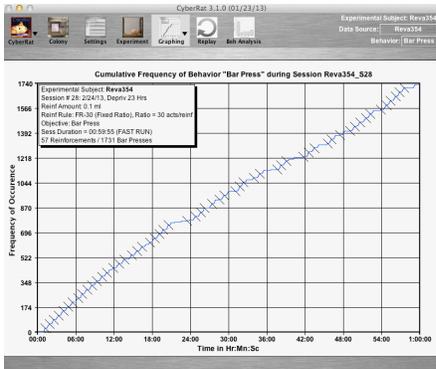
**STAGE 2 Procedure:** Now conduct 5 more 60 minute FR-30 sessions in Fast Simulation mode. Set the experimental schedule to fixed ratio under **Settings->Reinforcement-> Reinforcement Rules** and use the slider to adjust the Fixed Ratio to **30** under **Deprivation and Reinforcement Settings**. Under **Session Control**, select “**Fast Simulation with Video Off.**” Set the **Session’s Duration** to **60 minutes**. Click the “**Experiment**” menu button to run the session. Repeat four more times for a total of 5 sessions.

What patterns in behavioral operating characteristics emerge? Be prepared to include results and discussion of these phenomena in your presentation. See example figure on next page.

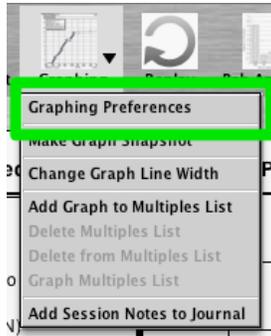


Example Figure: Sample illustration of a stable break-run pattern of responding on a well-established FR 30 reinforcement schedule.

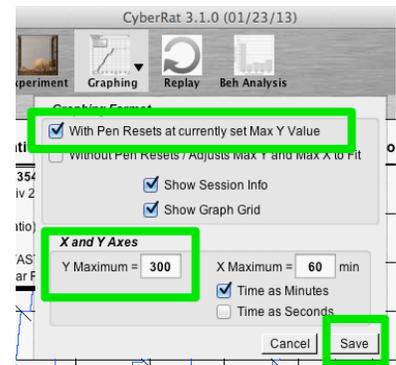
### Graphing Procedure:



STEP 1: FR 30 Cumulative Record Graph



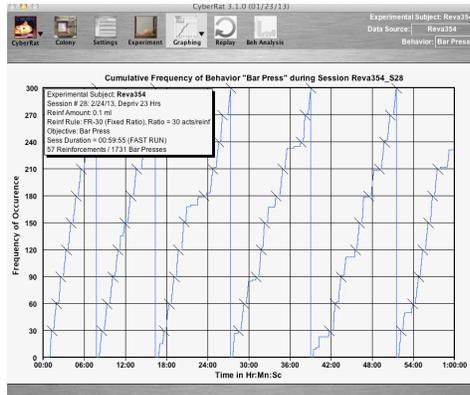
STEP 2: Graphing Preferences



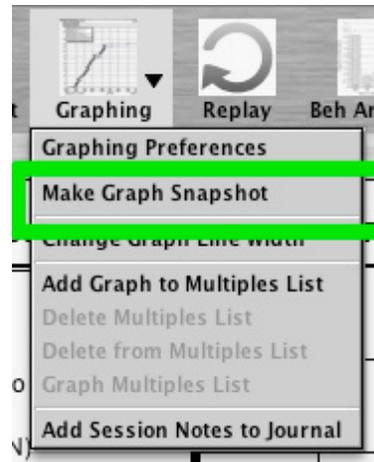
STEPS 3-5: Setting Max Y Axis Value

1. Select your last FR 30 session to graph.
2. Select **Graphing Preferences** under the **Graphing** menu button.
3. Select **With Pen Resets at Currently Set Max Y Value**.
4. Confirm **Max Y Value** is set at **300**.
5. Click **Save**.

6. Select *Make Graph Snapshot* under Graphing Menu to save a screenshot to your desktop



FR 30 Cumulative Record Graph with Y-Axis set to 300



STEP 6: Snapshot

## Analysis: Executive Summary

**I. Define:** Introduce the concept of intermittent scheduling of consequential operations. Define an FR 30 schedule. Describe “leaning.”

**II. Method:** Summarize settings and sequence of this lab.

**III. Discussion:** Discuss “Leaning the schedule” and how this technique solves the ratio strain problem illustrated in the previous assignment. Include a graph that demonstrates a stable “break-run” pattern of responding on an FR 30 schedule.

## IV. References:

- Catania, A. C. (2013). *Learning* (5th ed.). Cornwall-on-Hudson, NY: Sloan Publishing.
- Ray, R. D., & Miraglia, K. M. (2011). A sample of CyberRat assignments and their pedagogical functions as experimental activities in a learning course. *Journal of Behavioral and Neuroscience Research*, 9(2), 44-61.

## CyberRat Lab #9 - FR-FI Schedule Comparisons

*Examining different response rates under alternative conditions of equal densities of intermittent reinforcement*

### **Assignment:**

**STAGE 1 Objective:** Run five successive 60 min FR 30 “maintenance” sessions.

**Procedure:** Select your subject from the **Colony** and click on the **Settings** menu button. Set the experimental schedule to fixed ratio under **Reinforcement-> Reinforcement Rules** and use the slider to adjust the Fixed Ratio to **30** under **Deprivation and Reinforcement Settings**. Under **Session Control**, select “**Fast Simulation with Video Off.**” Set the **Session’s Duration** to **60 minutes**. Click the “**Experiment**” menu button to run the session. Run this session 4 more times for a total of 5 sessions.

**STAGE 2 Objective:** Now run a set of nine 60 min FR 30 evaluation sessions for graph-comparison purposes (see steps above).

**STAGE 3 Objective:** Next, shift to FI training for five sessions using a fixed time interval value that is equal to the average inter-reinforcement interval found in the FR 30 evaluation sessions.

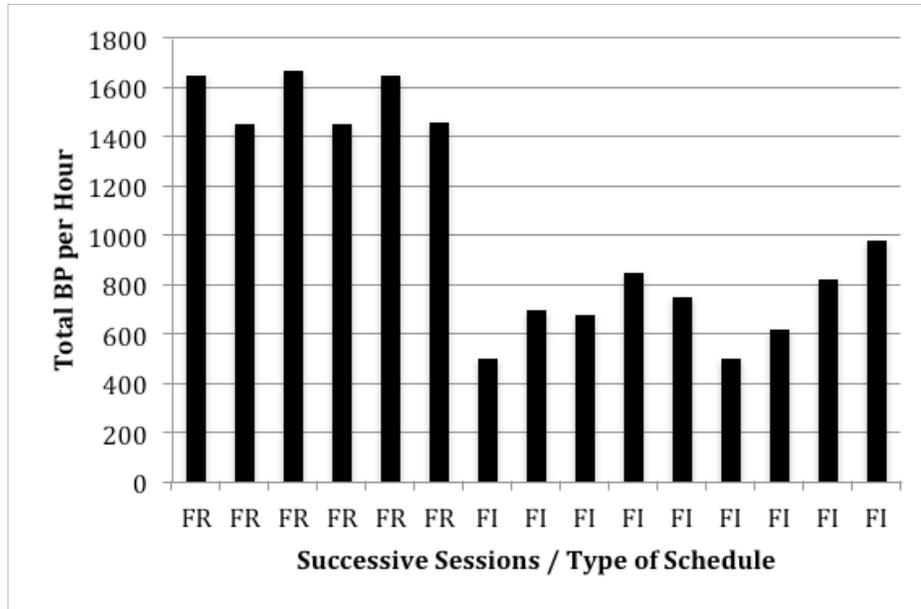
To find the inter-reinforcement interval you will need to divide the total number of seconds in a 60 minute session (3600) by the number of reinforcements administered during the session. For example, if there were 50 reinforcements (not bar presses) during the session, then  $3600/50 = 72$  sec per reinforcement. Do this for each of your nine sessions and find the average for the nine values. Use this average value as the Fixed Interval and run five 60 minute fast simulation FI “transition” sessions prior to running a set of nine 60 minute FI sessions for graph-comparison purposes.

**Procedure:** Click on the **Settings** menu button. Set the experimental schedule to **fixed interval** under **Reinforcement-> Reinforcement Rules** and use the slider to adjust the Fixed Interval to the inter-reinforcement interval you just calculated under **Deprivation and Reinforcement Settings**. Under **Session Control**, select “**Fast Simulation with Video Off.**” Set the **Session’s Duration** to **60 minutes**. Click the “**Experiment**” menu button to run the session. Run this session 4 more times for a total of 5 sessions. Now run 9 more sessions, using the same sessions, for graph comparison purposes.

**STAGE 4 Objective:** Now graph, in excel or a similar program, the total number of bar presses for each of your nine FR 30 and nine FI sessions on one graph. An example graph is included on the next page.

*“Because the same “density” of reinforcement is used in both conditions, the subtle differences in patterns and rates produced by these alternative schedules must be due only to the type of schedule and not to the number of reinforcers” (Ray & Miraglia, 2011, p. 54).*

One example *CyberRat* experiment using this FR 30 schedule determined that the average time between reinforcer presentations was 73 sec, and thus the FR series was followed with a series of FI 73 sec sessions. Results from this example are illustrated in the figure below.



*Example Figure. A series of successive CyberRat sessions applying two equal-density reinforcement schedules is illustrated. A series of stable FR 30 sessions were conducted for 60 min each to determine the average time between reinforcements. This time of 73 sec was used as the defining criteria for a shift to a subsequent series of FI 73 sec scheduled sessions. This illustrates different response rates under alternative conditions of equal densities of intermittent reinforcement.*

## **Analysis: Executive Summary**

**I. Define:** Define FR and FI intermittent schedules.

**II. Method & Procedure:** Summarize the settings and sequence of this lab.

**III. Discussion:** Using the data you just graphed explain the following:

*“Because the same “density” of reinforcement is used in both conditions, the subtle differences in patterns and rates produced by these alternative schedules must be due only to the type of schedule and not to the number of reinforcers” (Ray & Miraglia, 2011, p. 54).*

## **IV. References:**

Catania, A. C. (2013). *Learning* (5th ed.). Cornwall-on-Hudson, NY: Sloan Publishing.

Ray, R. D., & Miraglia, K. M. (2011). A sample of CyberRat assignments and their pedagogical functions as experimental activities in a learning course. *Journal of Behavioral and Neuroscience Research*, 9(2), 44-61.